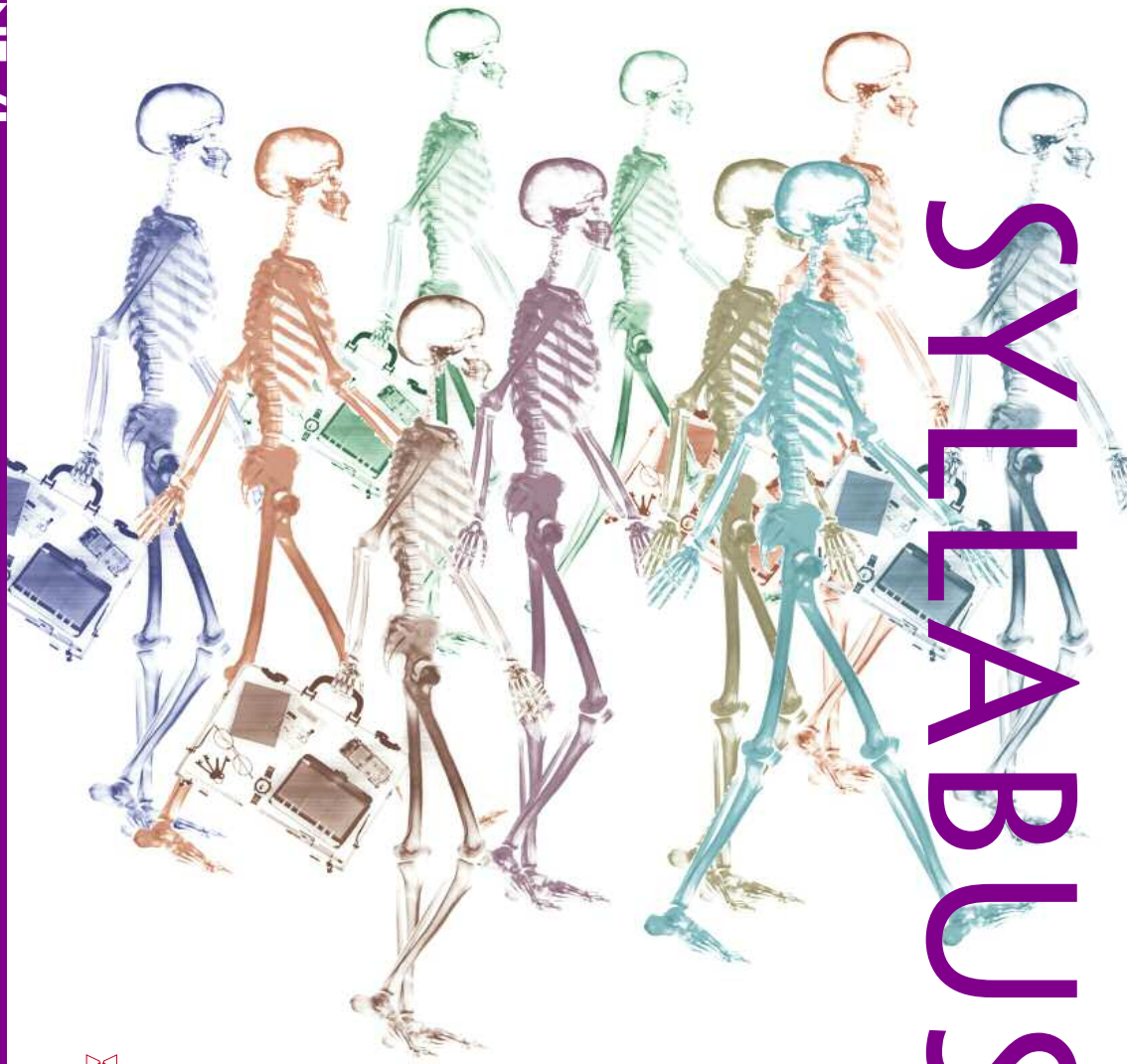


14

17 EN 18 SEPTEMBER 2009

# RADIOLOGEN DAGEN

D E R A I , A M S T E R D A M



# SYLLABUS



Nederlandse Vereniging voor Radiologie  
Radiological Society of the Netherlands



## Philips Prijs 2009 Onderscheidend onderzoek heeft zijn prijs



€ 7.500,- en een uniek kunstwerk. De Philips Prijs 2009 voor het beste onderzoek in Klinisch Radiologische Beeldvormende en Interventie Technieken maakt duidelijk wat wij belangrijk vinden: een sterke samenwerking tussen medische beroepspraktijk en industrie. Tijdens de Radiologendagen zal de winnaar van 2009 bekend gemaakt worden!

**RSNA** - Binnenkort krijgt u weer onze bekende RSNA mailing. We hopen op uw reactie, want het belooft spectaculair te worden in Chicago!



Philips RSNA 2009

[www.philips.nl/healthcare](http://www.philips.nl/healthcare)

**PHILIPS**  
sense and simplicity

Dames en heren van de NVvR,

Welkom op de Radiologendagen 2009!

Het succes van de voorgaande edities in de Doelen te Rotterdam laat onverlet dat het organisatie comité meent dit jaar in de RAI te Amsterdam ook een uitstekende, ruime en toch compacte locatie gevonden te hebben voor deze belangrijke bijeenkomst.

De organisatie vindt plaats in nauwe en gedegen samenwerking met Congress Company.

In samenwerking met het wetenschappelijk comité is een boeiend en gevarieerd programma samengesteld. In 10 refresher-courses, verdeeld over twee dagen, worden zeer uiteenlopende praktische en actuele onderwerpen belicht. Ook is er ruimte voor een historische beschouwing van de radiologie, verzorgd door de emeriti.

De donderdag vangt aan met een praktische plenaire sessie over botinterventies. In deze sessie ook aandacht voor de zogenaamde 'time out' procedure, in het kader van radiologische kwaliteitsbewaking.

Een doorsnede van de wetenschappelijke output uit de Nederlandse radiologische klinieken wordt gerepresenteerd in 10 verschillende parallelsessies, allen ingeleid door een keynote lecture, betrekking hebbend op een actueel onderwerp gerelateerd aan de betreffende sessie. Op vrijdag bestaat ook nog de mogelijkheid om in een speciale sessie een academisch overzicht te krijgen van de topreferente radiologie en speerpunten van onderzoek in Nederland.

De vrijdag wordt ingeleid met een samenvatting van drie belangrijke recente richtlijnen (appendicitis, inflammatoire darmziekten en aneurysma aortae abdominalis), gevolgd door een plenaire (interactieve) sessie door Ben Tiggelaar, een bevolgen spreker en managementtrainer die zaken als veranderingen in organisatie en kernvragen van strategie, prestatieverbeteringen en leiderschap op onnavolgbare wijze presenteert en beschouwt vanuit een gedragsperspectief.

Het wetenschappelijk programma op donderdag zal worden afgesloten worden met een plenaire interactieve Case Review Sessie, met het accent op infotainment. Een selectie van uit het land ingezonden casus wordt gepresenteerd, onder regie van collega Cees de Vries uit het OLVG. De case sessie gaat vooraf aan een speciale ALV, thematisch gewijd aan radiologische expertise centra.

Het wetenschappelijk programma op vrijdag wordt afgesloten met een speciale sessie waarin genomineerden voor de radiologendagenprijs hun voordracht mogen geven. Het stemgerechtigd publiek bepaalt de uiteindelijke winnaar. In de zelfde sessie zal ook de Lourens Penning Prijs worden uitgereikt, gekoppeld aan een voordracht, en zullen diploma's worden overhandigd aan radiologen die recent succesvol een fellowship hebben afgerond.

Buiten de geplande ruimten voor plenaire en parallel sessies vragen wij gaarne ook uw aandacht voor de posterpresentaties, en de expositie van de industrie. In dit kader wil het organisatie comité alle sponsors, en in het bijzonder Siemens, Sectra en Philips als hoofdsponsors, hartelijk danken voor hun ondersteuning.

Ten slotte bevelen wij u met veel genoegen de aangenaam muzikaal ondersteunde barbecue-beachparty aan, op donderdagavond in de achtertuin van de RAI, locatie Strand-Zuid.

Wij wensen een ieder inspirerende, leerzame en bijzonder gezellige dagen in Amsterdam!

Het organiserend comité van de Radiologendagen 2009

**Henk-Jan van der Woude, voorzitter**

**Bert-Jan de Bondt**

**Saskia Kolkman**

**Digna Kool**

**Jan Albert Vos**

## Donderdag 17 september 2009

Tijdstip	Onderwerp
09.00 – 09.45	Forum Lounge & Ruby Lounge Ontvangst & registratie
09.45 – 09.55	Forum <b>Opening door voorzitter</b> H.J. van der Woude, Onze Lieve Vrouwe Gasthuis, Amsterdam
09.55 – 11.00	Forum plenair: <b>Botinterventies</b> Voorzitter: W. Prevoo, NKI-AvL, Amsterdam <b>Time Out procedure</b> Spreker: K.P. van Lienden, Academisch Medisch Centrum, Amsterdam <b>Vertebroplastiek</b> Spreker: P.N.M. Lohle, St. Elisabeth Ziekenhuis, Tilburg <b>Laser behandeling discusprolaps</b> Spreker: G.L. Guit, Kennemer Gasthuis, Haarlem
11.00 – 11.30	Forum Lounge & Ruby Lounge Koffiepaauze
11.30 – 13.00	<b>Parallelsessies Wetenschappelijke voordrachten</b> <b>E102</b> <b>I: Abdominale radiologie / Acute radiologie</b> Voorzitters: A.C. van Breda Vriesman, Rijnland Ziekenhuis, Leiderdorp 2e voorzitter N.t.b. Key-note speaker: A.C. van Breda Vriesman, Rijnland Ziekenhuis, Leiderdorp <b>E103</b> <b>II: Mammariadiologie</b> Voorzitters: H.J. Teertstra, NKI-AvL, Amsterdam R.M. Pijnappel, Martini Ziekenhuis, Groningen Key-note speaker: H.J. Teertstra, NKI-AvL, Amsterdam <b>E104</b> <b>III: Cardiovasculaire radiologie 1</b> Voorzitters: L.J.M. Kroft, Leids Universitair Medisch Centrum, Leiden B.K. Velthuis, UMC Utrecht, Utrecht Key-note speaker: L.J.M. Kroft, Leids Universitair Medisch Centrum, Leiden <b>E105/E106</b> <b>IV: Neuroradiologie / Hoofdhals radiologie</b> Voorzitters: J. Casselman, AZ Sint-Jan, Brugge, België M.F. Boomsma, Isala klinieken, Zwolle Key-note speaker: J. Casselman, AZ Sint-Jan, Brugge, België <b>E107</b> <b>V: Interventieradiologie</b> Voorzitters: M.A.A.J. van den Bosch, UMC Utrecht, Utrecht W. Prevoo, NKI-AvL, Amsterdam Key-note speaker: M.A.A.J. van den Bosch, UMC Utrecht, Utrecht <b>E108</b> <b>Emeritus sessie I</b> <b>De geschiedenis van de radiologie (deel 1)</b> Voorzitter: J.F.M. Panhuysen <b>CT in de paleoantropologie</b> Spreker: F.W. Zonneveld <b>Röntgenologie in de Tweede Wereldoorlog</b> Sprekers: P.J. van Wiechen J. Vermeij
13.00 – 14.00	Forum Lounge & Ruby Lounge Lunch & postersessie
14.00 – 15.15	<b>Refresher courses</b> Forum <b>I: Pneumonie bij immuun-competente vs. immuun-gecompromiteerde patiënten</b> Voorzitter: C.M. Schaefer-Prokop, Meander Medisch Centrum, Amersfoort <b>Pneumonie in de immuun-competente patiënt</b> Spreker: I.A.H. van den Berk, Leids Universitair Medisch Centrum, Leiden <b>Pneumonie in de immuun-gecompromiteerde patiënt</b> Spreker: I.J.C. Hartmann, Erasmus MC, Rotterdam <b>Infectieuze vs. organiserende pneumonie</b> Spreker: C.M. Schaefer-Prokop, Meander Medisch Centrum, Amersfoort

Tijdstip

Onderwerp

E102

**II: Posterior fossa**

Voorzitter: R.B.J. de Bondt, Isala klinieken, Zwolle

**Perceptieoefheid en cholesteatoma: de synergie van beeldvorming en kliniek**

Spreker: J. Casselman, AZ Sint-Jan, Brugge-Oostende, België

Spreker: E. Offeciers, Sint-Augustinus, Wilrijk, België

E103

**III: "Is vet cool!?" Bariatrische problematiek en leversteatosis**

Voorzitter: B.M. Wiarda, Medisch Centrum Alkmaar, Alkmaar

**Bariatrische problematiek**

Sprekers: T.G. Wiersma, Ziekenhuis Rijnstate, Arnhem

I.M.C. Janssen, Ziekenhuis Rijnstate, Arnhem

**Imaging in liver steatosis (US, CT, MRI, MRS) in NASH and NAFLD**

Spreker: J. Karani, Kings College Hospital, London, United Kingdom

E104

**IV: Botsctigrafie (SPECT-CT) in de orthopedie**

Voorzitter: S. Jap-a-Joe, Onze Lieve Vrouwe Gasthuis, Amsterdam

**SPECT-CT in de orthopedie**

Spreker: F. Smit, Rijnland Ziekenhuis, Leiderdorp

**Botscan (SPECT-CT) in de orthopedie**

(impact van SPECT-CT t.o.v. standaard botscaan en evt. andere modaliteiten)

Spreker: H. van der Hoeven, St. Antonius Ziekenhuis, Nieuwegein

**Diagnostiek van het scaphoid**

Spreker: F.J.P. Beeres, Leids Universitair Medisch Centrum, Leiden

E105/E106

**V: Coronaire calciumscore: wat moet de radioloog weten?**

Voorzitter: T. Leiner, Maastricht Universitair Medisch Centrum, Maastricht

**Praktische implementatie van de coronaire calciumscore**

Spreker: R. Vliegenghart Proença, UMC Groningen, Groningen

**De rol van CT en MRI in de work-up van patiënten met (potentieel) coronairlijden**

Spreker: A. Moelker, Erasmus MC, Rotterdam

E107

**VI: Onderwijs is grensverleggend**

Voorzitter: M. Maas, Academisch Medisch Centrum, Amsterdam

**Radiologisch Onderwijs aan de basis is een investering in de toekomst!**

Spreker: S. Kolkman, Academisch Medisch Centrum, Amsterdam

**Simulatie in het onderwijs**

Spreker: M.P. Schijven, UMC Utrecht, Utrecht

**Toevertrouwen kritische activiteiten aan AI0s als onderdeel van een kwaliteitssysteem bij competentiegerichte specialistische opleidingen**

Spreker: T.J. ten Cate, UMC Utrecht, Utrecht

E108

**Emeritus sessie II**

**De geschiedenis van de radiologie (deel 2)**

Voorzitter: P.J. van Wiechen

**Petites Histoires uit 110 jaar Röntgengeschiedenis**

Spreker: C.B.A.J. Puylaert

**Het Radiologisch Historisch Genootschap in oprichting**

Spreker: C.J.L.R. Vellenga, Ziekenhuis Groep Twente, Almelo

**Eerste vergadering Radiologisch Historisch Genootschap in oprichting & discussie**

**Forum Lounge & Ruby Lounge**

Theepauze

15.15 – 15.45

**Forum**

**Philipsprijs**

15.45 – 16.00

**Forum**

**plenair: Case Review Sessie**

Sessieleider: C. de Vries, Onze Lieve Vrouwe Gasthuis, Amsterdam

16.00 – 17.00

**Forum**

**ALV**

thema: **Radiologie expertise centra in Nederland**

Voorzitter: J.S. Laméris, voorzitter NVvR

**E-radiologie: de radiologie als eerste op weg naar een landelijk EPD?**

Spreker: M. Sprenger, Nictiz, Den Haag


**Radnet: marktplaats voor de radioloog?**

Spreker: J.F.H. Veldhuizen, MRI Centrum, Amsterdam, Rotterdam, 's-Hertogenbosch en Groningen

**Uitreiking Erelegpenning aan Robin Smithuis**

17.00 – 18.00

**Forum Lounge & Ruby Lounge**

Borrel op expositie: exclusief aangeboden door: **AGFA** 

18.00 – 19.30

**STRANDZUID**

Feestavond

Vanaf 19.30

## Vrijdag 18 september 2009

Tijdstip	Onderwerp
08.15 – 08.45	Forum Lounge & Ruby Lounge Ontvangst & registratie
08.45 – 09.15	Forum plenair: <b>Richtlijnsessie I/II/III Inflammatoire darmziekten</b> Spreker: B.M. Wiarda, Medisch Centrum Alkmaar, Alkmaar <b>Appendicitis</b> Spreker: J.B.C.M. Puylaert, Medisch Centrum Haaglanden, Den Haag <b>AAA</b> Spreker: M.W. de Haan, Maastricht Universitair Medisch Centrum, Maastricht
09.15 – 10.30	Forum plenair: <b>lezing Ben Tiggelaar</b>
10.30 – 11.00	Forum Lounge & Ruby Lounge Koffiepauze
11.00 – 12.15	<b>Refresher courses</b> Forum <b>VII: Interactieve BIRADS training voor mammografie en MRI</b> Voorzitter: R.M. Pijnappel, Martini Ziekenhuis, Groningen <b>Uw laatste kans om uw BI-RADS kennis over mammografie en echografie te testen</b> Sprekers: H.M. Zonderland, Academisch Medisch Centrum, Amsterdam H.L.S. Go, Medisch Centrum Alkmaar, Alkmaar <b>Uw eerste kans om uw BI-RADS kennis over MRI te testen</b> Spreker: G.L. Guit, Kennemer Gasthuis, Haarlem E102 <b>VIII: Aortadissecties: diagnostiek en behandeling</b> Voorzitter: J.A. Vos, St. Antonius Ziekenhuis, Nieuwegein Spreker: R. Heijmen, St. Antonius Ziekenhuis, Nieuwegein Spreker: R. Balm, Academisch Medisch Centrum, Amsterdam Spreker: J.A. Vos, St. Antonius Ziekenhuis, Nieuwegein E103 <b>IX: Kinderoncologie</b> Voorzitters: R.R. van Rijn, Academisch Medisch Centrum, Amsterdam H.N. Caron, Emma Kinderziekenhuis/AMC, Amsterdam <b>Introductie</b> Spreker: H.N. Caron, Emma Kinderziekenhuis/AMC, Amsterdam <b>Hersentumoren bij kinderen</b> Spreker: N. de Graaf, Erasmus MC, Rotterdam <b>Hematologische oncologie bij kinderen</b> Spreker: M.E. Groote, Wilhelmina Kinderziekenhuis/UMC Utrecht, Utrecht <b>Solide abdominale tumoren bij kinderen</b> Spreker: E.E. Deurloo, Emma Kinderziekenhuis/AMC, Amsterdam E104 <b>Topreferente radiologie in Nederland: een academisch overzicht</b> Voorzitters: M.A.A.J. van den Bosch, UMC Utrecht, Utrecht J. Barentsz, UMC St Radboud, Nijmegen <b>Overzicht research programma Radiologie, Erasmus MC</b> Spreker: G.P. Krestin <b>7T MRI van het brein, UMC Utrecht</b> Spreker: J. Hendrikse <b>Prostate MRI, UMC St Radboud</b> Spreker: J. Barentsz <b>Cardiovasculaire research, MUMC</b> Spreker: T. Leiner <b>Research in VUMC</b> Spreker: C. van Kuijk <b>Molecular Imaging in LUMC</b> Spreker: L. van der Weerd <b>Research UMC Groningen</b> Spreker: P.M.A. van Ooijen <b>Research AMC Amsterdam</b> Spreker: C.B.L.M. Majoie E105/E106 <b>X: How to try not to be torn between ultrasound and MRI of the shoulder</b> Voorzitter: A.J. van der Molen, Leids Universitair Medisch Centrum, Leiden

# 14<sup>E</sup> RADIOLOGENDAGEN 2009

Tijdstip	Onderwerp
	<b>Shoulder US: my number one</b> Spreker: M.J.C.M. Rutten, Jeroen Bosch Ziekenhuis, 's-Hertogenbosch
	<b>Shoulder MRI: my number one</b> Spreker: C.F. van Dijke, Medisch Centrum Alkmaar, Alkmaar
	<b>US and MRI: how to avoid impingement between the two of them</b> Spreker: E. Llopis, Hospital de la Ribera, Valencia, Spain
	Forum Lounge & Ruby Lounge
12.15 – 13.30	Lunch
13.30 – 15.00	<b>Parallelsessies Wetenschappelijke voordrachten</b>
	<b>E102</b>
	<b>VI: Abdominale radiologie</b>
	Voorzitters: E.R. Ranschaert, Jeroen Bosch Ziekenhuis, 's-Hertogenbosch J. Fütterer, UMC St Radboud, Nijmegen
	Key-note speaker: E.R. Ranschaert, Jeroen Bosch Ziekenhuis, 's-Hertogenbosch
	<b>E103</b>
	<b>VI: Thoraxradiologie / Skeletradiologie</b>
	Voorzitters: P. Cleynert, Maasstad Ziekenhuis, Rotterdam J.W.J. de Rooy, UMC St Radboud, Nijmegen
	Key-note speaker: P. Cleynert, Maasstad Ziekenhuis, Rotterdam
	<b>E104</b>
	<b>VIII: Cardiovasculaire radiologie 2</b>
	Voorzitters: A.M. Spijkerboer, Academisch Medisch Centrum, Amsterdam H.C.M. van den Bosch, Catharina-ziekenhuis, Eindhoven
	keynote-speaker: A.M. Spijkerboer, Academisch Medisch Centrum, Amsterdam
	<b>E105/E106</b>
	<b>IX: Neuroradiologie</b>
	Voorzitters: J.C.J. Bot, VU Medisch Centrum, Amsterdam M. Smits, Erasmus MC, Rotterdam
	Key-note speaker: J.C.J. Bot, VU Medisch Centrum, Amsterdam
	<b>E107</b>
	<b>X. Kinderradiologie / Nucleaire radiologie</b>
	Voorzitters: R.A.J. Nievelstein, UMC Utrecht, Utrecht B. de Keizer, UMC Utrecht, Utrecht
	Key-note speaker: R.A.J. Nievelstein, UMC Utrecht, Utrecht
	Forum
15.00 – 16.15	plenair: <b>Sessie genomineerden Radiologendagenprijs &amp; Lourens Penning Prijs, fellowshipdiploma's</b>
	Forum Lounge & Ruby Lounge
16.15	Afscheidsborrel

## Organisatie

### ORGANISATIE COMITÉ

H.J. van der Woude, voorzitter

R.B.J. de Bondt

D.R. Kool

S. Kolkman

J.A. Vos

### WETENSCHAPPELIJK COMITÉ

H.J. Baarslag

J.C.J. Bot

H.N. van Hall

S.M.E.A.A. Jap-a-Joe

F.B.M. Joosten

P.R. Kornaat

T. Leiner

K.P. van Lienden

A.J. van der Molen

R.M. Pijnappel

W. Prevoo

R.R. van Rijn

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C.M. Schaefer-Prokop

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# Genomineerde abstracts voor de Radiologendagenprijs 2009

**NR. RP1      COMPARISON OF IMAGING MODALITIES FOR THE ASSESSMENT OF HEPATIC STEATOSIS IN PATIENTS UNDERGOING LIVER RESECTION**

J.R. van Werven, H.A. Marsman, A.J. Nederveen, F.J.W. ten Kate, T.M. van Gulik, J. Stoker  
*Academisch Medisch Centrum, AMSTERDAM*

**NR. RP2      T2W SUBTRACTION MR IMAGING IN PHASE II MS TRIALS: A POWERFUL NEW OUTCOME MEASURE**

B. Moraal<sup>1</sup>, I.J. van den Elskamp<sup>1</sup>, D.L. Knol<sup>1</sup>, B.M.J. Uitdehaag<sup>1</sup>, J.J.G. Geurts<sup>1</sup>, H. Vrenken<sup>1</sup>, P.J.W. Pouwels<sup>1</sup>, R.A. van Schijndel<sup>1</sup>, D.S. Meier<sup>2</sup>, C.R.G. Guttman<sup>2</sup>, F. Barkhof<sup>1</sup>  
<sup>1</sup>*VU Medisch Centrum, AMSTERDAM*  
<sup>2</sup>*Harvard Medical School, BOSTON, USA*

**NR. RP3      WHOLE-BODY MR IMAGING, INCLUDING DIFFUSION-WEIGHTED IMAGING, FOR STAGING MALIGNANT LYMPHOMAS IN CHILDREN: DIRECT COMPARISON TO CT - INITIAL EXPERIENCES**

M.A. Vermoolen, T.C. Kwee, H.M.E. Quarles van Ufford, F.J.A. Beek, M.B. Bierings, W.P.Th.M. Mali, R.A.J. Nivelstein  
*UMC Utrecht, UTRECHT*

**NR. RP4      CONSEQUENCES OF DIGITAL MAMMOGRAPHY IN POPULATION-BASED BREAST CANCER SCREENING: INITIAL CHANGES AND LONG TERM IMPACT ON REFERRAL RATES**

A.M.J. Bluekens<sup>1</sup>, M.J. Broeders<sup>2</sup>, D. Beijerinck<sup>3</sup>, N. Karssemeijer<sup>1</sup>, G.J. den Heeten<sup>2</sup>  
<sup>1</sup>*St. Elisabeth Ziekenhuis, TILBURG*  
<sup>2</sup>*Landelijk Referentie Centrum voor Bevolkingsonderzoek (LRCB), NIJMEGEN*  
<sup>3</sup>*Preventicon, UTRECHT*  
<sup>4</sup>*UMC St Radboud, NIJMEGEN*

**NR. RP5      BEPALING VAN CALCIUM SCORES VERKREGEN MET CT-CORONAIRANGIOGRAFIE**

N. van der Bijl, A. de Roos, L.J.M. Kroft  
*Leids Universitair Medisch Centrum, LEIDEN*

**NR. RP6      IMPACT OF A CAD PROTOTYPE ON THE DETECTION OF ACUTE PULMONARY EMBOLISM USED AS SECOND READER FOR OFF-HOURS CTPA STUDIES**

R. Wittenberg<sup>1</sup>, J.F. Peters<sup>2</sup>, L.F.M. Beenen<sup>1</sup>, F.H. Berger<sup>1</sup>, F. van Hoor<sup>1</sup>, M.M. van Santen<sup>1</sup>, J. van Schuppen<sup>1</sup>, I.J.A. Zijlstra<sup>1</sup>, M. Prokop<sup>3</sup>, C.M. Schaefer-Prokop<sup>1</sup>  
<sup>1</sup>*Academisch Medisch Centrum, AMSTERDAM*  
<sup>2</sup>*Philips Healthcare, BEST*  
<sup>3</sup>*UMC Utrecht, UTRECHT*

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Boermeester, M.A.	01.7	Daniels-Gooszen, A.W.	01.5	Goslings, J.C.	P04	Jaspers, M.M.J.J.R.	08.8
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Borel Rinkes, I.H.M.	P01	Diepstraten, S.C.E.	P23	Grond, J. van der	09.5, 09.8	Kessel, C.S. van	P01
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			08.5, P16	Haak, A. van den	02.8	Klerk, G. de	07.5, 07.8
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Kluin, J.	08.7		02.6, 02.7	Nieuwenhuijzen, G.A.P.	01.5	Rijn, J.C. van	04.1
Knippenberg, B.	05.6	Louwman, M.W.J.	02.1		02.8	Rijswijk, C.S.P. van	05.1
Knol, D.L.	RP2	Lugt, A. van der	03.1, 04.4	Nieuwenhuizen, R.A.	010.2	Rinkel, G.J.E.	04.1
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## Oprichting Historisch Genootschap van de NVvR

### September 2009

De Historische Commissie is in 1993 opgericht als opvolger van de Museum Commissie. Vanaf het begin tot thans heeft de HC bestaan uit Carl Puylaert, Peter van Wiechen, Joris Panhuysen, Gerd Rosenbusch, Hans Vermeij (namens Radiotherapie) en Kees Vellenga.

De HC houdt zich bezig met een breed palet van activiteiten, zoals:

- Historisch wetenschappelijk onderzoek, o.a. de twee boeken in 1995 en 2001 t.g.v. de 100-jarige ontdekking van de Röntgenstraling en het 100-jarig bestaan van onze Vereniging. Voorts nog enkele boeken en een groot aantal artikelen en voordrachten.
- Geschiedkundige en paradiologische bijeenkomsten, zoals de emeritus middagen tijdens de radiologendagen gedurende 3 jaar rond het millennium; de 100e verjaardag van prof. Ziedses des Plantes in 2002 met inauguratie van de kopie van de oorspronkelijke planigraaf in Utrecht. En de herdenking van prof. Gunning op 17 sept. 2005 met een symposium in de kerk met o.a. diens betachterkleinzoon prof. Gunning en Nobelprijswinnaar prof. Veltman; en onthulling van de muurplaqueette door burgemeester mr. Brouwer van Utrecht.
- Contacten met andere medisch-historische gremia, zoals het Historisch Genootschap van de NVv Heelkunde, Historia Medicinæ, Club D. de Moulin, Federatie van Historische Commissies. Ook met o.a. het Boerhaave Museum, het Delfts Medisch Museum (Griffioen), het Universiteitsmuseum Utrecht, het Anatomisch museum de Campers Groningen. En met historisch geïnteresseerde leden (Simon, Kingma, Taconis).
- Frequent contacten met en bezoeken aan buitenlandse historische instituten, zoals het Belgisch Museum voor Radiologie en het Deutsches Röntgenmuseum. Vele eenmalige contacten met historische instellingen in het buitenland.
- Jaarlijkse Historische reis 'In het voetspoor van Röntgen', waarbij altijd een officieel bezoek aan een historisch instituut plaatsvindt, zoals Parijs, Kopenhagen, St. Petersburg, Portugal, British Institute of Radiology in Londen, Würzburg / Giessen en Bamberg / Erlangen / Ingolstadt / Neurenberg. Door middel van publicaties maakten we deze instituten bekend bij en toegankelijk voor de leden van de NVv Radiologie.
- Antwoorden op vragen of ongevraagde adviezen op historisch gebied.
- Beheer van het archief. Vele jaren gedaan door Puylaert. Nu door Panhuysen.

De Historische Commissie bestaat al 16 jaar in deze samenstelling. De leden worden wat ouder en het werk neemt toe. We hebben daarom de Commissie in april 2009 uitgebreid met Kees Simon.

Daarnaast rijpte de laatste jaren bij ons een nieuw plan, namelijk het oprichten van een Historisch Genootschap, zoals bij andere medisch-wetenschappelijke verenigingen reeds bestaat.

Een dergelijk Historisch Genootschap heeft een roulerend bestuur en alle leden van de Nederlandse Vereniging – maar ook andere geïnteresseerden, zoals laboranten, radiotherapeuten, klinisch fysici, radiobiologen - kunnen er lid van worden. Lidmaatschap betekent dat men deel kan nemen aan themadagen en excursies, en zelf historisch onderzoek kan doen – al dan niet met andere leden.

De Historische Commissie heeft nog veel onontgonnen historisch radiologisch materiaal klaar liggen. We hebben handen nodig om de overmaat aan werk op dit gebied aan te pakken.

Er zal voorlopig geen contributie worden geheven.

Op donderdagmiddag 17 september vindt weer een symposium 'radiologische geschiedenis' plaats tijdens de Radiologendagen in de RAI. Tijdens die sessie zullen we nadere informatie geven over de oprichting van het Historisch Genootschap. Op de technische tentoonstelling zullen wij een balie hebben, waar u informatie kan krijgen en ons uw belangstelling kan tonen en adviezen geven.

Wij hopen op grote belangstelling. ***Wij hebben u nodig als lid en als bestuurslid.***

We moedigen u aan om reeds nu contact met één van ons op te nemen.

Kom in grote getale bij ons langs op 17 september en geef u op als lid van het **HISTORISCH GENOOTSCHAP!**

**De Historische Commissie**

### Sessie 1

## Abdominale radiologie / Acute radiologie

Donderdag 17 september 2009, 11.30 - 13.00 uur

01.1

### MAGNETIC RESONANCE IMAGING AND DIFFUSION WEIGHTED IMAGING IN ACUTE APPENDICITIS

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<sup>2</sup>Academisch Medisch Centrum, AMSTERDAM

**Purpose:** The primary goal was to study the accuracy of MRI as an alternative to CT in patients suspected of acute appendicitis (AA) with a non-diagnostic US. Secondly, to determine the accuracy of diffusion weighted imaging (DWI).

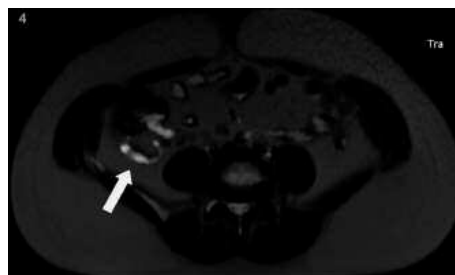
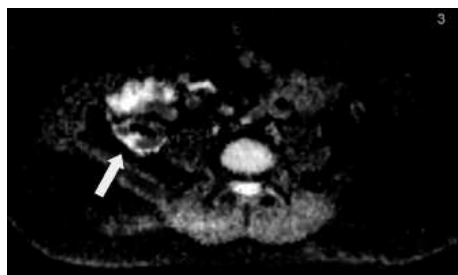
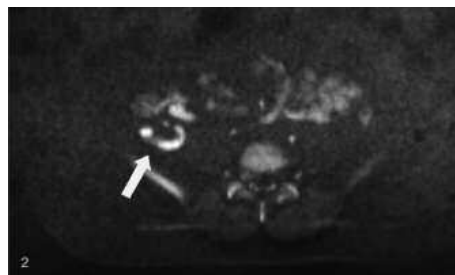
**Methods:** 70 adults and pediatric patients clinically suspected of AA and having a non-diagnostic US were included. All patients underwent abdominal MRI including DWI. Clinical data and imaging findings were collected and analyzed. Follow-up included all available data for a period of at least 2 months.

**Results:** AA was present in 29 patients (29/70, 41.4%).

MRI was completed in all, in 3 no DWI was performed. MRI was true positive in 28, false positive in 1, true negative in 40 and false negative in 1; sensitivity 96.6% and specificity 97.6%. The appendix was visualized in all but 4, the latter concerning 1 false negative and 3 patients with alternative diagnoses.

DWI showed disturbed diffusion at the site of the inflamed appendix in all but one cases of AA. 27 of 29 patients with AA underwent DWI, demonstrating disturbed appendiceal diffusion in 26. In the non-AA group, 39 of 40 patients underwent DWI and in all there was normal appendiceal diffusion. Sensitivity of DWI is 96.3% and specificity is 100%.

**Conclusion:** MRI has high sensitivity and specificity in diagnosing appendicitis in patients with inconclusive US. DWI showed disturbed diffusion in almost all patients with proven AA and has similar test accuracy as standard MRI sequences. Further comparative studies with DWI are necessary.



**Image 1:** Appendicitis in a 13-year-old boy

(1) Axial HASTE, (2) DWI (B800), (3) ADC-map, (4) Fusion image

01.2

**CURRENT OPINIONS ON DIAGNOSTIC IMAGING OF APPENDICITIS AMONG DUTCH RADIOLOGISTS: IS MRI AN ALTERNATIVE TO CT?**

M.E. Thieme<sup>1</sup>, R.S. van Giffen<sup>1</sup>, M.M.J. Hauwert<sup>2</sup>, M. Steen<sup>3</sup>, J. Stoker<sup>4</sup>, B.M. Wiarda<sup>1</sup>  
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<sup>2</sup>Waterland Ziekenhuis, PURMEREND  
<sup>3</sup>Westfries Gasthuis, HOORN  
<sup>4</sup>Academisch Medisch Centrum, AMSTERDAM

The goal of this study was to assess the current opinion among Dutch radiologists concerning imaging strategies in appendicitis, with an emphasis on the (potential) role of MRI. Therefore, a digital questionnaire was sent to all 93 Dutch hospitals. 70 hospitals (75.3%) including all 8 academic centers responded.

The questionnaire asked for general information about the radiology department; present diagnostic protocol for appendicitis; radiologists' knowledge and opinion of MRI in diagnosing appendicitis and information on MRI scheduling.

In all patient groups (adults, children and pregnant women) ultrasonography (US) was the initial diagnostic modality in the majority of hospitals (88.6%, 97.1% and 97.1% respectively). CT was used as second choice modality in adults and children (91.4% and 78.6%).

MRI was primarily used in pregnant women as second choice modality (60.9%). On the question if radiologists were familiar with the use of MRI in diagnosing appendicitis, 42.9% indicated to use MRI for this reason and 40% had read or heard about it, 17.1% did not. Radiologists' opinion towards MRI in appendicitis on a scale from 1 to 7 (1=very negative to 7= very positive) was positive, median 6.

Anticipated problems in implementing MRI for appendicitis were: a shortage in MRI technicians during off-office hours (80%), insufficient MRI capacity (25.7%) and time-consuming character of MRI (25.7%).

This survey showed that radiologists have a positive opinion towards the use of MRI for diagnosing appendicitis. Nevertheless many logistic factors must be overcome before MRI can be effectively implemented in the standard diagnostic pathway for appendicitis.

01.3

**HEPATIC UNSATURATED FATTY ACIDS IN PATIENTS WITH NON-ALCOHOLIC FATTY LIVER DISEASE ASSESSED BY 3.0T MAGNETIC RESONANCE SPECTROSCOPY**

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<sup>2</sup>Gelre Ziekenhuizen, APELDOORN

**Purpose:** Non-alcoholic fatty liver disease (NAFLD) is related to the metabolic syndrome and obesity. Liver biopsy is the reference standard to assess NAFLD. Magnetic Resonance Spectroscopy (MRS) is an alternative to assess hepatic fat content (HFC) and may also allow assessment of unsaturated fatty acids (UFA). There is increasing evidence that hepatic UFA are associated with the development of NAFLD. Therefore the purpose of this study was to assess hepatic UFA with MRS in patients suspected for NAFLD.

**Methods:** We included consecutive patients with deranged liver enzymes, with and without type 2 diabetes mellitus (DM2). Liver function (AST, ALT, and AP) and insulin resistance (HOMA-IR) were assessed. From the 3.0T MR spectra two ratios were calculated: Ratio 1 (UFA); unsaturated fatty acid peak vs. reference water peak and ratio 2 (HFC); total fatty acid peak vs. reference water peak.

**Results:** We included 26 patients included. In these patients hepatic UFA (ratio 1) correlated with AST/ALT ratio ( $r=-0.46, p=0.02$ ), HOMA-IR ( $r=0.59, p=0.004$ ) and HFC ( $r=0.81, p<0.001$ ). In diabetic patients ( $n=12$ ) hepatic UFA correlated with alkaline phosphatase levels ( $r=0.72, p=0.01$ ), HOMA-IR ( $r=0.73, p=0.01$ ) and HFC ( $r=0.83, p=0.002$ ). Compared to non-diabetic patients ( $n=14$ ) with NAFLD, hepatic UFA levels were increased in patients with DM2 and NAFLD (0.014 vs. 0.032,  $p=0.03$ ).

**Conclusion:** Hepatic UFA can be assessed with MRS. Hepatic UFA determined with MRS correlate with metabolic parameters associated with NAFLD. Hepatic UFA are increased in patients with DM2. This study provides first evidence for the use of MRS to assess hepatic UFA.

01.4

### VISCERAL FAT VOLUME AND ITS ASSOCIATION WITH MESENTERIC PANNICULITIS

N. van Putte-Katier<sup>1</sup>, O.E. Elgersma<sup>2</sup>, T.R. Hendriks<sup>2</sup>

<sup>1</sup>Erasmus MC, ROTTERDAM

<sup>2</sup>Albert Schweitzer Ziekenhuis, DORDRECHT

**Purpose:** Mesenteric panniculitis is a rare inflammatory disorder of unknown etiology affecting the mesentery. Recent studies have improved the understanding of adipose tissue and its active role in inflammatory mesenteric and intestinal disease. However, very little is known on the role of adipose tissue in the pathophysiology of mesenteric panniculitis. The purpose of this study was to determine whether increased mesenteric adipose tissue plays an important role in mesenteric panniculitis.

**Methods:** As part of a large hospital based prevalence study on mesenteric panniculitis, a nested case-control study was conducted. 94 patients (70% male) with mesenteric panniculitis were identified and compared to 94 individuals matched by gender and age. Total, subcutaneous and visceral fat volumes were measured on 10 x 5 mm contiguous CT-slices around the level of the umbilicus. A fat-density mask was constructed to include pixels with attenuation values ranging from -190 to -30 Hounsfield units.

**Results:** Mean age of individuals in both groups was 66,6 + 11,2 years. Persons with mesenteric panniculitis had a larger total fat volume (mean volume 2238 ml versus 2106 ml,  $p < 0,05$ ) and visceral fat volume (mean volume 1029 ml versus 916 ml,  $p < 0,05$ ). Subcutaneous fat volume (mean volume 1226 ml versus 1198 ml) was not significantly different between groups.

**Conclusion:** Significant higher levels of visceral fat exist in patients with mesenteric panniculitis compared to individuals without mesenteric panniculitis. Further research is necessary to correlate these findings to the endocrine and metabolic functions of visceral fat in mesenteric panniculitis.

01.5

### PREOPERATIVE MRI CAN PREDICT TUMOR INVASION INTO PELVIC STRUCTURES IN LOCALLY RECURRENT RECTAL CANCER

R.C. Dresen<sup>1</sup>, M. Kusters<sup>2</sup>, A.W. Daniels-Goozen<sup>2</sup>, V.C. Cappendijk<sup>1</sup>, G.A.P. Nieuwenhuijzen<sup>2</sup>, A.G.H. Kessels<sup>1</sup>, A.P. de Bruijne<sup>3</sup>, G.L. Beets<sup>1</sup>, H.J.T. Rutten<sup>2</sup>, R.G.H. Beets - Tan<sup>1</sup>

<sup>1</sup>Maastricht Universitair Medisch Centrum, MAASTRICHT

<sup>2</sup>Catharina-ziekenhuis, EINDHOVEN

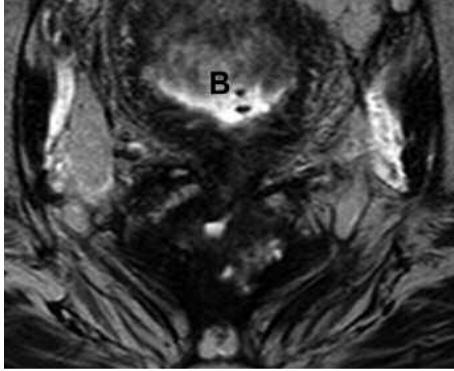
<sup>3</sup>VieCuri Medisch Centrum, VENLO

**Purpose:** To assess the accuracy of preoperative MRI for identification of tumor invasion into pelvic structures in patients with locally recurrent rectal cancer (LRR) scheduled for curative resection.

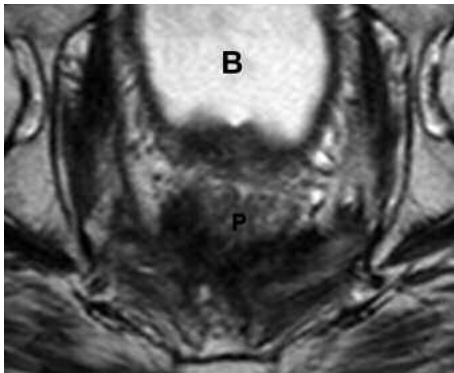
**Patients and methods:** Preoperative MRIs of 40 consecutive patients with LRR scheduled for curative treatment between October 2003 and November 2006 were analyzed retrospectively. Four observers with different experience in reading pelvic MRI assessed tumor invasion into the following structures: bladder, uterus/seminal vesicles, vagina/prostate, left and right pelvic walls and sacrum. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated and a ROC curve was constructed. Surgical and/or histopathological findings were used as reference standard. Interobserver agreement was measured using kappa statistics.

**Results:** Preoperative MRI was accurate for the prediction of tumor invasion into structures with NPVs of 93-100% and AUCs of 0.79-1.00 for all structures and observers. PPVs were 53-100%. Overstaging occurred in 11 (observer 1), 22 (observer 2), 10 (observer 3) and 9 (observer 4) structures and understaging in 9 (observer 3) and 2 (observer 4) structures. Assessment failures were mainly due to misinterpretation of diffuse fibrosis, especially at the pelvic side walls. Interobserver agreement ranged between 0.64 and 0.99 for experienced observers.

**Conclusion:** Preoperative MRI is accurate for the prediction of tumor invasion into pelvic structures. MRI may be useful as preoperative road map for surgical procedure and may thus increase chances of complete resections. Interpretation of diffuse fibrosis remains difficult.



**Image 1:** An example of overstagging



**Image 2:** An example of understagging



**Image 3:** A true negative case

01.6

**GRADING OF LUMINAL CROHN'S DISEASE ACTIVITY AT MAGNETIC RESONANCE IMAGING**

M.L.W. Ziech, J. Stoker

Academisch Medisch Centrum, AMSTERDAM

**Purpose:** To determine how Crohn's disease (CD) activity at MR enterography/enteroclysis is graded by international experts.

**Materials and methods:** Radiologists whom had published on grading luminal CD at MRI between 2006 and 2009 or presented at RSNA and ECR were invited. Participants completed a questionnaire concerning MRI methods and features for grading luminal CD. All items were scored and importance was assessed by means of a visual analogue score (VAS) between 0 (unimportant) and 100 (important).

**Results:** 8 out of 22 abdominal radiologists (experience 6-16 years) responded, including all 5 radiologists with 3 and/or more recent publications/presentations. All radiologists indicated that bowel wall thickness (VAS mean 69; SD 21), T1-enhancement and the comb sign were used in grading. Bowel wall enhancement was considered as mild-severe disease activity, but the importance was indicated variably (VAS mean 69; SD 28). The comb sign was considered severe disease by 6 radiologists (VAS mean 60; SD 18). Seven radiologists found that an abscess indicated severe disease activity (VAS mean 73; SD 18). T1-stratification (6/8, VAS mean 53; SD 10) and enlarged lymph nodes (6/8, VAS mean 40; SD 15) indicated disease activity. T2-signal intensity (5/8), creeping fat (5/8), stenosis (5/8), the outer contour of bowel wall (4/8), ulcerations (4/8), T2-stratification (2/8) and enhancing lymph nodes (2/8) were less often used.

**Conclusion:** Bowel wall thickness, T1-enhancement and the comb sign were the features most often used by experienced abdominal radiologists for grading luminal CD. There was no consensus on the relevance of other imaging features.

01.7

**ACCURACY OF ABDOMINAL CT IN THE DIAGNOSIS BOWEL ISCHEMIA IN PATIENTS SUSPECTED WITH ACUTE ABDOMEN IN GENERAL**

A. van Randen, W. Laméris, P.M. Bossuyt, M.A. Boermeester, J. Stoker

Academisch Medisch Centrum, AMSTERDAM

**Purpose:** Bowel ischemia is a non-frequent but potential fatal cause of acute abdominal pain at the emergency 2.0.2.

department (ED), therefore accurate diagnosis is warranted.

**Material and methods:** Consecutive patients with acute abdominal pain for >2 hours and <5 days were included in a multicentre study, evaluating abdominal CT at the ED. CT was performed with solely intravenous contrast after 6 seconds delay. Radiologists evaluated the CT blinded, solely with knowledge of clinical and laboratory findings performed that day. They recorded imaging features as well as a differential diagnosis (1-3). Reference diagnosis was assigned by an expert panel after 6 months and was used to calculate accuracy statistics for CT.

**Results:** In 20 months, 1021 patients were included of which 12 (1%) had a reference diagnosis of bowel ischemia. Sensitivity of CT was 0.31(95% CI:0.13-0.58) at a specificity of 1.00(95%CI:0.996-100) if the radiologists had recorded bowel ischemia as the most likely diagnosis. This resulted in a positive predictive value of 1.00(95%CI:0.51-1.00) and a negative predictive value of 0.99(95%CI:0.98-0.995). If radiologists recorded bowel ischemia as either the first, second or third differential diagnosis CT sensitivity was 0.39(95%CI:0.18-0.65) ( $p=1.00$ ) with a positive predictive value of 0.50(95%CI:0.24-0.76) ( $p=0.221$ ).

**Conclusion:** CT misses the diagnosis bowel ischemia in the majority of cases. However, if radiologists assign the diagnosis bowel ischemia as their most likely diagnosis, this is most likely correct.

01.8

### CT VAN HET HELE LICHAAM BIJ TRAUMA PATIËNTEN: RELATIE TUSSEN DE LOCATIES VAN DE GEVONDEN LETSELS

D. van der Zee, J. Hendrikse  
UMC Utrecht, UTRECHT

**Doel:** Bij patiënten met een ernstig trauma wordt in de opvang steeds vaker gebruik gemaakt van de CT scan van het hele lichaam bij verdenking op uitgebreider letsel. Doel van de huidige studie is om uit te zoeken of er relaties bestaan tussen de lokaties van de gevonden letsels bij een CT scan.

**Methode:** Retrospectief hebben wij gekeken naar trauma patiënten in 2007 en 2008 waarbij er een CT scan van het hele lichaam met intraveneuze toediening van contrastmiddel is verricht.

**Resultaten:** In totaal werden er 223 CT-scans verricht waarvan in 75% van de gevallen er sprake was van ernstige pathologie. Hiervan werd er in 91 gevallen (40,8%) traumatisch hoofdletsel, in 24 (10,8%) cervicaal letsel, in 104

(46,6%) thoracale letsel en in 82 (36,8%) abdominaal letsel gediagnosticeerd. De meest voorkomende traumatische afwijkingen zijn ribfracturen (30,9%), pneumothorax (21,5%), bekkenfracturen (21,1%) en aangezichtsfracturen (19,7%). Gekeken naar de relatie tussen verschillende lichaamsdelen is er een significante kans op een traumatische afwijking in een aangrenzend lichaamsdeel wanneer er traumatisch letsel wordt gediagnosticeerd. Bij hoofdletsel werd er in 16,5% ( $p:0,022$ ) een cervicale afwijking en in 54,9% ( $p:0,039$ ) een thoracale afwijking gevonden. Bij een thoracale afwijking werd er in 18,3% ook cervicale afwijkingen gevonden ( $p 0,001$ ). Daarentegen werd er geen relatie gevonden tussen hoofd - abdominaal en cervicaal - abdominaal letsel.

**Discussie:** Bij trauma patiënten bevinden er zich vaak traumatische afwijkingen in aangrenzende lichaamsdelen, dit moet met name in het achterhoofd worden gehouden als een CT onderzoek van een trauma patiënt beperkt blijft tot een enkel lichaamsdeel.



Afbeelding 1: Fractuur C5 tot en met T1



Afbeelding 2: Zelfde pat. fig 1. Fractuur L2 + acetabulum rechts

## Sessie 2

## Mammarradiologie

Donderdag 17 september 2009, 11.30 - 13.00 uur

O2.1

**INTER-OBSERVER VARIABILITY IN MAMMOGRAPHY SCREENING AND EFFECT OF TYPE AND NUMBER OF READERS ON SCREENING OUTCOME**L.E.M. Duijm<sup>1</sup>, M.W.J. Louwman<sup>2</sup>, J.H. Groenewoud<sup>3</sup>,  
L.V. van de Poll-Franse<sup>4</sup>, J. Fracheboud<sup>5</sup>, J.W. Coebergh<sup>5</sup><sup>1</sup>Catharina-ziekenuis, EINDHOVEN<sup>2</sup>Integraal Kankercentrum Zuid, EINDHOVEN<sup>3</sup>University of Applied Sciences, ROTTERDAM<sup>4</sup>Tilburg University, TILBURG<sup>5</sup>Erasmus MC, ROTTERDAM

**Purpose:** To determine the variability in radiologists' interpretation of screening mammograms and assess the influence of type and number of readers on screening outcome.

**Materials and methods:** Twenty-one screening mammography radiographers and eight screening radiologists participated. A total of 106,093 mammograms were double-read by two radiographers and, in turn, by two radiologists. Initially, radiologists were blinded to the referral opinion of radiographers. Women were referred if considered positive at radiologist double reading or referred after radiologist review of positive cases at radiographer double reading.

**Results:** Single radiologist reading resulted in a mean cancer detection rate of 4.64 per 1,000 screens (95%CI = 4.23-5.05) with individual variations from 3.44 (95%CI = 2.30-4.58) to 5.04 (95%CI = 3.81-6.27), and a sensitivity of 63.9% (95%CI = 60.5-67.3), ranging from 51.5% (95%CI = 39.6-63.3) to 75.0% (95%CI = 65.3-84.7). Sensitivity at independent radiologist double reading (I), radiologist double reading followed by radiologist review of positive cases at radiographer double reading (II), triple reading by one radiologist and two radiographers with referral of all positive readings (III) and quadruple reading by two radiologists and two radiographers with referral of all positive readings (IV) were as follows: 68.6% (95%CI = 65.3-71.9)(I); 73.2% (95%CI = 70.1-76.4)(II); 75.2% (95%CI = 72.1-78.2)(III), and 76.9% (95%CI = 73.9-79.9)(IV).

**Conclusion:** Screener performance significantly varied at

radiologist single reading. Radiologist double reading increased sensitivity by a relative 7.3%. When there is a shortage of screening radiologists, triple reading by one radiologist and two radiographers may be an alternative to radiologist double reading.

O2.2

**PROBELEIDE TUMOREXCISIE EN SENTINEL NODE PROCEDURE D.M.V. ÉÉN INTRA-TUMORALE INJECTIE VAN RADIOFARMACON BIJ PATIËNTEN MET EEN NIET-PALPABELE MAMMATUMOR**

D.L.M. Schepens, D.G. Franssen-Franken

*Onze Lieve Vrouwe Gasthuis, AMSTERDAM*

**Doel:** Evaluatie van accuratesse van probegeleide tumorexcisie en sentinel node procedure d.m.v. één intratumorale injectie Tc-99m-nanocolloid uitgevoerd bij patiënten met een niet-palpabel mammacarcinoom.

**Methoden:** In 2007 kregen 33 patiënten met een niet-palpabel mammacarcinoom, die mammasparend behandeld werden, één dag preoperatief Tc-99m-nanocolloid intratumoraal toegediend, echogeleid (n=25) of middels stereotaxie (n=8) en ondergingen een lymfescintigram. Peroperatief werd Patent Blue periaireolaire geïnjecteerd.

**Resultaten:** De tumor betrof in 20 en 13 patiënten een BI-RADS 4 respectievelijk 5 classificatie. De tumoren hadden een gemiddelde tumoromvang van 1,3 cm (range 0,3 - 2,5 cm). Alle tumoren werden peroperatief geïdentificeerd en in 26 patiënten (79%) primair radicaal verwijderd. In 5 van 7 patiënten met een irradicaal verwijderde tumor werd geen resttumor in de reëxcisie gedetecteerd, één patiënt had resttumor en van één patiënt was geen follow-up beschikbaar.

In 32 van de 33 patiënten (97%) werd de sentinel node gedetecteerd op het lymfescintigram. Bij één patiënt is peroperatief de sentinel node middels Patent Blue gedetecteerd. In totaal werden er 98 lymfklieren geëxcideerd waarbij in 7 van de 33 patiënten 5 micro- en 5 macrometastasen werden gevonden. Bij aanvullende okselklierdissectie in 6

patiënten werden 112 lymfklieren verwijderd waarbij bij één patiënt 3 additionele lymfkliermetastasen gevonden werden. Eén patiënt werd elders behandeld.

**Conclusie:** Probegeleide tumorexcisie en sentinel node procedure d.m.v. één enkele beeldgeleide intratumorale injectie van Tc-99m-nanocolloïd zorgde in 100% voor detectie van de tumor en in 97% voor identificatie van de sentinel node bij patiënten met een niet-palpabele mammatumor die mammasparende therapie ondergingen. Derhalve blijkt deze methode accuraat en efficiënt.

02.3

### ADDITIONELE WAARDE VAN MAGNETIC RESONANCE IMAGING (MR) MAMMOGRAFIE BIJ PREOPERATIEVE STADIËRING

H.C. van Beek, J.J. Hensen, D. Vroegindewij, R.A. Niezen, A.C. Sikkenk  
*Maasstad Ziekenhuis, ROTTERDAM*

**Doel:** MR mammografie wordt gebruikt bij de preoperatieve stadiëring van patiënten met een bewezen maligniteit in het kader van mammasparende therapie. Doel van dit onderzoek was het analyseren van de additionele waarde van MR mammografie ten aanzien van preoperatieve beleidswijzigingen in deze patiëntengroep.

**Methoden:** Retrospectief werden alle MR mammografieën verricht in 2008 met de indicatiestelling preoperatieve stadiëring geïncludeerd. In totaal betrof het 52 patiënten. De volgende klinische data werden geanalyseerd: leeftijd, multifocaliteit, multicentriciteit en beleidswijziging. De MR mammografieën werden geanalyseerd door twee radiologen werkend in consensus. Multifocaliteit werd gedefinieerd als meerdere invasieve tumoren in een kwadrant en multicentriciteit als een of meerdere invasieve foci op meer dan vier centimeter van de primaire tumor.

**Resultaten:** De gemiddelde leeftijd van de patiënten was 57 jaar. Bij deze groep werd in 29% multifocaliteit gevonden, in 13% multicentriciteit en in 4% zowel multifocaliteit als multicentriciteit. Bij 34% van de patiënten is het beleid gewijzigd: in 15% is geconverteerd van een lumpectomie naar een ruimere lumpectomie en in 19% van een lumpectomie naar een mastectomie. De wijziging in chirurgische benadering bleek in 89% van de patiënten een terechte beslissing. Van de 52 patiënten had 90% een ductaal type adenocarcinoom, 8% een lobulair type adenocarcinoom en 2% een colloidcarcinoom.

**Discussie:** MR mammografie in het kader van preoperatieve stadiëring is van eminent belang. In ons onderzoek werd bij 34% van de patiënten op basis van de bevindingen bij MR

mammografie gekozen voor een andere chirurgische benadering. Dit was in 89% van de gevallen een terechte beslissing.

02.4

### PREOPERATIVE MRI AND FACTORS ASSOCIATED WITH BREAST CANCERS OF LIMITED EXTENT IN WIDE-LOCAL EXCISION SPECIMENS

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<sup>1</sup>UMC Utrecht, UTRECHT

<sup>2</sup>NKI-AvL, AMSTERDAM

<sup>3</sup>Peterborough District Hospital, PETERBOROUGH, United Kingdom

**Purpose:** To discriminate between invasive breast cancers with extensive subclinical disease around the MRI visible lesion and those without subclinical disease.

**Materials and methods:** Sixty-two breast-cancer patients (64 breasts) eligible for breast-conserving therapy on the basis of conventional imaging and MRI were included. The wide-local excision (WLE) specimens were processed using complete embedding, reconstruction and correlation with MRI. Tumors were stratified by presence (extensive-breast-cancer) or absence (limited-breast-cancer) of subclinical disease beyond 10mm from the edge of the MRI-visible lesion in the WLE. Imaging features at mammography, ultrasonography, contrast-enhanced MRI as well as at core histology were evaluated for their ability to discriminate between the extensive and limited breast cancers. Interpretation of MRI was focused on morphological and kinetic properties of contrast uptake. Assessment of core histology included tumor grade and molecular subtype; basal-type (ER-), luminal-type (ER+), and Her2+ type.

**Results:** Of the 64 index tumors, 57 were visible at mammography, 59 at ultrasonography and 61 at MRI. Thirty-five (57%) tumors were limited breast cancers. Significantly associated with extensive breast cancer were presence of a Her2+ index tumor ( $p=0.04$ , PPV=69%, NPV=65%), and moderate/extensive quantity of DCIS in the index tumor ( $p<0.001$ , PPV=78%, NPV=64%). Absence of washout kinetics at MRI had high negative predictive value for extensive breast cancer ( $p=0.036$ , NPV=89%, PPV=50%).

**Conclusions:** Risk of extensive occult disease around MRI-visible lesions decreases with absence of washout kinetics at MRI, but increases with Her2+ types and presence of DCIS in the index tumor. Tumors with the latter properties may be less suitable for more localized therapy such as partial breast irradiation.

02.5

### INVASIVE BREAST CANCER AND ITS SURROUNDING SUBCLINICAL DISEASE SPREAD IN WIDE LOCAL EXCISION SPECIMEN: CORRELATION BETWEEN MRI AND HISTOPATHOLOGIC FINDINGS

A.C. Schmitz<sup>1,2</sup>, M.A.A.J. van den Bosch<sup>1</sup>, C.E. Loo<sup>2</sup>, J.L. Peterse<sup>2</sup>, M. Gertenbach<sup>3</sup>, W.P.Th.M. Mali<sup>1</sup>, E.J. Rutgers<sup>2</sup>, H. Bartelink<sup>2</sup>, K.G. Gilhuijs<sup>2</sup>

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<sup>3</sup>Peterborough District Hospital, PETERBOROUGH, United Kingdom

**Purpose:** Several studies have shown superior ability of Magnetic Resonance Imaging (MRI) to visualize the extent of breast cancer. It raises the question whether margins in breast-conserving therapy (BCT) may be reduced on the basis of MRI. The purpose of this study was to correlate MRI findings with histopathologic findings and to establish the incidence and quantity of MRI-occult disease in BCT patients.

**Materials and methods:** Patients with invasive breast cancer were prospectively included if BCT was performed after conventional imaging and MRI. The wide-local excision (WLE) specimen was subjected to detailed microscopic examination. To correlate MRI and pathology the size of the index tumor was first compared with the size of the MRI-visible lesion. Secondly, distances and quantity of surrounding tumor foci were reconstructed. Tumors were stratified by absence or presence of an extensive intraductal component (EIC- or EIC+).

**Results:** Sixty-two patients (64 breasts) were included. Sixty-one MRI-visible lesions were analyzed. Subclinical disease >10 mm from the edge of the MRI-visible lesion was found in 52% of all specimens (35% in EIC-, 94% in EIC+ tumors ( $p < 0.001$ )). The majority of surrounding tumor foci was DCIS (51%), followed by invasive foci (10%) and lymphatic emboli (2%).

**Conclusion:** Half the number of the WLE specimens did not contain subclinical disease >10 mm from the edge of the MRI-visible lesion. Therefore, reduction of current treatment margins in BCT after MRI is not warranted until these cancers of limited extent can be identified pre-operatively.

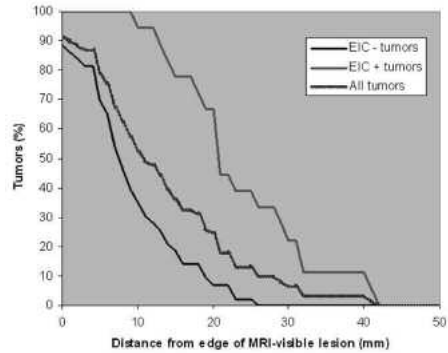


Figure 1: Subclinical disease in the WLE specimen

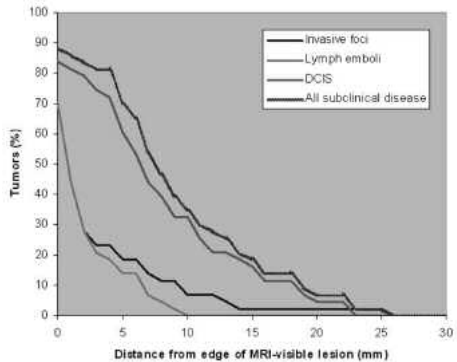


Figure 2: Subclinical disease in the EIC-tumors

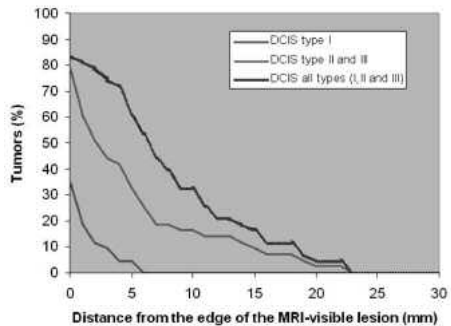


Figure 3: Subclinical disease in the EIC-tumors

02.6

### DIFFUSION WEIGHTED IMAGING TO MONITOR EARLY RESPONSE OF BREAST CANCER TO NEOADJUVANT CHEMOTHERAPY: CORRELATION WITH CONTRAST KINETICS

A.M.Th. Schmitz, C.E. Loo, K. Pengel, A. Paape, S. Muller, K.G.A. Gilhuijs  
NKI-AvL, AMSTERDAM

**Purpose:** To establish correlations between changes in the apparent diffusion coefficient (ADC) of breast cancer at MR diffusion-weighted imaging (DWI) during neoadjuvant chemotherapy (NAC) and changes in morphology of contrast uptake.

**Method and materials:** Twenty-four biopsy-proven breast cancer patients were monitored prior and during NAC using dynamic contrast-enhanced MRI (FLASH-3D) and MR DWI. ADC maps were calculated from the diffusion images. The mean of the smallest ADC values in the tumor (lowest 10% values) were obtained using a custom-built workstation that registers corresponding regions of interest (ROI) in contrast uptake and ADC by linked cursors. Correlations were established between changes in mean ADC and changes in morphology of contrast-uptake. ADC changes were compared with RECIST criteria applied to initial enhancement and to previously optimized criteria applied to late enhancement. Pearson's correlation coefficients and Chi-squared tests were employed to evaluate significance of associations.

**Results:** Increase in ADC was correlated with a decrease in largest tumor diameter at initial enhancement ( $r=-0.42$ ,  $p=0.04$ ) and at late enhancement ( $r=-0.58$ ,  $p=0.005$ ). Maximum agreement occurred at +6% change in ADC, yielding 66.7% accuracy ( $p=0.02$ ) with respect to the RECIST criteria applied to initial enhancement, and 86.4% accuracy ( $p=0.004$ ) with respect to late enhancement.

**Conclusion:** Changes in ADC during NAC show potential as surrogate marker for changes in late enhancement, thus giving potential for high-resolution morphology imaging without compromising information present at late kinetics.

02.7

### MRI OF THE BREAST IN PATIENTS WITH DCIS TO IMPROVE SELECTION FOR THE SENTINEL LYMPH NODE PROCEDURE

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<sup>2</sup>NKI-AvL, AMSTERDAM

**Purpose:** Ductal carcinoma in situ (DCIS) is a pre-invasive breast lesion without the ability to metastasize. Core biopsy has been reported to underestimate presence of invasion in up to 20% of patients with preoperatively diagnosed DCIS. The aim of the current study was to evaluate the efficacy of preoperative MRI to identify patients with DCIS who are at low risk of invasive breast cancer.

**Patients and methods:** Patients diagnosed with DCIS on core biopsy (absence of invasion) were prospectively included. All patients underwent preoperative contrast-enhanced MRI. Clinical, mammographical, histological features from core biopsies, and morphological and temporal MRI features were assessed. All patients underwent breast surgery. Analyses were performed to identify features associated with presence of invasion in the resection specimens. Chi-square statistics and ROC analyses were employed.

**Results:** One-hundred-thirty-seven DCIS lesions (134 patients) were included. Fifty-seven lesions (41.6%) showed no suspicious enhancement at MRI, 12 (8.8%) showed a type-1 curve (continuous increase), 22 (16.0%) a type-2 curve (plateau) and 46 (33.6%) a type-3 curve (washout). Twenty-three lesions showed invasive cancer on final histology. The most predictive features to exclude presence of invasion were absence of enhancement or a type-1 curve at MRI (risk of invasion 4%; area-under-the ROC-curve: 0.80,  $p=0.00002$ ).

**Conclusion:** Complementing clinical and conventional imaging parameters, contrast-uptake kinetics at MRI provide high negative-predictive value to exclude presence of invasion. The technique shows potential to facilitate selection of patients with DCIS in whom sentinel node procedures should not be considered.

Supporting material "MRI of the breast in patients with DCIS to improve selection for the sentinel lymph node procedure"

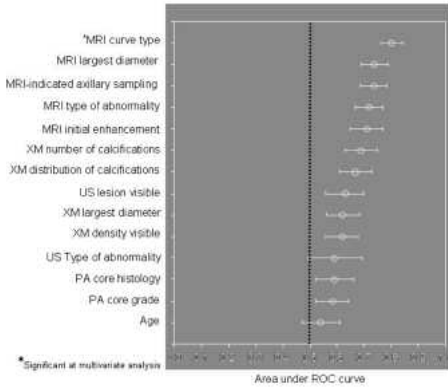


Figure 1: Ranked performance of features associated with invasive disease in preoperative DCIS (N=137)

MRI	No enhancement	Increase (Type 1)	Plateau (Type 2)	Washout (Type 3)
Invasion present	1	0	5	17
Invasion absent	55	12	17	30

Table 1: At multivariate analysis, the enhancement kinetics at MRI is the single most predictive parameter associated with presence of invasion in preoperative DCIS (N=137)

02.8

**RADIOACTIVE SEED LOCALIZATION OF BREAST CANCER PRIOR TO NEOADJUVANT CHEMOTHERAPY**

L.S.F. Yo<sup>1</sup>, L.E.M. Duijm<sup>1</sup>, A.W. Daniëls-Gooszen<sup>1</sup>, Y.E.A. van Riet<sup>1</sup>, G.A.P. Nieuwenhuijzen<sup>1</sup>, A. van den Haak<sup>1</sup>, M. van Beek<sup>2</sup>, F.H. Jansen<sup>1</sup>

<sup>1</sup>Catharina-ziekenhuis, EINDHOVEN

<sup>2</sup>PAMM laboratoria, VELDHOVEN

**Purpose:** Tumor localization in patients undergoing neoadjuvant chemotherapy is currently done with radiopaque clips, which necessitates an additional wire localization prior to breast conserving therapy. As an alternative to radiopaque clip placement, we determined the feasibility and clinical value of radioactive seed localization (RSL) of breast cancer in patients receiving neoadjuvant chemotherapy.

**Patients and methods:** Fifty-six consecutive patients underwent Iodine-125 labeled RSL of primary breast cancers and their satellite lesions prior to neoadjuvant chemotherapy. Ultrasound guided localization was performed using 4.5 by 0.8 mm titanium seeds, labeled with Iodine-125. At definitive surgery, a gamma detector was used for peroperative seed tracing.

**Results:** The average RSL procedure time was 11 minutes (range, 5-25 minutes). A total of 63 seeds were delivered and post RSL mammography showed that all but 3 of the seeds were positioned within 1 centimeter from the center of the primary tumor or satellite lesions. Seed migration was observed in none of the patients at follow-up radiology and the mean time from RSL to definitive surgical therapy was 26 weeks (range, 13-35 weeks). Breast conserving surgery or mastectomy was performed in 45 women (80%) and 11 women (20%), respectively.

**Conclusion:** RSL is an attractive alternative to radiopaque marker clip localization of breast tumors in women scheduled for neoadjuvant chemotherapy. RSL saves the patient an additional preoperative wire localization procedure and simplifies treatment planning.

### Sessie 3

## Cardiovasculaire radiologie 1

Donderdag 17 september 2009, 11.30 - 13.00 uur

O3.1

### EVALUATION OF ATHEROSCLEROTIC PLAQUE COMPOSITION IN A HEALTHY ELDERLY POPULATION: THE ROTTERDAM STUDY

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*Erasmus MC, ROTTERDAM*

**Purpose:** Plaque vulnerability to rupture is related to the composition and morphology of the atherosclerotic plaque. With multiple contrasts, MRI can provide an effective mean to identify and quantify different components of atherosclerotic plaque in the carotid arteries.

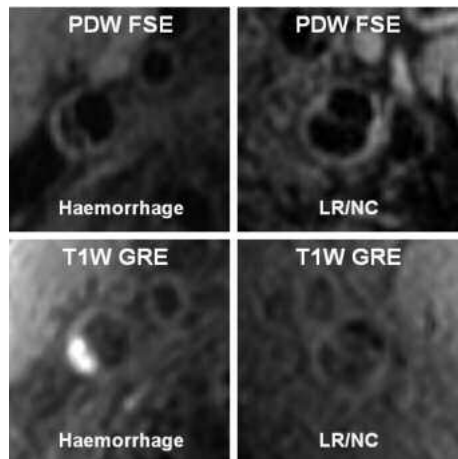
**Methods:** The study is performed within the Rotterdam study, a large ongoing population-based study. Participants with asymptomatic carotid atherosclerosis (ultrasound defined) were studied. We acquired MRI scans with multiple contrast weightings using a 1.5Tesla MRI scanner.

Presence of plaque, different plaque components (calcification, intraplaque hemorrhage (IPH), lipid rich necrotic core (LR/NC), fibrous tissue), predominant plaque component and maximal plaque thickness was determined using previously defined MR imaging criteria.

**Results:** Five hundred subjects (48,3-98,3 years; 57% men) were studied. Thirty-two studies (6%) were excluded due to low image quality. Hundred-ten carotid arteries were normal. In 826 carotid arteries (88%) a plaque was present. Calcifications, IPH and LR/NC were respectively seen in 62%, 21% and 22% of the plaques. IPH and LR/NC were present in respectively 12% and 13% of carotid plaques with a plaque thickness below the median plaque thickness (3.1mm). In plaques with a thickness >3.1mm these components were present in 30% and 31% of the plaques. The predominant plaque component was fibrous tissue in 55%, calcification in 28%, IPH in 9% and LR/NC in 8% of the plaques.

**Conclusion:** Carotid plaque evaluation is feasible. Different components of the plaque can be identified. IPH and LR/NC,

which are considered constituents of the vulnerable plaque, are present predominantly in 26% of asymptomatic participants.



**Image 1:** LRNC vs. Intraplaque hemorrhage MR images from two subjects. The left panels show a hyperintense structure on T1W and a hypo-intense structure on PDW in a 79-year-old participant. This corresponds with intraplaque hemorrhage. The right panels show a hypo-intense lesion in T1W and PDW images, which correspond with a large lipid core in a 73-year-old participant.



**Image 2:** Holder for bilateral surface coil.

03.2

### HCM AND ARVC REFERENCE VALUES IN SEDENTARY PATIENTS ON CARDIAC MRI ARE NECESSARY FOR COMPARISON TO VALUES IN ATHLETES AT RISK

N.H.J. Prakken, T. Luijckx, B.K. Velthuis, M. Cox, R.N. Hauer, M.J. Cramer  
UMC Utrecht, UTRECHT

**Purpose:** Unrecognized asymptomatic cardiomyopathies are a major cause of sudden cardiac death in athletes of which hypertrophic cardiomyopathy (HCM) and arrhythmogenic right ventricular cardiomyopathy (ARVC) are the most common causes. Differentiating healthy athletes from HCM and ARVC on cardiac MRI (CMR) is complicated by overlapping volumes and wall-mass. To narrow this overlap, reference values are needed. Our aim was to establish CMR volumes and wall-mass of patients with confirmed HCM and ARVC and compare these values to athletes and matched controls (non-athletes).

**Methods:** 443 persons aged 18-60 years underwent CMR (mean age 32±12 years, 43% women): 19 HCM patients, 30 ARVC patients, 216 endurance athletes (9-18hrs/wk exercise training) and 178 matched non-athletes (0-3 hrs/wk training). Blinded observers experienced in cardiac MRI used a reproducible contour tracing protocol for volumes, function, and wall-mass analysis.

**Preliminary results:** Right ventricular (RV) volume and mass are higher and RV and left ventricular (LV) ejection fraction (EF) are lower in ARVC patients as compared to athletes and non-athletes. ARVC patients show lower LV volumes and mass as compared to athletes. RV EF and LV mass are higher in HCM patients than in athletes and non-athletes. HCM patients show lower RV and LV volumes as compared to athletes. (table)

**Conclusions:** These preliminary data confirm HCM and ARVC patients show significant differences from controls but substantial overlap with athletes.

Male/Female (n)	Non-athletes 87/91	Athletes 133/83	HCM patients 11/8	ARVC patients 21/9
Male/Female RV Volume (mL)	222±39/164±23	267±38/200±31	189±41#/144±26#	272±88*/207±43*
Male/Female RV EF (%)	53±5/56±6	52±5/52±5	60±5*/65±7*#	40±13*/43±10*#
Male/Female RV Mass (g)	25±6/19±4	29±6/23±4	26±6/22±4	34±9*/27±4*
Male/Female LV Volume (mL)	202±32/156±22	242±33/187±28	195±33#/155±23#	204±32#/175±25
Male/Female LV EF (%)	58±6/60±6	57±5/56±4	59±7/65±4#	49±8*/50±7*#
Male/Female LV Mass (g)	97±18/61±11	120±23/79±17	150±40*#/110±42*#	90±16#/67±7

**Table 1:** (\*)# =significantly different from (non)athletes

03.3

### STIFFNESS OF THE DESCENDING AORTA IS INDEPENDENTLY RELATED TO RENAL FUNCTION IN TYPE 1 DIABETES MELLITUS PATIENTS WITHOUT EVIDENT RENAL IMPAIRMENT

S.G.C. van Elderen, J.J.M. Westenberg, L.J.M. Kroft, J.W.A. Smit, A. de Roos  
Leids Universitair Medisch Centrum, LEIDEN

The purpose of this study was to investigate the possible association between aortic stiffness and renal function in type 1 diabetes mellitus (DM) patients without evident renal impairment.

To test the study purpose, 73 type 1 DM patients (40 male, mean age 46.2±12.3 years, mean DM duration 23.4±10.7 years) were consecutively included from the local outpatient clinic. Exclusion criteria consisted of an estimated glomerular filtration rate (eGFR)<60 ml/min/1.73m<sup>2</sup>, the presence of proteinuria, and general contra-indications for magnetic resonance imaging (MRI). In all study-participants aortic pulse wave velocity (PWV), as a marker of aortic stiffness, was assessed using MRI. Multivariable linear regression analysis was used to test the possible association between aortic PWV and eGFR. Age, the use of antihypertensive drugs and glycated hemoglobin (HbA1c) levels were defined as confounders.

The mean eGFR was 94.9±16.5 ml/min/1.73m<sup>2</sup> (range between 68 and 147 ml/min/1.73m<sup>2</sup>). The mean PWV of the aortic arch was 6.29±2.19 m/s, the mean PWV of the descending aorta was 8.21±4.65 m/s.

A significant association was found between PWV of the descending aorta and eGFR (p=0.017, Beta=-0.308), independent of age, hypertension and HbA1c. No significant association was found between eGFR and PWV of the aortic arch.

In conclusion, in type 1 DM patients without renal impairment, renal function is independently associated with stiffness of the descending aorta, but not of the aortic arch.

03.4

### MDCT CORONARY ARTERY PLAQUE PHENOTYPES IN PATIENTS WITH DIABETES, IMPAIRED GLUCOSE HOMEOSTASIS AND NORMOGLYCAEMIA

M.P.M. Tijssen, D.V. Loeffen, L. Hofstra, E. Laufer, J.E.

Wildberger, T. Leiner

Maastricht Universitair Medisch Centrum, MAASTRICHT

**Purpose:** To assess coronary plaque phenotypes in patients with diabetes mellitus (DM), impaired glucose homeostasis (IGH) and normoglycaemia.

**Method and materials:** We assessed Agatston scores (CCS) and plaque phenotypes in 670 patients (mean age 58±11 yrs; 369M) referred ruling out coronary artery disease (CAD). Examinations were performed on a Philips Brilliance 64-slice CT-scanner. Coronary arteries were analyzed for presence and severity of non-calcified (NC), mixed (MX) and calcified (CA) plaques. Degree of stenosis was classified as wall irregularities, non-significant (<70%) or significant stenosis (>70%). Plaque phenotype mix was assessed for patients with known DM, IGH, and normoglycaemia.

**Results:** 85 patients had DM, 53 IGH and 532 were normoglycaemic. The mean CCS in the group of patients with diabetes was 313±550 and 21 (27%) had at ≥1 significant stenosis. In the group with IGH, the mean CCS was 237±423 and 10 patients (20%) had ≥1 significant stenosis. In the normoglycaemic group the mean CCS was 156±343 and 87 patients (16%) had at ≥1 significant stenosis (all P<0.05). There was no significant difference in plaque phenotype mix between groups. In diabetics the distribution of plaque phenotypes was 11%NC, 30%MX, and 59%CA. In patients with IGH the distribution was 7%NC, 42%MX, and 50%CA. In normoglycaemic patients the distribution was 14%NC, 31%MX, and 55%CA (all P>0.05).

**Conclusion:** Patients with DM and IGH had a significantly higher burden of disease when compared to patients with normoglycaemia but no difference in relative plaque phenotype mix.

03.5

### CORONARY ARTERY DISEASE BURDEN IN ASYMPTOMATIC PATIENTS WITH A ZERO CORONARY CALCIUM SCORE

D.V. Loeffen, M.P.M. Tijssen, S. Mahesh, L. Hofstra,

J.E. Wildberger, T. Leiner

Maastricht Universitair Medisch Centrum, MAASTRICHT

**Purpose:** To assess the prevalence of coronary artery atherosclerosis in asymptomatic patients with zero coronary cal-

cium score (OCCS) undergoing imaging because of elevated risk profile.

**Method and materials:** We assessed Agatston coronary calcium scores in 293 asymptomatic patients (mean age 57±12 yrs; 191M) referred for imaging because of an elevated risk factor profile. All patients underwent coronary CT angiography (CTA) irrespective of the CCS, except for subjects whose CCS>1000. Examinations were performed on a 64-slice spiral CT-scanner (Philips Brilliance 64). Image data were evaluated on an Extended Brilliance Workspace 4.0 workstation (Philips Medical Systems). In all patients the coronary artery tree was analyzed for presence and severity of non-calcified, mixed and calcified plaques using the standard 16-segment scoring system. Degree of stenosis was classified as wall irregularities, non-significant (<70%) or significant (>70%) luminal narrowing.

**Results:** 107 patients (mean age 50±11 yrs, 62M) had OCCS. Of these patients, 85 patients (79.4%) had no evidence of coronary artery disease, 3 (2.8%) had mild vessel wall irregularities, 3 (2.8%) had bridging without stenoses, 12 (11.2%) had non-significant stenoses in at least 1 segment, and 2 (1.9%) had a significant non-calcified stenosis. In 2 patients (1.9%) images were inconclusive because of motion artefacts.

**Conclusion:** Up to 15.8% of asymptomatic patients with elevated risk factor profile and a OCCS exhibit signs of coronary artery disease. Significant soft plaque is present in 1.9% of patients with a OCCS, hence a OCCS does not exclude clinically relevant atherosclerotic coronary artery disease.

03.6

### DUAL SOURCE CT CORONARY PLAQUE ASSESSMENT IN CARDIAC ASYMPTOMATIC PATIENTS WITH FAMILIAL HYPERCHOLESTEROLAEMIA

L.A. Neefjes, J.G. Langendonk, E.J.G. Sijbrands, A. Rossi,

A.C. Weustink, N.R. Mollet, P.J. de Feyter, G.P. Krestin

Erasmus MC, ROTTERDAM

**Clinical relevance:** Familial Hypercholesterolaemia (FH) patients traditionally have been assessed by biomarkers, and coronary plaque imaging may provide additional information.

**Purpose:** To assess the presence, extent and type of coronary plaques in cardiac asymptomatic FH patients using Dual Source CT coronary angiography (CTCA).

**Materials and methods:** Eighty-seven cardiac asymptomatic

matic FH patients (54 men; mean age 52,8±7,3), treated according to clinical standards, underwent Dual Source CTCA. We performed a non-contrast enhanced scan for assessment of the total coronary calcium score and a CTCA to assess the coronary plaque burden. An optimized pulsing protocol was applied to keep the radiation dose as low as possible. The presence of obstructive (>50% diameter stenosis) or non-obstructive plaque and the type of coronary plaque, calcified, non-calcified or mixed, was evaluated per segment (AHA 17 segment model).

**Results:** In 22%, 53% and 25% of the patients the Agatston calcium score was 0, >0-400 and >400, respectively. A total of 485 plaques were observed of which 10% was obstructive. No CT-evidence of coronary artery disease was found in 22%, non-obstructive disease in 51% and obstructive lesions in 27% of the patients. Of the obstructive lesions 30% was located proximal, 45% mid and 25% distal in the coronary tree. The main plaque component of all detected lesions was calcified in 55%, non calcified in 24% and mixed in 21%.

**Conclusion:** In cardiac asymptomatic FH patients 22% has no CT-evidence of coronary disease, 51% has non-obstructive disease and 27% even has advanced coronary disease detected by CTCA.

03.7

## ASSESSMENT OF IMAGE QUALITY OF THE RIGHT VENTRICLE IN THREE DIFFERENT POST-GADOLINIUM IR SEQUENCES IN PATIENTS SUSPECTED OF ARVC

A.S. Plaisier<sup>1</sup>, M.C. Burgmans<sup>2</sup>, N.H. Prakken<sup>3</sup>, M.J. Cramer<sup>3</sup>, B.K. Velthuis<sup>3</sup>, E.P.A. Voncken<sup>3</sup>

<sup>1</sup>Albert Schweitzer Ziekenhuis, DORDRECHT

<sup>2</sup>Leids Universitair Medisch Centrum, LEIDEN

<sup>3</sup>UMC Utrecht, UTRECHT

**Purpose:** An expression of Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC) is right ventricular scarring. This can be visualised by post-gadolinium delayed enhancement inversion recovery (DE-IR) imaging. We compared the quality of three different gradient echo MRI sequences for short axis DE-IR imaging of the right ventricle (RV).

**Methods:** We retrospectively analysed ninety-seven MRI scans performed between February 2006 and December 2008 in patients suspected of ARVC. A Phase Sensitive Inversion Recovery 2D sequence (PSIR), a 2D sequence (2D) and a 3D sequence (3D) were applied in respectively 38, 32 and 27 MRI-examinations. The exams (mean patient age: 41,2 years, 67% men) were randomized and presented to

two radiologists who were blinded for patient details. The RV was divided in 10 segments (figure 1). Every segment was assessed for image quality. A consensus reading was performed if data differed between the two readings.

**Results:** Image quality was good in 25% of all segments in the 3D group, 66% in the 2D group and 79% in the PSIR group. 90% of the PSIR exams were considered as clinically suitable compared to 75% in the 2D group and 7% in the 3D group (figure 2). Poor image quality was observed in 51% (3D), 10% (2D), and 2% (PSIR) of all segments. Breathing-artifacts occurred in 22% (3D), 59% (2D) and 53% (PSIR). Movement-artifacts occurred in 56% (3D), 28% (2D) and 29% (PSIR).

**Conclusion:** Post-gadolinium imaging using the PSIR sequence results in a better image quality of the RV compared to the 2D and 3D sequence.

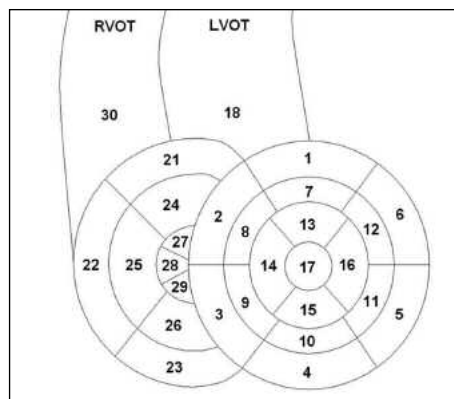


Figure 1: Segmental division of the right ventricle.

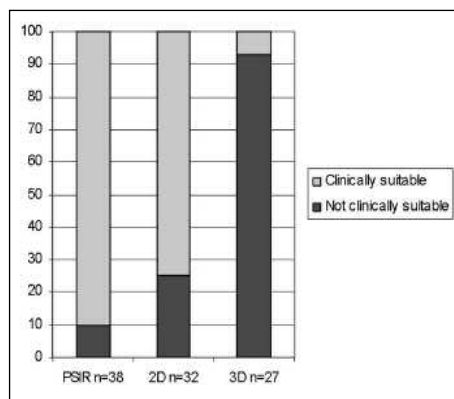


Figure 2: Percentage of clinically suitable exams by type of sequence

03.8

### **DYSFUNCTIONAL HAEMODIALYSIS FISTULAS AND GRAFTS: DETECTION OF ARTERIAL INFLOW STENOSES WITH COLOUR DOPPLER ULTRASONOGRAPHY**

L.E.M. Duijm<sup>1</sup>, R.N. Planken<sup>2</sup>, A.V. Tielbeek<sup>1</sup>,  
G.M. Krietemeijer<sup>1</sup>, P. Douwes-Draaijer<sup>1</sup>, P.W. Cuypers<sup>1</sup>,  
J.H.M. Tordoir<sup>3</sup>

<sup>1</sup>*Catharina-ziekenuis, EINDHOVEN*

<sup>2</sup>*Academisch Medisch Centrum, AMSTERDAM*

<sup>3</sup>*Maastricht Universitair Medisch Centrum, MAASTRICHT*

**Purpose:** The value of Colour Doppler Ultrasonography (CDUS) for the detection of access site stenoses and out-flow stenoses has been established. The European Best Practice Guidelines on Vascular Access propose Magnetic Resonance Angiography (MRA) for visualization of the arterial inflow. We prospectively determined the value of CDUS for evaluation of the complete arterial inflow in dysfunctional haemodialysis access.

**Patients and methods:** A total of 115 arteriovenous fistulas and 22 arteriovenous grafts in 70 females and 67 males (mean age 65.4 years, age range 20.7-85.5 years) were included. CDUS was performed by vascular technologists and comprised evaluation of the arterial inflow from the subclavian artery. Stenoses were considered significant if showing >50% luminal diameter reduction at gray-scale imaging and/or a peak systolic velocity ratio >2. At subsequent Digital Subtraction Angiography (DSA), a catheter was advanced into the central arterial inflow after retrograde venous access puncture. DSA was used as standard of reference; stenoses showing >50% diameter reduction were considered significant. Radiologists were blinded to CDUS findings.

**Results:** CDUS detected 19 inflow stenoses (subclavian artery: 2; axillary artery: 4; brachial artery: 6; radial artery: 7) in 17 patients. All but two of these stenoses (1 brachial artery and 1 subclavian artery stenosis) were confirmed at DSA. DSA depicted two additional subclavian artery stenoses.

**Conclusion:** As an alternative to MRA, CDUS accurately detects arterial inflow stenoses. Full retrograde DSA, including complete inflow evaluation, should be reserved for exceptional cases that remain suspicious of having a central inflow stenosis following negative CDUS findings.

## Sessie 4

Neuroradiologie /  
Hoofdhals radiologie

Donderdag 17 september 2009, 11.30 - 13.00 uur

O4.1

**COILING OF INTRACRANIAL ANEURYSMS:  
A SYSTEMATIC REVIEW ON INITIAL OCCLUSION  
AND REOPENING AND RETREATMENT  
RATES**S.P. Ferns<sup>1</sup>, M.E.S. Sprengers<sup>1</sup>, W.J.J. van Rooij<sup>2</sup>,  
G.J.E. Rinke<sup>3</sup>, J.C. van Rijn<sup>1</sup>, S. Bipat<sup>1</sup>, M. Sluzewski<sup>2</sup>,  
C.B.L.M. Majoie<sup>1</sup><sup>1</sup>Academisch Medisch Centrum, AMSTERDAM<sup>2</sup>St. Elisabeth Ziekenhuis, TILBURG<sup>3</sup>UMC Utrecht, UTRECHT

**Purpose:** The proportion of incompletely occluded aneurysms after coiling varies widely between studies. We systematically reviewed the literature to determine initial occlusion, reopening and retreatment rates of coiled aneurysms according to predefined criteria and subgroups.

**Materials and methods:** We searched Pub-Med and EMBASE (January 1999-September 2008) for studies of over 50 coiled aneurysms. Two reviewers independently extracted data. We grouped studies reporting on only ruptured aneurysms, posterior circulation aneurysms and studies with large proportions of aneurysms > 10 mm to assess possible determinants for incomplete occlusion, reopening and retreatment.

**Results:** 46 studies totalling 8161 coiled aneurysms met inclusion criteria. Immediately after coiling, 91.2% (95%CI: 90.6-91.9%) of the aneurysms were adequately occluded. Aneurysm reopening occurred in 20.8% (95%CI: 19.8-21.9%) and retreatment was performed in 10.3% (95% CI: 9.5-11.0%).

Reopening rate was lower in studies reporting on ruptured aneurysms only compared to all studies (11.4% versus 20.8%, RR 0.55; 95%CI:0.47-0.64) and was higher in studies focussing on posterior circulation aneurysms compared to studies with >85% anterior circulation aneurysms (22.5% versus 15.5%, RR 1.5; 95%CI:1.2-1.7). Regression analysis showed higher retreatment rates with increasing proportion of aneurysms >10 mm ( $\beta$  0.252, 95%CI:0.073-0.432). We could not find a relation between reopening and type of coils used.

**Conclusion:** At follow-up, one fifth of all coiled intracranial aneurysms shows reopening of which half is retreated. Possible risk factors for aneurysm reopening are location in the posterior circulation and size >10mm. To confirm our findings, a meta-analysis on individual well reported patient data is desirable.

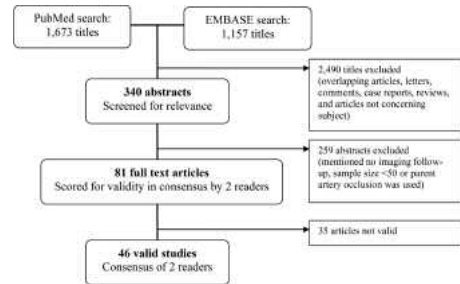


Figure 1: Flow chart showing literature search

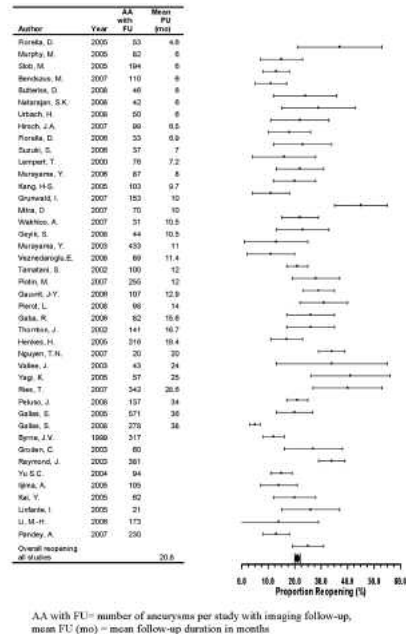


Figure 2: Included studies with reopening rates

O4.2

### LATE ADVERSE EVENTS IN COILED RUPTURED ANEURYSMS WITH INCOMPLETE OCCLUSION AT SIX MONTHS ANGIOGRAPHIC FOLLOW-UP

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<sup>2</sup>St. Elisabeth Ziekenhuis, TILBURG

**Background:** Patients with coiled ruptured aneurysms with incomplete occlusion at 6 months are not only at risk for rebleed during further follow-up, but also for complications of angiographic follow-up and retreatment, and for progressive mass effect by uncontrollable aneurysm growth. In this study we assessed frequency and outcome of all these possible aneurysm related events in 124 patients with incompletely occluded aneurysms at 6 months during a follow-up of 419 follow-up patient years.

**Methods:** Between 1994 and 2007, 901 ruptured aneurysms were coiled and 713 (79%) had 6 months angiographic follow-up, of which 124 were incompletely occluded (17%). These 124 patients were followed for mean 3.4 years (median 2.5, range 0.1-11.7 years).

**Results:** During follow-up, 307 angiograms were performed without complications. Of 124 aneurysms, 88 were retreated (71%). Fifteen aneurysms were retreated more than once. Altogether, 124 additional treatments were performed and no complications occurred (0%, 95% CI 0.0-3.6%). Four aneurysms rebleed causing death in 2 patients. Another 4 patients experienced progressive mass effect by growth of the coiled aneurysm leading to death in 1. Annual event rate was 1.9%, annual mortality was 0.7% and annual rebleed rate was 1.0% (8, 3 and 4 in 419 patient-years).

**Conclusion:** In patients with coiled ruptured aneurysms with incomplete occlusion at 6 months, a strategy of imaging follow-up and retreatment when possible leads to a low incidence of serious adverse events. Rebleed and progressive mass effect of the aneurysm were responsible for these events, not complications from additional treatment or angiographic follow-up.

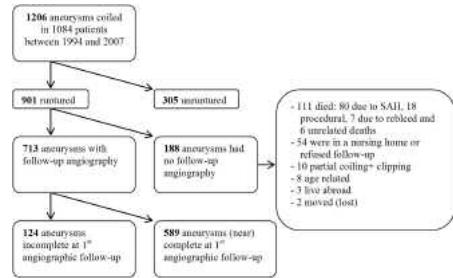


Figure 1: Flow chart showing patient selection

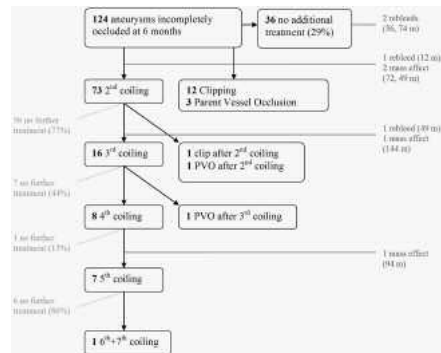


Figure 2: Flow chart showing retreatments

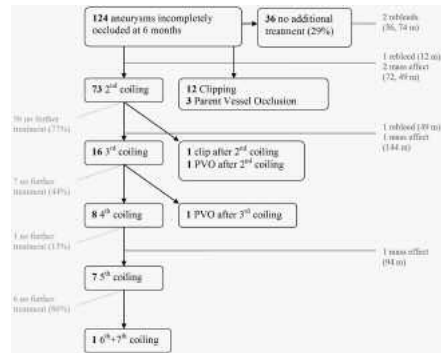


Figure 3: Cumulative incidence of late events

04.3

### MULTICENTER REPRODUCIBILITY OF CONTINUOUS, PULSED AND PSEUDO-CONTINUOUS ARTERIAL SPIN LABELING; CAN WE USE GENERAL REFERENCE VALUES OF CEREBRAL BLOOD FLOW?

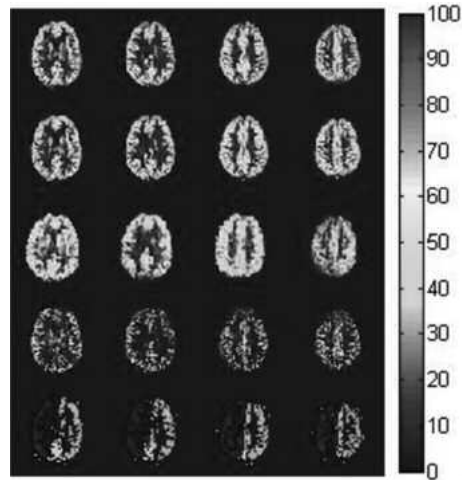
S. Gevers<sup>1</sup>, M.J.P. van Osch<sup>2</sup>, J. Hendrikse<sup>3</sup>, R.P.H. Bokkers<sup>2</sup>, D.A. Kies<sup>2</sup>, C.B.L.M. Majoie<sup>1</sup>, A.J. Nederveen<sup>1</sup>

<sup>1</sup>Academisch Medisch Centrum, AMSTERDAM

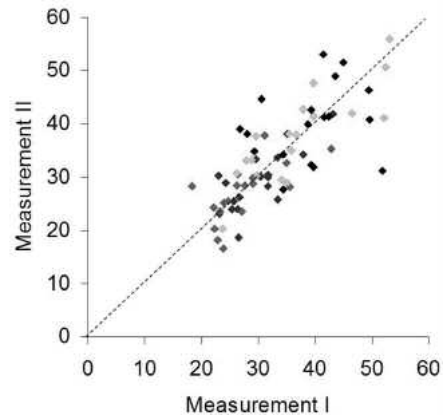
<sup>2</sup>Leids Universitair Medisch Centrum, LEIDEN

<sup>3</sup>UMC Utrecht, UTRECHT

Arterial spin labeling (ASL) has the unique capacity to visualize brain perfusion non-invasively. The set-up of ASL experiments can be complex and reproducibility data are sparse. Knowledge on reproducibility is essential for the interpretation of perfusion values. It determines whether general reference values could be used in clinical decision-making or if each hospital should first gauge its own data in healthy controls. In the present study we assessed intra- and multicenter reproducibility of presently used ASL sequences. Six healthy volunteers were scanned twice in three different imaging centers equipped with Philips 3T MR-scanners and equal implementation of ASL sequences. The imaging protocol consisted of MR-angiography, continuous (CASL), pulsed (PASL) and pseudo-continuous ASL (pseudo-CASL) with and without background suppression (BS), regional perfusion imaging for flow territory definition and a 3D T1-weighted scan for registration and segmentation. All images were transformed into anatomical space. Whole brain (WB) and regional cerebral blood flow (CBF) were quantified. Reproducibility was expressed in terms of the repeatability index. Figure 1 shows perfusion images obtained by different ASL techniques. Mean WB-CBF values were 37.2 to 37.9 ml/100g/min for different ASL techniques. Figure 2 shows test-retest CBF values. Repeatability indices are presented in Table 1. Based on our results, one can be 95% sure that WB-CBF differences will be less than 25% between imaging centers. This finding could enable the use of general reference values, with CBF deviating less than 25% considered normal. Pseudo-CASL was least variable with BS further reducing its variability.



**Figure 1:** Perfusion images obtained by Pseudo BS, Pseudo no BS, CASL, PASL and RPI (top to bottom)



**Figure 2:** Mean WB-CBF values (mL/100g/min) for CASL (green), PASL (black), Pseudo BS (BLUE) and Pseudo no BS (red)

		Pseudo BS	Pseudo no BS	CASL	PULSAR
WB	Intracenter	7.6	12.9	10.1	15.5
	Multicenter	9.6	10.0	14.9	12.2
LICA	Intracenter	14.2	20.5	14.9	15.6
	Multicenter	14.0	18.6	17.1	25.5
IRICA	Intracenter	14.9	19.2	15.2	22.5
	Multicenter	18.4	24.2	15.9	24.1
BA	Intracenter	15.5	22.0	15.2	42.7
	Multicenter	19.2	22.6	18.4	41.4

**Table 1:** Repeatability Indices of WB-CBF measurements

04.4

### HIGH PREVALENCE OF INTRACRANIAL ARTERIAL STENOSES IN A LARGE CONSECUTIVE COHORT OF ISCHEMIC STROKE PATIENTS

P.J. Homburg, G. Plas, S. Rozie, H.L. Tanghe, D.W. Dippel, A. van der Lugt  
Erasmus MC, ROTTERDAM

**Purpose:** Intracranial arterial stenoses in patients with a recent TIA or ischemic stroke have been associated with a high risk of stroke recurrence. In Asian populations, intracranial arterial stenoses were shown to be highly prevalent in patients with cerebrovascular events. We aimed to study the prevalence and risk factors associated with intracranial arterial stenosis in consecutive European patients with a TIA or minor stroke.

**Method and materials:** A total of 406 patients with TIA or minor stroke were included. All patients underwent multi-detector CTA of the extra- and intracranial arteries of the brain. The presence of intracranial stenoses ( $\geq 30\%$  luminal narrowing) was determined with MIP and MPR images. In all patients cardiovascular risk factors were registered and used in a multivariate model to identify independent associations with intracranial artery stenosis.

**Results:** In 89 (22%) patients, 133 stenoses were observed, of which most were located in the posterior circulation (103 of 133). In only 22 (5%) patients, ischemic symptoms could be related to the vascular territory of a stenotic artery. None of these 22 patients had a cardiac source of embolism, while 8 had a  $>50\%$  stenosis in the extracranial carotid bifurcation. Age (OR=2.2), male-gender (OR=2.5), non-Caucasian race (OR=2.9), history of myocardial infarction (OR=2.1) and hypercholesterolemia (OR=2.0) were independently associated with intracranial stenosis.

**Conclusion:** A high prevalence of intracranial stenosis was observed in this European stroke population. However, most stenoses were asymptomatic. The majority of stenoses were located in the posterior circulation. Invasive intervention should therefore be considered with restraint.

04.5

### VOLUME VERSUS TWEEDIMENSIONALE METINGEN VAN VESTIBULAIRE SCHWANNOMEN: KLINISCHE BETEKENIS VOOR HET MONITOREN VAN TUMORGROEI

R. van de Langenberg<sup>1</sup>, R.B.J. de Bondt<sup>2</sup>, P. Nelemans<sup>3</sup>, B.G. Baumert<sup>1</sup>, R.J. Stokroos<sup>1</sup>

<sup>1</sup>Maastricht Universitair Medisch Centrum, MAASTRICHT

<sup>2</sup>Isala klinieken, ZWOLLE

<sup>3</sup>Universiteit Maastricht, MAASTRICHT

**Doel:** Bepalen van de meest geschikte meetmethode om de beste interobserver reproduceerbaarheid te bereiken bij het monitoren van groei van het vestibulair schwannoom (VS).

**Materiaal en methode:** Retrospectieve vergelijking van conventionele tweedimensionale metingen met volumemetingen op contrast enhanced (CE) T1-WI en T2-WI MRI-scans van 68 patiënten. Twee readers voerden onafhankelijk van elkaar tweedimensionale en volume metingen uit. Het kleinst meetbare verschil buiten de meetfout (Smallest detectable differences (SDD)) werd berekend en de intraclass correlatie coefficient (ICC) voor tweedimensionale en volume metingen werd bepaald.

**Resultaten:** Beide technieken lieten de beste reproduceerbaarheid zien op CE T1-WI MRI. SDD voor relatieve verschillen ten opzichte van de uitgangs MRI, (SDD(%)) toonde aan dat tweedimensionale metingen geassocieerd zijn met een hogere interobserver- error vergeleken met volumemetingen (40% versus 19%), welke afnam bij toename van tumorgrootheid. De ICC was 0.999 bij volumemetingen en 0.947-0.978 bij tweedimensionale metingen.

**Conclusie:** Volumemetingen zijn nauwkeuriger vergeleken met tweedimensionale metingen bij het monitoren van VS groei en worden bij voorkeur bepaald op CE T1-WI MRI. De SDD tussen opeenvolgende scans overschrijdt de arbitraire 1 à 2 mm toename tussen scans, die nu gebruikt wordt als maat voor tumorgroei.

04.6

### DISTRIBUTION OF CEREBRAL BLOOD FLOW IN THE NUCLEUS CAUDATUS, NUCLEUS LENTIFORMIS AND THALAMUS: A TERRITORIAL ARTERIAL SPIN LABELING MRI STUDY

J. Hendrikse<sup>1</sup>, S.M. Chng<sup>2</sup>, N. Venketasubramanian<sup>2</sup>,

E.T. Petersen<sup>2</sup>, X. Golay<sup>2</sup>

<sup>1</sup>UMC Utrecht, UTRECHT

<sup>2</sup>National Neuroscience Institute, SINGAPORE, Singapore

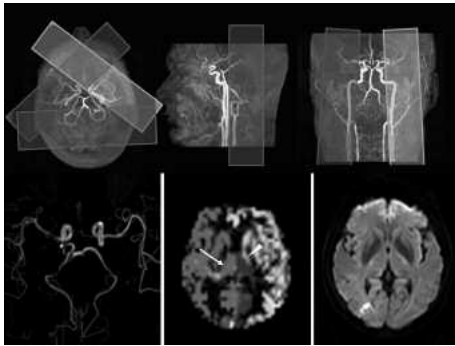
**Background and purpose:** Anatomical variations of the circle of Willis are known to influence the distribution of cerebral blood flow to cortical brain regions. The aim of the present study is to investigate the effect of variations in the circle of Willis anatomy on the perfusion territory to the nucleus caudatus, nucleus lentiformis and the thalamus.

**Materials and methods:** The ethics committee of our institution approved the study protocol. A total of 159 patients with first time clinical symptoms of cerebral ischemia were recruited. Perfusion territory contribution of the left internal carotid artery (ICA), right ICA and vertebralis arteries to the deep brain regions were visualized with

territorial arterial spin labeling (TASL) Magnetic Resonance Imaging (MRI). The anatomy of the circle of Willis was evaluated with time-of-flight MR angiography.

**Results:** The perfusion territory contributions to the deep brain structures could be evaluated in 119 patients. In patients with a fetal type circle of Willis, there was a contribution from the ipsilateral ICA to the thalamus in all 41 hemispheres (100%), compared to 96 of the 197 hemispheres (49%) without a fetal type circle of Willis. In patients with a hypoplastic A1 segment, there was more often a contribution of the contralateral ICA to the perfusion of the nucleus caudatus and the nucleus lentiformis.

**Conclusion:** A large variation is present in the perfusion territory contributions to the deep brain structures, which can be partly explained by variations in the anatomy of the circle of Willis.



**Image 1:** Territory arterial spin labeling MRI

04.7

#### REPRODUCIBILITY OF FLOW TERRITORIES DEFINED BY PLANNING-FREE VESSEL ENCODED PSEUDO-CONTINUOUS ARTERIAL SPIN LABELING

S. Gevers<sup>1</sup>, A.J. Nederveen<sup>1</sup>, J. Hendrikse<sup>2</sup>, R.P.H. Bokkers<sup>2</sup>, D.A. Kies<sup>3</sup>, C.B.L.M. Majoie<sup>1</sup>, M.J.P. van Osch<sup>3</sup>

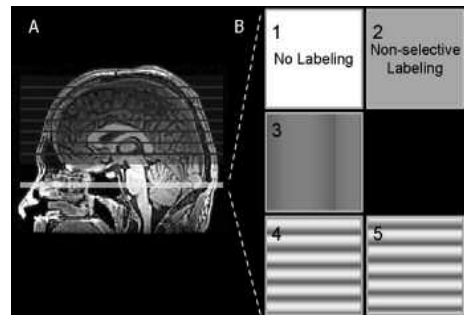
<sup>1</sup>Academisch Medisch Centrum, AMSTERDAM

<sup>2</sup>UMC Utrecht, UTRECHT

<sup>3</sup>Leids Universitair Medisch Centrum, LEIDEN

Perfusion territory information adds valuable information in the evaluation of brain disease. Selective arterial spin labeling (ASL) MRI has the unique capacity to show perfusion territories non-invasively. Whereas first implementations required time-consuming planning of a labeling plane, the recent introduction of vessel-encoded pseudo-continuous ASL (pseudo-CASL) has enabled complete planning-free acquisition of all major flow-territories within 5 minutes. The clinical applicability of this method is dependent on its

reproducibility. Therefore we assessed the reproducibility of planning-free vessel-encoded pseudo-CASL. Local ethics committees of 3 imaging centers approved the study protocol. Six healthy volunteers were scanned twice at each site. Participating centers were equipped with a Philips 3T MR-scanner with equal implementation of vessel-encoded (pseudo-CASL) (Figure 1). Flow territories of the right and left internal carotid (RICA and LICA) and basilar artery (BA) were defined using k-means clustering. Edge pixels separating flow territories were identified and the mean and mean maximum distance between the flow territory boundaries was used as a measure of reproducibility. Visual comparison showed that all repeated scans yielded the same flow territories for all but one individual, who was excluded from further analysis. Table 1 shows mean and mean-maximum intra- and intercenter distances. Mean intracenter RICA distances differed significantly between sites. Mean-maximum intracenter distances were not significantly different between sites. Intracenter and intercenter mean distances were not significantly different. Intracenter mean-maximum distances were significantly smaller than intercenter mean-maximum distances ( $P < 0.01$ ). The results of this study indicate that planning-free vessel encoded pseudo-CASL is a reproducible selective ASL technique.



**Figure 1:** Imaging volume and labeling plane (A), spatially manipulated labeling efficiency: 1. control, 2. non-selective labeling, 3. labeling efficiency varied between -1 and 1 in the left-right direction, 4. labeling efficiency varied in the anterior-posterior direction, 5. identical but shifted in posterior direction compared to previous dynamic (B)

Intracenter	RICA	LICA	BA
Mean site I, II, III			
Mean	2.2 ± 0.6	2.1 ± 0.5	2.5 ± 0.7
Mean max	7.9 ± 2.3	8.4 ± 2.0	10.0 ± 4.2
Intercenter	RICA	LICA	BA
Mean	2.6 ± 0.3	2.5 ± 0.3	4.0 ± 2.9
Mean max	9.0 ± 1.4	9.7 ± 1.5	10.6 ± 2.7

**Table 1:** Mean and mean maximum distances between perfusion territory edge pixels of the RICA, LICA and BA. Presented values are mean values and standard deviations of all sites and subjects.

04.8

### **MULTI-DETECTOR CT ANGIOGRAPHY FOR THE QUANTIFICATION OF CAROTID CALCIUM IN THE ATHEROSCLEROTIC CAROTID PLAQUES IN ASYMPTOMATIC AND SYMPTOMATIC PATIENTS**

F.H. Potters<sup>1</sup>, S. Rozie<sup>1</sup>, A. van der Lugt<sup>1</sup>, G. Saba<sup>2</sup>, G. Mallarini<sup>2</sup>

<sup>1</sup>Erasmus MC, ROTTERDAM

<sup>2</sup>Policlinico Universitario, MONSERRATO, Italy

**Purpose:** Calcification in the atherosclerotic carotid plaque has been associated with carotid plaque stability. We therefore hypothesize that asymptomatic patients have higher calcium volumes in their atherosclerotic plaques than symptomatic patients.

**Methods and materials:** 95 asymptomatic (74% male, mean age 71 years) and 351 (60% male, mean age 62) patients with cerebrovascular symptoms in the territory of the carotid artery, underwent multi-detector CT Angiography of the carotid arteries.

The asymptomatic patients were scanned using a 4-slice scanner Philips, MX8000. The symptomatic patients were scanned using a 16-slice MDCT scanner Siemens, Sensation 16.

First, the presence of atherosclerotic carotid disease was detected. Second, the calcium volume was measured using a custom-made software tool and drawing contours manually. The cut-off value used for calcifications was >130 HU. The data was adjusted for age and gender. Two observers, who were blinded to clinical information, performed the volume measurements in consensus.

**Results:** Atherosclerotic carotid disease was present in 93 % of the asymptomatic subjects and in 65% of the symptomatic patients.

The volume of the calcified part of the plaque in the asymptomatic subjects was  $378 \pm 311$  mm<sup>3</sup> and was  $138 \pm 190$  mm<sup>3</sup> in the symptomatic patients, which was significantly different.

**Conclusion:** The volume of the calcified part of the atherosclerotic carotid plaque in asymptomatic patients was larger than in symptomatic patients.

Clinical relevance/application Plaques in asymptomatic patients have higher calcium volumes which could be useful for risk stratification and follow-up MDCTA-studies.

## Sessie 5

## Interventieradiologie

Donderdag 17 september 2009, 11.30 - 13.00 uur

05.1

**UITKOMSTEN VAN PERCUTANE RADIO-FREQUENTE ABLATIE VAN NIERTUMOREN**M.A. Stam, A.R. van Erkel, R.F.M. Bevers, C.S.P. van Rijswijk  
Leids Universitair Medisch Centrum, LEIDEN

**Introductie:** Radiofrequente ablatie (RFA) is een minimaal invasieve behandeling waarbij percutaan een elektrode in de tumor wordt geplaatst waarna het tumorweefsel door verhitting wordt vernietigd. RFA is een alternatief voor chirurgie bij patiënten met kleine niertumoren (<4 cm) waarbij het behoud van nierweefsel voorop staat (solitaire nier, bilaterale tumoren en slechte nierfunctie) of wanneer chirurgie niet wenselijk is vanwege comorbiditeit.

**Patiënten en methoden:** Van april 2003 t/m maart 2009 werden in ons ziekenhuis 24 niertumoren (19 patiënten) met RFA behandeld. RFA was geïndiceerd vanwege comorbiditeit voor chirurgie of slechte nierfunctie. Primair technisch succes is gedefinieerd als het ontbreken van aankleurend tumorweefsel op de eerst volgende controle CT scan met intraveneus contrast. Indien er op de eerste controle CT scan aankleurend tumorweefsel zichtbaar was ondergingen de patiënten een tweede ablatie sessie. Recidief tumor is gedefinieerd als hernieuwde aankleuring van de tumor na eerdere succesvolle tumorablatie.

**Resultaten:** De gemiddelde grootte van de tumoren was 2,1 cm (1,0-4,0). De RFA-procedure was primair technisch succesvol bij 21 tumoren (88%). Bij drie patiënten (13%) was er sprake van tumorresidu waarna een tweede RFA succesvol werd uitgevoerd (secundaire technisch succes 100%). Gedurende de follow-up (range 0-66, mediaan 13 maanden) ontstond 1 recidief in de rand van de eerdere ablatie en 2 nieuwe tumoren op een andere locatie in dezelfde nier. Complicaties traden op bij drie patiënten (16%); langdurige pijn, zenuwletsel en een pyelocutane fistel.

**Conclusie:** RFA is een geschikte methode voor de behandeling van kleine niertumoren bij patiënten met een slechte nierfunctie of contra-indicaties voor chirurgie.

05.2

**VAST: VERTEBRAL ARTERY STENTING TRIAL. PROTOCOL FOR A RANDOMISED SAFETY AND FEASIBILITY TRIAL**J.A. Vos<sup>1</sup>, A. Compter<sup>2</sup>, H.B. van der Worp<sup>2</sup>, W. Schonewille<sup>1</sup>, A. Algra<sup>2</sup>, T.H. Lo<sup>2</sup>, W.P.Th.M. Mali<sup>2</sup>, F.L. Moll<sup>2</sup>, L.J. Kapelle<sup>2</sup><sup>1</sup>St. Antonius Ziekenhuis, NIEUWEGEIN<sup>2</sup>UMC Utrecht, UTRECHT

**Background:** Twenty to 30 percent of all transient ischaemic attacks (TIAs) and ischaemic strokes involve the vertebral-basilar circulation. Atherosclerotic stenosis  $\geq$  50% in the vertebral artery accounts for vertebral-basilar stroke in at least one third of the patients. Percutaneous transluminal angioplasty and stenting of vertebral stenosis has been introduced as an attractive treatment option.

**Objectives:** Primary aim of the Vertebral Artery Stenting Trial (VAST) is to assess safety and feasibility of stenting for symptomatic stenosis. Secondary aim is to assess the rate of new vascular events in the vertebral-basilar territory in patients with symptomatic vertebral stenosis on best medical therapy with or without stenting.

**Design:** This is a randomised, open clinical trial, comparing best medical treatment with or without vertebral artery stenting in patients with recently symptomatic vertebral artery stenosis  $\geq$  50%. VAST will include 180 patients with TIA or non-disabling ischaemic stroke attributed to vertebral artery stenosis. Primary outcome: any stroke, vascular death, or non-fatal myocardial infarction within 30 days after start of treatment. Secondary outcome: any stroke or vascular death during follow-up and the degree of (re)stenosis after one year.

**Discussion:** Improvements in imaging of the vertebral artery and in endovascular techniques have created new opportunities for the treatment of symptomatic vertebral artery stenosis. This trial will assess the feasibility and safety of stenting for symptomatic vertebral artery stenosis and will provide sufficient data to inform a conclusive randomised trial testing the benefit of this treatment strategy. VAST is supported by the Netherlands Heart Foundation (2007B045; ISRCTN29597900).

05.3

### **INTRA-ARTERIAL RADIOEMBOLIZATION WITH YTTRIUM-90 MICROSPHERES OF PATIENTS WITH UNRESECTABLE LIVER TUMORS: EARLY RESULTS IN THE NETHERLANDS**

J.W. Wijlemans, M.G.E.H. Lam, E.P.A. Vonken, B.A. Zonnenberg, K.J. van Erpecum, M.A.A.J. van den Bosch  
UMC Utrecht, UTRECHT

**Introduction:** Patients with unresectable liver tumors can be treated with intra-arterial Yttrium-90 radioembolization. We present an overview of the first procedures in The Netherlands.

**Methods:** Five patients were treated in our hospital between February and April 2009. Preprocedural mesenteric angiography was performed, extrahepatic visceral arteries were embolized if necessary, and 99mTc-labeled MacroAggregated Albumin (150 MBq) was injected in the hepatic artery. Provided patients did not show a lung shunt >20% or extrahepatic deposits of MAA on the SPECT-scan, Yttrium-90 treatment was performed within two weeks. Periprocedural (<30 days) complications were recorded and tumor response at 1 month follow-up was measured using the RECIST criteria.

**Results:** Five patients (3 females; mean age 57.2, range 38-68) presented with neuroendocrine metastases (n=2), hepatocellular carcinoma (n=2) and intrahepatic cholangiocarcinoma (n=1). Extrahepatic artery embolization was performed in 3/5 (60%) patients. SPECT excluded one patient for radioembolization due to MAA deposits in the duodenum (despite coiling of GDA and RGA); he was treated with TACE. Radioembolization was performed in 4/5 (80%) patients (unilateral n=3, bilobar n=1). In one patient a 50% dose reduction was performed because of a lung shunt of 18%.

No complications occurred. Reported side effects were nausea (n=1), fatigue (n=1) or abdominal pain (n=1). Mean hospital stay was two nights. One month follow-up imaging, available in two patients at the time of writing, showed partial response in both cases.

**Conclusion:** Yttrium-90 radioembolization of liver tumors is a technically feasible procedure with minimal side effects and can be performed in an outpatient setting.

05.4

### **TYPE II ENDOLEAK EMBOLIZATION WITH REAL-TIME 3D-FLUOROSCOPY NEEDLE GUIDANCE**

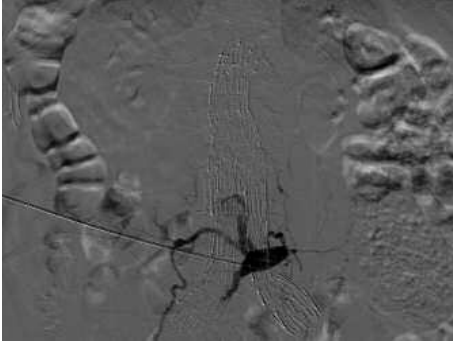
S.J. Braak, L. van Bindsbergen, M.J.L. van Strijen, J.P.M. van Heesewijk, R.H.W. van de Mortel, J.P. de Vries  
St. Antonius Ziekenhuis, NIEUWEGEIN

**Purpose:** Type-II endoleaks post-EVAR are often treated with percutaneous embolization, which is impossible with complex feeding vessels. A new alternative technique is direct puncture of the endoleak with real-time 3D-fluoroscopy guidance using cone-beam CT.

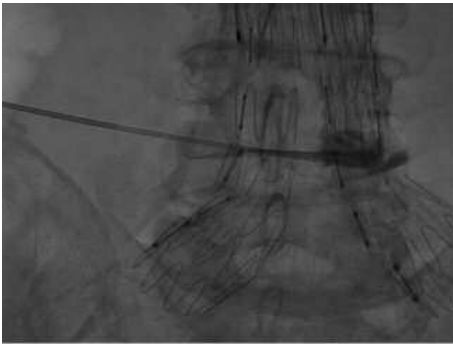
**Material and method:** 3D-Fluoroscopy uses a flat panel detector system, capable of rotating around the patient in 4-6 seconds. 3D-CT reconstruction of the acquired information is used for needle path planning. The calculated trajectory is then projected on the fluoroscopy image, producing a guiding path. After direct puncture of the endoleak a digital subtraction angiography (DSA) is made, followed by pressure measurement and embolization with Tissucol®. Control CT-(angiography) after 1 and 6 months were performed.

**Results:** During follow-up of 936 EVAR patients 6 patients presented with complex type-II endoleaks with growth of the aortic aneurysm, which could not be treated with transfemoral percutaneous embolization because of complex feeding vessels. All underwent real-time 3D-fluoroscopy with direct, exact needle placement in the type-II endoleak. DSA confirmed 3 or more complex tortuous feeding vessels (figure 1). During pressure measurement there was no difference in endotension with the systolic arterial pressure. After injecting the Tissucol® endotension disappeared. The initial technical success (embolization of all feeding arteries) was 100% (figure 2). No recurrent endoleaks were seen during short-term CT-scan follow-up.

**Conclusion:** 3D-fluoroscopy is a successful treatment modality for complex type-II endoleaks. The advantages using this technique is the possibility to perform DSA, pressure measurement and visualization of embolization. This technique is quick, little discomfort for the patient and short hospitalization period.



**Image 1:** DSA of type-II endoleak, mult. feeders



**Image 2:** Singleshot; the start of the embolization

05.5

### TRANSARTERIËLE CHEMO-EMBOLISATIE (TACE) MET 'DOXORUBICIN ELUTING BEADS' (DEB): EVALUATIE EERSTE PATIËNTEN

H. Brandt Corstius, M.J. Coenraad, A.R. van Erkel  
Leids Universitair Medisch Centrum, LEIDEN

**Inleiding:** Transarteriële chemo-embolisatie (TACE) is een behandeling waarbij chemotherapeutica gebonden aan partikels selectief worden toegediend in de tumor voedende arterie waarbij tegelijkertijd embolisatie wordt veroorzaakt. In theorie worden hierdoor een aantal gunstige effecten bereikt waardoor het effect van chemotherapie toeneemt: verminderde aanvoer van zuurstof en voeding aan de tumor en een grotere opname van het chemotherapeuticum door de vertraagde bloedstroom en hogere directe concentratie.

TACE wordt voornamelijk palliatief toegepast bij tumoren in de lever, zowel bij primaire tumoren als bij metastasen en alleen wanneer geen chirurgische verwijdering mogelijk is en/of indien er onvoldoende reactie is op systemische chemotherapie.

Het doel van onze studie is om de respons en veiligheid van TACE met doxorubicin eluting beads (DEB) te bepalen in

patiënten met hepatocellulair carcinoom of hypervasculaire metastasen.

**Methoden:** Een cohort van 16 patiënten werd geëvalueerd: 14 patiënten met HCC en 2 patiënten met levermetastasen (carcinoïd en schildklier). Alle patiënten werden 1 of meerdere malen behandeld met TACE in de periode 2007-2008. Patiënten werden behandeld met DEB (100-300, 300-500 of 500-700 µm; maximale dosis 100 mg doxorubicine). Respons werd bepaald aan de hand van de EASL-criteria en complicaties werden geregistreerd.

**Resultaten:** De objectieve respons bedroeg gemiddeld 60% in de gehele groep en 75% in een subgroep met levercirrose. Alle patiënten hadden symptomen van het post embolisatie syndroom. Een patiënt vertoonde een ernstige complicatie.

**Conclusie:** TACE met DEB is veilig en effectief als lokale behandeling van HCC indien transplantatie en resectie niet mogelijk zijn. De resultaten zijn vergelijkbaar met eerdere studies met DEB.

05.6

### CRURALE STENTING NA ONBEVREDIGENDE PTA BIJ DE BEHANDELING VAN KRITISCHE ISCHEMIE

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B. Knippenberg, H. van Overhagen  
HagaZiekenhuis, DEN HAAG

**Doel:** Evaluatie selfexpandable nitinol stenting bij de behandeling van kritieke ischemie na onbevredigend PTA resultaat ("bail-out" stenting).

**Methoden:** Tussen Juni 2007 - Mei 2008 zijn 14 patiënten (6/14 DM; 11 mannen en 4 vrouwen; lftd 53-87 /gemid. 76jr) met 15 extremiteiten behandeld voor kritische ischemie (Rutherford category 5 n=14; category 4 n=1) met een infrapopliteale X-pert stent na onsuccesvolle PTA van lange stenosen (n=2) of occlusies (n=13) van de onderbeensarteriën (TASC D n=15). In 14 gevallen werd één Xpert stent (Abbott Laboratories Vascular Enterprises Beringen, Switzerland) geplaatst en in 1 patiënt 2 stents. In 13 extremiteiten werd additionele PTA en/of stenting uitgevoerd van de ipsilaterale AFS(n= 9), Apopl (n=2) of beiden (n= 2).

**Resultaten:** Follow-up varieerde van 1-12 mnd (mediaan 6mnd). Zeven patiënten met 8 behandelde extremiteiten waren nog in leven zonder (major) amputatie na 6-12mnd (Amputation Free Survival 50%). In 7 van deze 8 extremiteiten vond klinische verbetering plaats (>/ 2 Rutherford categorieën). Stents waren doorgankelijk in 6 van deze 7 extre-

miteiten, in één geval was de stent geoccludeerd. Bij één patiënt, waarbij geen klinische verbetering optrad, is geen beeldvorming vervaardigd. 4 Extremititeiten werden geamputeerd na 2-5 maanden. Na 12 mnd zijn 4 patiënten overleden, waarvan 1 na amputatie.

**Conclusie:** Crurale stents kunnen na onbevredigend PTA resultaat helpen amputatie te voorkomen bij patiënten met ernstige kritische ischemie.

O5.7

### **INTRA-ARTERIAL TREATMENT FOR ACUTE MIDDLE CEREBRAL ARTERY STROKE. PROCEDURES AND OUTCOME OF A RETROSPECTIVE CASE-SERIES IN A DUTCH EXPERT CENTRE**

R.I. Wadman, J.P.M. van Heesewijk, W.J. Schonewille, M.J.L. van Strijen, M. van Leersum, T.Th. Overtoom, J.A. Vos  
*St. Antonius Ziekenhuis, NIEUWEGEIN*

**Purpose:** Evaluation of safety and efficacy of intra-arterial treatment (IAT) for acute ischemic middle cerebral artery (MCA) stroke in our tertiary referral center for cerebrovascular disease.

**Material and methods:** All 37 patients (mean age 62 years (25-80), 59% male) who underwent IAT from 2005 to 2008 were included. Mean baseline NIHSS was 11 (range: 0-17). Primary treatment for MCA stroke within 4.5 hours after onset of symptoms was IV-thrombolysis (IVT). Indications for IAT: presentation >4.5 hours after symptom onset (n=4), tandem Internal Carotid Artery and MCA occlusions (n=9), non-recanalisation after IVT (n=11), other (n=16). Full technical success was defined as recanalisation of the entire MCA and partial technical success as recanalisation of at least one previously occluded main MCA-branch. Clinical success was defined as post-intervention NIHSS reduction of more than 5 points

**Results:** Nine patients underwent IA thrombolysis only, 5 had mechanical thrombectomy only, in 7 patients only stents were placed. The remainder had a combination of treatments.

Clinical success was achieved in 17 patients (46%). Clinical outcome strongly correlated with recanalisation. With full recanalisation (n=18) 67% of the patients improved; with partial recanalisation (n=16) 25% had favorable outcome while none of the patients with technical failure (n=2) improved. Six patients (16%) developed symptomatic Intra Cranial Hemorrhage (ICH) and died. Fatality-rate declined over 2005-2008 (p<0.01); ICH-occurrence in 2008 was 6.7%. Our data are in keeping with the literature.

**Conclusion:** IAT is a promising additional treatment option for MCA stroke. Recanalisation determines clinical outcome.

O5.8

### **PERCUTANEOUS CRYO-ABLATION OF RENAL CELL CARCINOMA USING CONE BEAM CT**

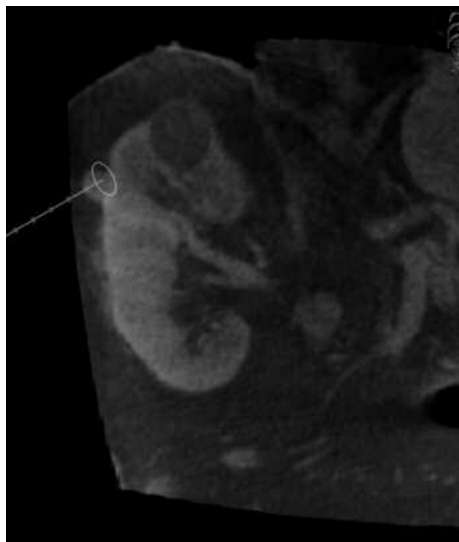
M.J.L. van Strijen, S.J. Braak, M.G. Onaca, J.P.M. van Heesewijk  
*St. Antonius Ziekenhuis, NIEUWEGEIN*

**Purpose:** Description of the initial results of using cone beam CT for percutaneous cryo ablation for renal cell carcinoma in selected patients.

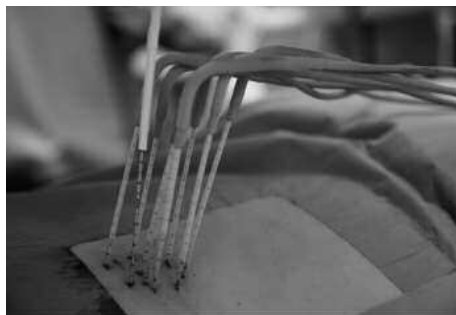
**Method and material:** Patients unable to undergo laparoscopic tumour nephrectomy or candidates for laparoscopic cryo-ablation were selected for percutaneous treatment. All patients were treated under general anaesthesia in the angio suite. With the use of a flat panel detector system rotating around the patient a cone beam CT was performed. This CT was then used for planning and positioning of the cryo needles needed to produce an ice sphere extending beyond the margins of the renal tumour. Verification of the position of the needles as well as the extent of the ice ball were also verified by cone beam CT.

**Results:** In total 9 tumours were treated with cryo-ablation in 8 patients with a mean age of 69.1 years, a mean tumour size of 2.6 cm, and with a mean number of 5 cryo needles. All procedures were a technical success without major complications during or immediately after the intervention. In 4 patients cryo-ablation was performed because of a previous contralateral tumor nephrectomy, in 2 patients because of inoperability, in 1 patient because of incomplete laparoscopic ablation previously, and in 2 patients because of a specific preference by urologist and patient.

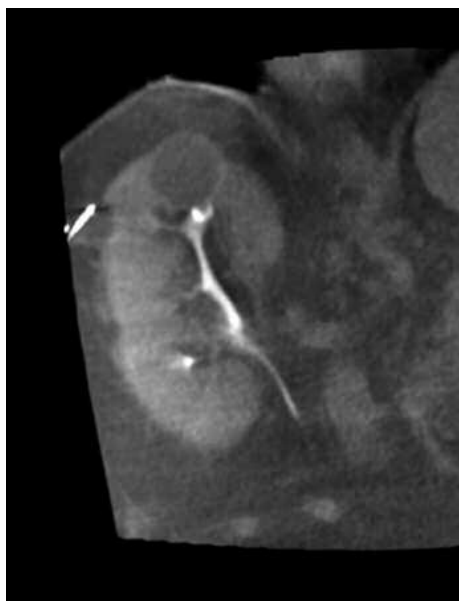
**Conclusion:** Compared to laparoscopy needles can be placed very quickly and accurately, with little discomfort for the patient. Follow-up with CT is currently performed at 3 and 6 month intervals, with results available shortly.



**Image 1:** Cone beam path planning for a small tumour



**Image 3:** Multiple cryo-needles in place



**Image 2:** Needle position and ice ball formation

## Sessie 6

## Abdominale radiologie

Vrijdag 18 september 2009, 13.30 - 15.00 uur

O6.1

**VALUE OF DIFFUSION WEIGHTED MR IMAGING FOR PREDICTING TUMOUR RESPONSE TO CHEMORADIATION THERAPY IN PATIENTS WITH ADVANCED RECTAL CANCER**D.M.J. Lambregts<sup>1</sup>, G.L. Beets<sup>1</sup>, C. Matos<sup>2</sup>,S. Gourtsoyanni<sup>3</sup>, A.G.H. Kessels<sup>1</sup>, M. Maas<sup>1</sup>,J.E. Wildberger<sup>1</sup>, R.G.H. Beets-Tan<sup>1</sup><sup>1</sup>Maastricht Universitair Medisch Centrum, MAASTRICHT<sup>2</sup>Academic Erasme Hospital, BRUSSELS, Belgium<sup>3</sup>University Hospital of Heraklion, CRETE, Greece

**Purpose:** To evaluate the potential of diffusion weighted imaging (DWI) in patients with locally-advanced rectal cancer (LARC) for preoperative prediction of response to chemoradiation therapy (CRT) and selection of good responders (ypT0-2).

**Materials and methods:** 40 patients with LARC who underwent CRT followed by surgery were retrospectively evaluated. All patients underwent T2W-FSE MR sequences, prior and post CRT. Pre-CRT MRI included additional DWI sequences using 2 B-values (0,1000 s/mm<sup>2</sup>). ADC was calculated for all tumours on pre-CRT MRI. Tumour-volume reduction was assessed on pre- and post-CRT T2W-images. Histology was the standard reference. Mann-Whitney and ROC-curve analyses were performed to assess the value of pretreatment ADC-values for predicting tumour-volume reduction and tumour-downstaging.

**Results:** ADC-values were lower in tumours with  $\geq 75\%$  downsizing after CRT as compared to those with  $< 75\%$  downsizing (mean 688 vs 869  $\times 10^{-6}$  mm<sup>2</sup>/s,  $p < 0.05$ ). ADC-values were also lower in tumours downstaged to ypT0-2 as compared to those with no downstaging. (mean 691 vs 828  $\times 10^{-6}$  mm<sup>2</sup>/s,  $p < 0.05$ ). AUC for prediction of downstaging to ypT0-2 was 0.836 when ADC-values were combined with volume reduction, while it was 0.704 for ADC measurements only ( $p < 0.05$ ).

**Conclusions:**

1. Low primary ADC-values correspond with good response to CRT.

2. Combined assessment of primary ADC and volume-reduction after CRT could be useful for accurate selection of tumors that are downstaged to ypT0-2.
3. Diffusion weighted MRI helps in selection of patients, likely to show good response to CRT, allowing further tailoring of treatment (for example a local excision instead of rectum resection).

O6.2

**MRI FOR PREOPERATIVE ASSESSMENT OF LOCAL TUMOUR EXTENT AND NODAL STATUS IN PATIENTS WITH RECTAL CANCER: IS THERE A LEARNING CURVE?**M. Maas<sup>1</sup>, D.M.J. Lambregts<sup>1</sup>, J. Dohmen<sup>2</sup>, G. Opendakker<sup>3</sup>, M. Bilderbeek-Beckers<sup>4</sup>, S.L. Engelsman<sup>1</sup>, J.E. Wildberger<sup>1</sup>, G.L. Beets<sup>1</sup>, R.G.H. Beets - Tan<sup>1</sup><sup>1</sup>Maastricht Universitair Medisch Centrum, MAASTRICHT<sup>2</sup>St. Jans Gasthuis, WEERT<sup>3</sup>Laurentius Ziekenhuis, ROERMOND<sup>4</sup>VieCuri Medisch Centrum, VENLO

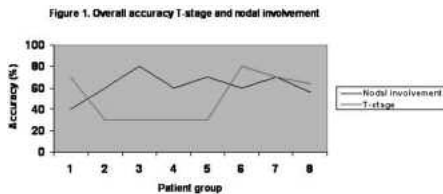
**Purpose:** A multicentre-trial showed good results for rectal cancer staging with ultrasmall superparamagnetic iron oxide (USPIO)-MRI. In that study local radiologists scored T & N-stage. MRIs were independently double-read by an expert pelvic MR-radiologist. The results of the expert were then revealed to the local radiologists, creating a continuously available and friendly feedback setting. Treatment decision making was based on the expert-reading. Aim of this study was to determine the learning curve of general radiologists in such a study setting.

**Materials and methods:** 88 rectal cancer patients underwent preoperative MRI and surgery in 3 regional centres. Images consisted of T2W and USPIO-T2\* MRI for nodal staging. The study methods were as described above. Histology was the standard reference. Accuracy for T- and N-staging was assessed for every other 10 patients and outlined to determine the learning curve.

**Results:** Results are shown in figure 1. Accuracy for T-staging improved from 30% to 80% after 50 patients. Accuracy

was stable at 30% for the first 50 patients, except for a peak of 70% in the first 10 patients, reasons of it not clear. Overstaging occurred more frequently (36.9%) than understaging (11.9%). Accuracy for N-staging improved from 40% to 80% in the first 30 patients; hereafter plateauing of the curve occurred with accuracies ranging between 60%-70%. Overstaging occurred more frequently (34.1%) than understaging (6.8%).

**Conclusions:** This setting of continuously available expert feedback shows a steep learning curve for general radiologists with an optimal performance for T and N-staging of rectal cancer reached after 30 MRIs.



**Figure 1:** Learning curve for overall T- and N-staging

06.3

### DIFFUSION WEIGHTED MR IMAGING FOR PREDICTION OF NODAL STATUS IN RECTAL CANCER PATIENTS: A LESION BY LESION ANALYSIS

D.M.J. Lambregts, G.L. Beets, M. Maas, F.C.H. Bakers, A.P. de Bruïne, J.E. Wildberger, R.G.H. Beets - Tan  
Maastricht Universitair Medisch Centrum, MAASTRICHT

**Purpose:** To assess the value of diffusion weighted imaging (DWI) for prediction of metastatic nodes in rectal cancer.

**Materials and methods:** 22 patients underwent preoperative MRI including standard T2W-FSE and DWI sequences. Two readers with respectively 13 and 2 years experience in pelvic-MRI prospectively scored each visible node on T2W-FSE for benign or malignancy using a confidence level score (0=definitely benign to 4=definitely malignant). ADC-maps were calculated using 3 B-values (0,500,1000 s/mm<sup>2</sup>). When a node was identified on DWI, mean ADC was calculated by placing a ROI on the DW-image and copy its location to the corresponding ADC-map. An anatomic map was used to ensure lesion-by-lesion matching with histology. Mean-ADC for benign and malignant nodes was compared with histology. ROC-analyses were performed to evaluate accuracy for standard T2W and T2W+DWI MRI.

**Results:** 174 nodes were identified, of which 29 N+. T2W and T2W+DWI MR identified 88 and 132 nodes respectively. Mean-ADC (+SD) was 1350±175 for N+ nodes versus

1047±178 \*10<sup>-6</sup> mm<sup>2</sup>/s for N0-nodes (p<0.001). AUC improved from 0.756 (reader 1) and 0.748 (reader 2) for T2W-MR only to 0.876 and 0.816 respectively for T2W+DWI MR (p=0.01 reader 1, p=0.1 reader 2).

#### Conclusions:

1. Addition of DWI to T2W-FSE sequences increased the number of detected rectal cancer nodes.
2. Mean ADC of malignant nodes was significantly higher than that of benign nodes.
3. Addition of DWI to T2W-FSE sequences improved diagnostic performance for prediction of nodal metastases for both expert and general radiologists. The improvement was significant with more reading experience.

06.4

### LOW-FIBER DIET IN CT COLONOGRAPHY BOWEL PREPARATION: INFLUENCE ON IMAGE QUALITY, PATIENT ACCEPTANCE AND POLYP DETECTION

M.H. Liedenbaum<sup>1</sup>, A.H. de Vries<sup>1</sup>, J. Stoker<sup>1</sup>, M.J. Denters<sup>1</sup>, I.W.O. Serlie<sup>2</sup>, E. Dekker<sup>1</sup>

<sup>1</sup>Academisch Medisch Centrum, AMSTERDAM

<sup>2</sup>Philips Medical Systems, BEST

**Purpose:** To determine if a low-fiber diet is necessary for an optimal tagging-only bowel preparation for CT colonography (CTC).

**Methods:** 50 consecutive Fecal Occult Blood Test positive patients received iodine tagging bowel preparation (4\*50 mL meglumine ioxithalamate) one day before CTC; 25 patients had a low-fiber diet (group 1) and 25 had no special diet (group 2). CTC was read by two experienced observers. Reference standard was segmental unblinded colonoscopy. Tagging homogeneity was determined per segment on a 5-point scale. Automatic measurement of density of residual feces was performed. Patient acceptance was assessed with questionnaires. Per polyp sensitivity for polyps ≥10mm and ≥6mm was calculated.

**Results:** Homogeneity was scored grade 5 in 13 segments in group 1 and in 24 segments in group 2 (p>0.05). In group 1 mean density was 619HU versus 674HU in group 2 (p>0.05). In group 1 52% of patients experienced no or mild burden from the CTC preparation versus 64% in group 2 (p>0.05). 14 polyps ≥10mm were found in group 1 and 15 in group 2. For polyps ≥6mm this was 32 and 31 respectively. Sensitivities for polyps ≥10mm for observer 1 were 100% and 80% (p>0.05) and 100% and 87% for observer 2 (p>0.05) for group 1 and 2 respectively. Sensitivities for polyps ≥6mm for observer 1 were respectively 84% and 68% (p>0.05) and 97% and 80% for observer 2 (p<0.05).

**Conclusion:** Use of a low-fiber diet in bowel preparation for CTC shows a trend towards better residue homogeneity and polyp detection.

06.5

### DIAGNOSTIC PERFORMANCE OF USPIO-ENHANCED MRI FOR NODAL STAGING IN PRIMARY RECTAL CANCER IS DEPENDENT ON THE NUMBER OF LYMPH NODES HARVESTED AT HISTOLOGY

M. Maas, D.M.J. Lambregts, M.J. Lahaye, A.P. de Bruïne, J.E. Wildberger, G.L. Beets, R.G.H. Beets - Tan  
Maastricht Universitair Medisch Centrum, MAASTRICHT

**Purpose:** Nodal involvement in rectal cancer indicates poor prognosis. Knowledge of nodes impacts treatment-choice. Nodal staging is traditionally performed at histology. 12-16 nodes is defined as “good harvesting”, less as “bad harvesting”. Bad harvesting is associated with worse long-term prognosis. In a multicenter-study, accuracy of Ultrasmall Superparamagnetic Particles of Iron Oxide (USPIO)-MRI for treatment stratification was evaluated. The current study aims to assess whether there is a difference in USPIO-MRI performance with good vs. bad node-harvesting.

**Materials and methods:** 117 rectal cancer patients were evaluated. Patients underwent USPIO-MRI followed by surgery. An expert reader predicted nodal status on USPIO-MRI using a confidence level score (0=definitely N-, 4= definitely N+) with histology as the reference standard. Patients were categorised according to the number of lymph nodes harvested at histology (group 1=0-4 nodes, 2=4-8 nodes, 3=8-12 nodes, 4=12-16 nodes, 5=16-20 nodes, 6=>/= 20 nodes). ROC-curve analyses were performed for the 6 groups.

**Results:** Area-under-curve for group 1 (n=9) was 0.643, for group 2 (n=29) 0.830, for group 3 (n=32) 0.833, for group 4 (n=27) 0.917, for group 5 (n=12) 0.857, for group 6 (n=8) 1.00.

#### Conclusions:

1. Diagnostic performance of USPIO-MRI for nodal staging in rectal cancer increases with increasing number of harvested nodes at histology.
2. Best MR performance correlates with groups 4-6, confirming that the optimal number of nodes to be harvested at histology is  $\geq 12$ .
3. With suboptimal histological nodal staging, nodal staging with USPIO-enhanced MRI would be more reliable for clinical decision-making.

06.6

### KRIMP VAN EEN DUALMESH® NA LAPAROSCOPISCHE CORRECTIE VAN HERNIA VENTRALIS OF CICATRICALIS

S.B.A. van der Valk, E.J.P. Schoenmaeckers, J.F.T.J. Raymakers, S. Rakic, J.H.W. van den Hout  
Ziekenhuis Groep Twente, ALMELO

**Doel:** Krimp bij een intraperitoneaal geplaatste ePTFE (expanded polytetrafluoroethyleen) mat bij laparoscopische reconstructies van een hernia ventralis of cicatricialis (LRHVC) blijft een zorg. Vele experimentele studies rapporteren uiteenlopende resultaten. DualMesh (ePTFE) is goed zichtbaar op een CT-scan. Bij patiënten met een CT-scan na een recente LRHVC met DualMesh werd de krimp gemeten.

**Method:** Van 656 patiënten na een LRHVC met DualMesh, zijn alle patiënten geselecteerd die na meer dan 3 maanden postoperatief een CT-scan ondergingen en waarbij de exacte transversale diameter van de geplaatste DualMesh bekend was (n=40). De maximale transversale diameter van de DualMesh werd gemeten door een ervaren assistent en een radioloog, onafhankelijk van elkaar en geblindeerd voor de oorspronkelijke afmeting van de DualMesh. De krimp van de DualMesh werd gedefinieerd als het relatieve verlies in transversale diameter in vergelijking met de originele transversale diameter.

**Resultaten:** De gemiddelde tijdsduur tussen LRHVC en CT-scan was 17.9 maanden (range, 3-59mnd). De gemiddelde krimp van DualMesh was 7.5% (range, 0-23.7%). Bij 11 patiënten was er geen krimp. In de totale onderzoeksgroep was er 0-10% krimp bij 27 patiënten (68%), tussen 10-20% bij 10 patiënten (25%) en 20-40% bij 3 patiënten (8%). Er kon geen verband worden vastgesteld tussen verstreken tijd vanaf operatie tot CT-scan en de krimp. Er waren 2 recidieven, 1 mogelijk gerelateerd aan krimp.

**Discussie:** Dit is het eerste klinische onderzoek dat krimp bij een intraperitoneaal geplaatste synthetische mat (DualMesh) beoordeelt. In de praktijk krimpt DualMesh aanzienlijk minder dan werd gerapporteerd in experimentele studies (8-51%).

06.7

### GADOFOSVESET-ENHANCED 3DT1W GRE MR-SEQUENCE ADDITIONAL TO STANDARD 2DT2W FSE: DOES IT IMPROVE RADIOLOGISTS' PERFORMANCE FOR PREDICTING RECTAL TUMORS LIMITED TO THE BOWEL WALL?

D.M.J. Lambregts, M. Maas, I.J.G. Rutten, S.L. Engelsman, M.J. Lahaye, G.L. Beets, J.E. Wildberger, R.G.H. Beets - Tan Maastricht Universitair Medisch Centrum, MAASTRICHT

**Purpose:** Selection of rectal tumors limited to the bowel wall (pT1-2) could offer patients a local excision instead of rectal excision. Standard 2DT2W-FSE has high sensitivity but low specificity for selection of T0-2 tumours. Aim of this study was to evaluate whether addition of a Gadofosveset 3DT1W-GRE sequence with the possibility of MPR-reconstructions would increase radiologists' performance for selecting pT1-2 tumours.

**Material and methods:** 18 primary rectal cancer patients underwent 2DT2W-FSE (sagittal, coronal and axial) and axial Gadofosveset 3DT1W-GRE (1mm isotropic voxels) with additional MPR followed by surgery. Two readers with different experience independently scored T-stage; first on 2DT2W and subsequently on Gadofosveset-3DT1W images. Likelihood of tumour limited to the bowel wall was scored using a confidence level (0=definitely outgrowing wall to 4=definitely confined to wall). Histology was the standard reference. ROC-analyses were performed to compare diagnostic performance.

**Results:** Sensitivity, specificity, PPV and NPV for T1-2 prediction on T2W-MRI were 100%, 57%, 79% & 100% for the more experienced reader 1 and 71%, 55%, 50% & 75% for reader 2. For the combined T2WFSE + 3DT1W-GRE the figures were 82%, 29%, 64% & 50% for reader 1 and 73%, 29%, 40% & 62% for reader 2. Area under the ROC-curve decreased from 0.83 on T2W-MRI to 0.66 on the combined images for reader 1 ( $p=0.12$ ) and from 0.74 to 0.55 for reader 2. ( $p=0.18$ )

**Conclusion:** The addition of Gadofosveset-enhanced 3DT1W-GRE imaging to standard T2W FSE sequences did not improve radiologists' performance for selecting tumours limited to the bowel wall. Standard 2DT2W MRI remains sufficient for clinical decision making in rectal cancer treatment.

06.8

### FREQUENCY AND IMPORTANCE OF INCIDENTAL EXTRA-UROGENITAL FINDINGS IN CT FOR WORKUP OF COLIC PAIN OR HEMATURIA

F.J. Nag, J.J.J. de Vries, L.G.B.A. Quekel,

C.M. Schaefer - Prokop

Meander Medisch Centrum, AMERSFOORT

**Purpose:** To evaluate frequency and clinical importance of incidental extra-urogenital findings in CT examinations obtained for diagnostic workup of colic pain or hematuria.

**Methods:** We retrospectively evaluated 386 consecutive CT examinations obtained between January and June 2008 for the diagnostic workup of suspected urolithiasis (186 unenhanced scans) or hematuria (200 CT urograms). Extra-urogenital findings (EUFs) were categorized by clinical relevance and examined by type of examination, age and sex, and required additional workup.

**Results:** At least one EUF was seen in 66% of patients. EUFs were significantly more frequent in patients > 45 years than in younger patients ( $p<0.01$ ). 71% of patients without any EUF were younger than 45 years. EUFs with moderate clinical relevance were seen in 82/486 patients (21%); EUFs with high clinical relevance were seen in 33/486 patients (8.5%). Findings included 6 pneumonias, 4 aortic aneurysms > 5cm, 4 pulmonary malignancies, 4 liver malignancies, 1 rectum malignancy, 3 pathologic lymph adenopathies, 4 acute bowel inflammations (diverticulitis/colitis/appendicitis) and 7 others. EUF tended to be more frequently found after iv. contrast (high relevance, 10% versus 7%; moderate relevance, 25% versus 14%). Additional examinations for workup of EUFs were more frequently required with unenhanced CTs ( $n=5$  versus 1,  $p<0.05$ ).

**Conclusions:** Extra-urogenital findings requiring immediate further workup or elective follow up are seen in approximately one fourth of patients older than 45 years.

**Clinical Relevance:** Because of the frequency of clinically relevant extra-urogenital findings in older patients with colic pain or hematuria a thorough search for such findings is mandatory.

### Sessie 7

## Thoraxradiologie / Skeletradiologie

Vrijdag 18 september 2009, 13.30 - 15.00 uur

07.1

### FREQUENCY AND PATTERNS OF LUNG METASTASES IN PATIENTS WITH PANCREAS TUMORS

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C.M. Schaefer - Prokop<sup>2</sup>

<sup>1</sup>Academisch Medisch Centrum, AMSTERDAM

<sup>2</sup>Meander Medisch Centrum, AMERSFOORT

**Purpose:** Little is known about the frequency and morphology of lung metastases in patients with (in)operable pancreas tumors because these patients were usually not followed once tumor irresectability was confirmed on abdominal CT scan. With new chemotherapeutic options these patients are now increasingly followed also radiologically with chest CT.

**Methods:** In a retrospective study set up we defined 252 patients with histologically proven pancreas tumors. Patient demographics and tumor size were defined and presence of lymphnodes, vascular infiltration and liver metastases were documented. Chest CT scans were screened for the presence and patterns of focal lung densities that fulfilled radiological and clinical criteria for representing metastases.

**Results:** Lung metastases were seen in 17% of patients with pancreas tumors. Most frequently they presented as sharp nodules (66%), followed by star like lesions (43%), miliary (15%) pattern and a lymphatic spread of disease (17%). The presence of lymphadenopathy was the only significant indicator for the presence of lung metastases (70 vs 44%,  $p < 0.001$ ) followed by liver metastases (51 vs 38%, 0.116) and vascular infiltration (49% vs 35%,  $p < 0.155$ ). Multi-regression analysis did not reveal significant correlations.

**Conclusions:** Lung metastases are seen in less than one fifth of patients with pancreas tumors and appear to be a late sign of tumor spread. Loco-regional lymphadenopathy represents a significant risk for the presence for lung metastases.

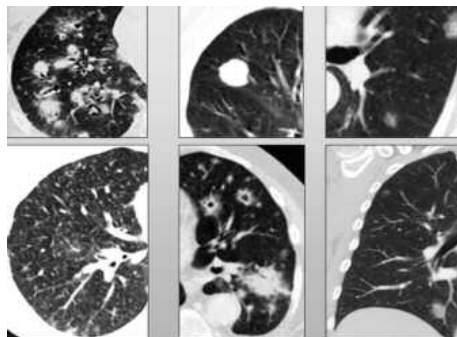


Image 1: Lung metastases in pancreas tumor patients

07.2

### STAND-ALONE PERFORMANCE OF A CAD PROTOTYPE FOR PULMONARY EMBOLISM DETECTION: A MULTI-VENDOR MULTI-INSTITUTIONAL COMPARISON

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J.J. Sonnemans<sup>2</sup>, M. Prokop<sup>5</sup>, C.M. Schaefer - Prokop<sup>6</sup>

<sup>1</sup>Academisch Medisch Centrum, AMSTERDAM

<sup>2</sup>Philips Healthcare, BEST

<sup>3</sup>VU Medisch Centrum, AMSTERDAM

<sup>4</sup>MC Haaglanden, DEN HAAG

<sup>5</sup>UMC Utrecht, UTRECHT

<sup>6</sup>Meander Medisch Centrum, AMERSFOORT

**Purpose:** To assess the performance of a computer assisted detection (CAD) algorithm for acute pulmonary embolism (PE) in pulmonary CT angiographies (CTPA) at various institutions.

**Methods:** We included 240 64-slice CTPA from 3 institutions that use different vendors (GE-LightSpeed VCT, Philips-Brilliance, Siemens-Sensation). 40 consecutive scan with PE and 40 consecutive scans without PE were selected per institution. Candidate lesions identified by a CAD prototype were classified as true positive (TP) or false positive (FP) using independent evaluation by two readers and consultation of a third chest radiologist in discordant cases. Various image quality parameters were subjectively scored using 5

point scales (5=excellent, 1=inadequate). Image noise was measured in the descending aorta as standard deviation (SD) of CT numbers. Underlying causes for FP were classified. Statistical evaluation was performed on a per-patient basis.

**Results:** The three patient groups matched with respect to age, accompanying lung disease and inpatient/outpatient ratio. No significant differences were found for overall image quality (4.3, 3.9 and 4.4), vascular enhancement (4.8, 4.2 and 4.7), motion artifact (3.1, 3.0 and 2.9) and noise (30, 34 and 34 HU). The sensitivity was 100%, 97% and 87%. The mean FP rate per scan was 3.7, 4.4 and 6.0 (median 2, 2 and 3). Misinterpretation of veins was the most frequent cause for FP at all sites. The number of FP per scan was significantly associated with overall image quality at all institutions.

**Conclusions:** The stand-alone performance of the CAD prototype is only moderately affected by scanner and protocol variations.

07.3

**THE PREDICTIVE VALUE OF RIGHT VENTRICULAR EJECTION FRACTION FOR CLINICAL OUTCOME IN PATIENTS WITH ACUTE PULMONARY EMBOLISM AS ASSESSED BY ELECTROCARDIOGRAPHY SYNCHRONIZED MULTI-DETECTOR ROW COMPUTED TOMOGRAPHY**

*N. van der Bijl, F.A. Klok, A. de Roos, M.V. Huisman, L.J.M. Kroft  
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**Purpose:** To assess whether right ventricular ejection fraction (RVEF) obtained with electrocardiography (ECG)-synchronized multi-detector row computed tomography (CT) predicts the 6 weeks outcome in patients with acute pulmonary embolism (PE).

**Methods:** 464 consecutive patients presenting with clinically suspected acute PE were included. All patients underwent standard CT pulmonary angiography (Aquilion 64; Toshiba Medical Systems, Otawara, Japan) to confirm or exclude the diagnosis of PE and ECG-synchronized dynamic cardiac CT to assess right ventricular (RV) function. RV dysfunction was defined as RVEF <47%. Adverse clinical outcome was defined as the occurrence of: death, hemodynamic instability with need for cardiopulmonary resuscitation, admittance to an intensive care unit, mechanical ventilation or the use of inotropic or thrombolytic agents within the first 6 weeks. This study was approved by our Institutional Review Board.

**Results:** 114 patients, 61 male (53.5%), mean age (±SD) 56.3 (±16.1) were diagnosed with acute PE. RVEF was less than 47% in 51 (45%) patients. Adverse outcome occurred in 10 patients (8.8%); 5 patients experienced hemodynamic instability, 2 received thrombolytic therapy and cardiovascular resuscitation was performed in 3 patients. Seven of these 10 patients died, 4 were directly related to PE. RV dysfunction was identified in 9 of 10 patients with adverse events (90%, 95%CI 56-99.8%; Odds Ratio 13.3; 95%CI 1.62-109; p=0.005). The positive likelihood ratio of a RVEF <47% for the occurrence of adverse endpoints was 2.23.

**Conclusion:** Right ventricular dysfunction assessed by ECG-synchronized dynamic cardiac CT is a strong predictor for adverse clinical outcome in patients with acute PE.

07.4

**RADIATION REDUCTION AND IMAGE QUALITY EFFECTS OF BISMUTH BREAST SHIELDING IN CT PULMONARY EMBOLISM PROTOCOLS**

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**Introduction/Aim:** To evaluate the effect of bismuth breast shielding (BS) on image quality and radiation reduction in low dose CT-protocols for pulmonary embolism (PE). BS is a FDA approved device. In phantom studies BS appeared to be successful in locally reducing radiation dose.

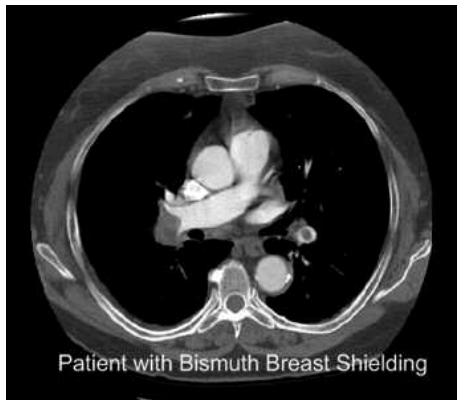
**Methods:** Phantom: A sequential scanning protocol was used on a 64-slice CT-scanner to simulate a standard protocol. TLD measuring points were skin level, centre of the breast, chest wall and dorsal superficial tissue.

**Patients:** women suspected of PE were randomly scanned with or without BS. Scan results, image noise (SD of the attenuation (HU) in 3 ROI's) and subjective image quality (0-4 scale by 4 radiologists) were compared.

**Results:** Phantom: dose reduction of 50% (17.3 vs. 8.7mSv) at skin level, 49% (14.3 vs. 7.3mSv) in the breast centre and 39% (9.3 vs. 5.7mSv) at the chest wall. Dose unchanged at dorsal superficial tissue (9.4 vs. 9.8mSv).

**Patients:** 16 with and 24 patients without BS were included. PE were found in 19% (3/16) in the BS group vs. 33% (8/24) in the control group. Image noise reached 55.6HU(SD=50.5) vs. 28.1HU(SD=9.6) in subcutaneous mamma fat, 39.2HU(SD=11.9) vs. 33.2HU(SD=7.1) in lung tissue left upper lobe and 39.9HU(SD=5.5) vs. 36.7HU(SD=7.9) at pulmonary trunk. Subjective image quality score was 3.2 and 3.1 respectively.

**Conclusion:** BS achieved a local radiation dose reduction. So far, groups are too small to compare numbers of PE. Noise is dominantly increased in the superficial structures; the pulmonary trunk is mostly spared. Subjective image quality was not affected.



07.5

### ASYMPTOMATISCHE WERVELFRACTUUR FREQUENT GEMIST: OORZAAK EN GEVOLG IN 188 PATIËNTEN ONDERZOCHT

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**Doel:** Een asymptomatische wervelfractuur is onafhankelijk van de BMD een reden om behandeling tegen osteoporose te starten, omdat deze patiënten een vier tot zeven keer verhoogd risico op een toekomstige heupfractuur hebben. Deze studie onderzoekt hoe accuraat osteoporotische wervelfracturen worden gedetecteerd in een middelgrote perifere opleidingskliniek.

**Method:** 188 patiënten van 50 jaar en ouder met een fractuur van het appendiculaire skelet na laag energetisch trauma werden tussen december 2005 en oktober 2006 geïncludeerd. Alle patiënten ondergingen laterale X-TWK en X-LWK. Deze werden op gebruikelijke wijze verslagen. Alle foto's werden in 2009 herbeoordeeld door een radioloog (A) en een AIOS (B) volgens de criteria van Genant et al., gevolgd door een consensus-reading. Een wervelfractuur werd gedefinieerd als  $\geq 20\%$  hoogteverlies. De wervelcorporen Th4-L4 werden beoordeeld.

**Resultaten:** Bij 85 patiënten werden na consensus-reading 116 fracturen gevonden. A had 26 vals negatieven, B 13. Zij hadden respectievelijk 1 en 13 vals positieven. De verklaring voor de vals negatieven was meestal onderschatting van wervels met hoogteverlies tussen 20-25%. De voornaamste reden voor de vals-positieven was foutieve plaatsing van de

meetpunten. Onenigheid trad in 79% op bij hoogteverlies  $\leq 25\%$ . De oorspronkelijke verslagen vermeldden 76 fracturen bij 52 patiënten; 34% verschil.

**Discussie:** Wanneer strikt volgens evidence-based literatuur wordt gemeten komen 34% meer wervelinzakkingen aan het licht dan bij routinematige beoordeling. Tussen de twee beoordeelaars bestond voor consensus-reading een aanzienlijke interobserver-variëteit (31%), waar deze studie duidelijke oorzaken voor vond. Deze bevindingen kunnen helpen om te voorkomen dat mensen ten onrechte niet behandeld worden voor osteoporose.

07.6

### TO INVESTIGATE JOINT ABNORMALITIES IN EARLY KNEE OSTEOARTHRITIS (OA) USING MAGNETIC RESONANCE IMAGING (MRI)

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H. Viergever, M. Kloppenburg  
Leids Universitair Medisch Centrum, LEIDEN

**Method and materials:** Knee MRIs were obtained in 155 subjects (median age 56 years, 78% women) with early knee OA defined as pain or stiffness for which a physician was consulted not more than 6 months ago (4% radiographic knee OA according to Kellgren-Lawrence score  $\geq 2$ ), and in 30 age and sex-matched controls without clinical and radiographic OA. MRIs were scored following a semi-quantitative scoring system. Odds ratios (OR) with 95% confidence intervals (CI) for OA in relation to joint abnormalities and sensitivity and specificity were calculated. Multivariate analysis was performed for the association between joint abnormalities and self-reported symptoms. Adjustments were made for confounders.

**Results:** MR images demonstrated joint abnormalities both in controls and in OA patients. However OA patients had an increased risk for cartilage defects, osteophytes, cysts, bone marrow lesions and intrasubstance degeneration (OR (95%CI): 3.8 (1.6-9.1), 3.2 (1.4-7.6), 2.9 (1.0-8.1), 4.5 (1.5-13.9), 2.3 (1.0-5.4) respectively) compared to controls. Sensitivity ranged from 14-68% and specificity from 57-90%. OA patients reported more symptoms in the presence of osteophytes and meniscal subluxation ( $p < 0.05$ ). Less symptoms were reported in the presence of joint effusion and Baker's cysts.

**Conclusion:** Osteoarthritic features in the knee are already present in controls without OA, but more frequent in early OA. Yet, no single MRI feature distinguishes OA from non-OA. Especially osteophytes and meniscal subluxation are associated with symptoms in these early patients. Further studies on age effects and OA are needed.

07.7

**MAGNETIC RESONANCE IMAGING CHARACTERISTICS OF THE KNEE IN FAMILIAL GENERALISED OSTEOARTHRITIS: A SPECTRUM OF ABNORMALITY**

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**Objective:** To determine whether patients having generalised OA (GOA), without knee involvement, exhibit degeneration on knee MRI.

**Materials and methods:** MRI of the knee were obtained from 205 patients (20% male; mean age 60 years (43-76)) diagnosed with GOA and 30 controls without clinical/radiographic OA (ROA). The subjects were divided into 3 groups defined as follows: 1.controls; 2.ROA-/pain-; 3.ROA-/pain+. MRI were analyzed using a validated semi-quantitative scoring system.

Logistic regression was used to calculate odds ratios with 95% confidence intervals, adjusted for confounders, for the incidence of separate MRI abnormalities in the different groups in the entire knee, the patellofemoral (PFJ) and tibiofemoral (TFJ) joints versus the control group.

**Results:** The most frequently observed abnormality in the control group was intrasubstance meniscal degeneration (43%), followed by cartilage defects (39%) and osteophyte formation (39%). Cartilage defects and osteophyte formation were seen particularly in the PFJ. The prevalence of MRI abnormalities increased across the patient population groups.

Cartilage degeneration, osteophytes and tears were similarly significantly increased in groups 2 and 3 in the entire knee and TFJ versus the control population. In the PFJ, group 3 showed a significantly higher prevalence for osteophytes and cartilage. BML was significant only in the group with pain.

**Conclusions:** Pain can be attributed to BML in the entire knee and to cartilage defects and osteophytes in the PFJ. MRI degeneration shows a spectrum of changes and no specific cut-off points in advancing OA. Meniscal tears play an important role in GOA without knee involvement.

07.8

**IS DUAL ENERGY X-RAY ABSORPTIOMETRY (DEXA) NOODZAKELIJK IN OSTEOPOROSE-SCREENING?**

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**Doel:** Osteoporosescreening door bepaling van botmineraaldichtheid (BMD) bij patiënten met verhoogd risico op osteoporose is van belang omdat de helft van de toekomstige fracturen door behandeling voorkomen kan worden. Een asymptomatische wervelfractuur is onafhankelijk van de BMD een reden om behandeling tegen osteoporose te starten, omdat in deze groep het risico op een toekomstige heupfractuur vier tot zeven keer verhoogd is. Uitkomstmaat van deze studie is de prevalentie van asymptomatische wervelfracturen in een hoog-risico populatie.

**Methode:** Alle patiënten boven de 50 jaar die op de spoedeisende hulp worden gezien met een fractuur na laag energetisch trauma worden verwezen naar de fractuur- en osteoporosepoli (FOP). Op de FOP wordt o.a. de BMD gemeten middels DEXA en een laterale X-TWK en X-LWK gemaakt. Vanaf december 2005 tot oktober 2006 werden alle patiënten van de FOP in de studie geïncludeerd. Exclusiecriteria zijn chronisch delier en dementie. Wervelfractuur werd gedefinieerd als 20% of meer hoogteverlies anterieur, mediaan en/of posterieur. De wervelcorpora Th4-L4 werden beoordeeld.

**Resultaten:** In totaal werden 200 patiënten geïncludeerd. Van 7 patiënten werden geen wervelfoto's gemaakt. 5 patiënten presenteerden zich met een symptomatische wervelfractuur. Van de 188 overgebleven patiënten hadden 78 patiënten (41%) in totaal 109 asymptomatische wervelfracturen. 22 patiënten (12%) hadden 2 of meer fracturen.

**Discussie:** 41% van de 188 patiënten had een asymptomatische wervelfractuur en daarmee een reden om behandeling tegen osteoporose te starten. DEXA zou in deze groep achterwege kunnen worden gelaten. Dit kan een besparing opleveren van de logistieke en economische last.

### Sessie 8

## Cardiovasculaire radiologie 2

Vrijdag 18 september 2009, 13.30 - 15.00 uur

08.1

### CARDIAC MRI: ADAPTATION TO PHYSICAL TRAINING IN MATURE ATHLETES

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UMC Utrecht, UTRECHT

**Purpose:** Increasing age is accompanied by a higher risk of sports-related cardiovascular events. In athletes aged 40-60 years, sudden cardiac death (SCD) is usually caused by ischemic coronary artery disease (80%) and 'silent' cardiomyopathies. Our purpose is to establish maximum cardiac MRI (CMR) reference values (mean+2SD) in mature athletes to facilitate differentiation from cardiomyopathies. As training intensity changes with increasing age, its impact was also assessed.

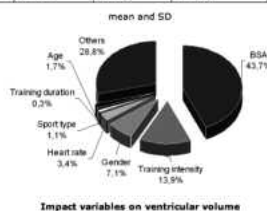
**Methods:** 143 persons aged 40-60 years underwent CMR: 78 endurance athletes (exercising >9 hrs/wk), and 65 matched controls (≤3 hrs/wk). Experienced blinded observers performed data analysis and body surface area (BSA) indexation.

**Results:** Ventricular volumes and mass were significantly higher in athletes than controls. (table) Although significant, age has much less impact on ventricular volume (mass not presented) than BSA, training intensity, and gender. (figure)

**Conclusions:** We present maximum of normal values for the mature healthy persons heart and demonstrate that age is much less associated with ventricular volumes (and mass) than BSA, training intensity, and gender.

**BSA corrected results**

	Control Men (32)	Athlete Men (55)	Control Women (33)	Athlete Women (23)
RV Volume (mL/m <sup>2</sup> )	107 ± 15	128 ± 19	91 ± 12	104 ± 12
RV Mass (g/m <sup>2</sup> )	13 ± 2.8	15 ± 3.3	12 ± 2.5	13 ± 2.6
LV Volume (mL/m <sup>2</sup> )	98 ± 12	117 ± 16	88 ± 11	98 ± 9.7
LV Mass (g/m <sup>2</sup> )	88 ± 8.0	96 ± 11	36 ± 6.6	80 ± 6.9



08.2

### EVALUATION OF THE MECHANICAL PROPERTIES OF THE CAROTID ARTERY WITH ECG-GATED DUAL SOURCE CT ANGIOGRAPHY

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Erasmus MC, ROTTERDAM

**Purpose:** The purpose of this study was to evaluate the feasibility of ECG-gated multidetector computed tomography angiography (MDCTA) in the assessment of the mechanical properties of the vessel wall in the carotid bifurcation.

**Methods:** 44 patients were included (mean ages 63 ± 8.7 years, 28 male) with a recent TIA or minor stroke. All patients underwent ECG-gated MDCTA of the carotid arteries, on a 64 slice DSCTA scanner (Siemens, SOMATOM definition, Forchheim, Germany) after Institutional Review Board approval and patient consent were obtained. A four-dimensional (cine) data set was created by 3D images reconstruction at every 8% of the RR interval of the cardiac cycle. In all time phases, the lumen area (A) was manually outlined in the common carotid artery (CCA) and in the internal carotid artery (ICA), thus making area versus time curves for visualization and analysis of carotid pulsatile waveform. Using the change in lumen area ( $\Delta A = A_{max} - A_{min}$ ), the relative distension was calculated as  $[\Delta A / A_{min}] * 100$ . The pulse pressure was used to calculate the distensibility (D) as:  $\Delta A / (A_{min} * \Delta P)$  (10-3kPa-1).

**Results:** Most segments in the carotid arteries (61%) showed an evident biphasic waveform. The mean distensibility in the carotid artery was 25.7 ± 14.4 (10-3kPa-1) and was not significantly different for the CCA and ICA. The distensibility in normal and atherosclerotic carotid arteries was not significantly different.

**Discussion:** ECG-gated DSCTA allows the evaluation of distensibility in the carotid arteries. This scan protocol can simply be integrated into modified clinical routine scanning protocols.

Three multiplanar reformatted images acquired from datasets at different phase in the RR interval. Images were reconstructed perpendicular to the center lumen line. The lumen is outlined manually. Change in lumen area, segmented by the ROI, demonstrates a cyclic carotid distension of the common carotid artery (% RR-interval).

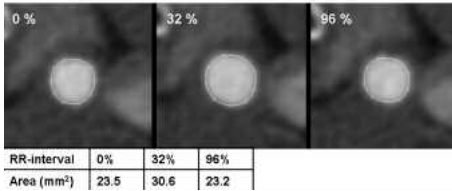


Figure 1: Multiplanar reformatted DSCTA images

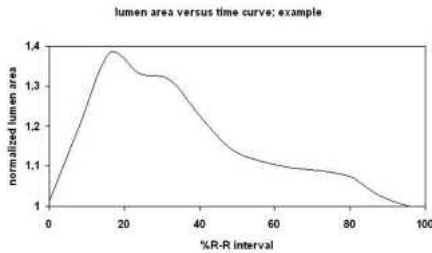


Figure 2: Lumen area versus time curve of a cardiac cycle

08.3

### CORONARY ARTERY DISEASE BURDEN IN PATIENTS WITH ATYPICAL CHEST PAIN AND ZERO CORONARY CALCIUM SCORE

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**Purpose:** To assess the prevalence of coronary artery atherosclerosis in patients with atypical chest pain and zero coronary calcium score (OCCS).

**Method and materials:** We assessed Agatston scores in 521 patients (mean age  $59 \pm 11$  yrs; 260 M) referred for imaging because of atypical chest pain. All patients underwent coronary CT angiography (CTA) irrespective of the CCS, except for subjects whose  $CCS > 1000$ . Examinations were performed on a 64-slice spiral CT-scanner (Philips Brilliance 64). Image data were evaluated on Extended Brilliance Workspace 4.0 workstation (Philips Medical Systems). In all patients coronary arteries were analyzed for presence and severity of non-calcified, mixed and calcified plaques using the standard 16-segment scoring system. Degree of stenosis was classified as wall irregularities, non-significant ( $< 70\%$ ), or significant luminal ( $> 70\%$ ) luminal narrowing.

**Results:** 206 patients (mean age  $54 \pm 10$  yrs, 79 males) had a OCCS. Of these patients, 159 (77.2%) had no evidence of coronary artery disease, 7 (3.4%) had mild vessel wall irre-

gularities, 6 (2.9%) had bridging without stenoses, 28 (13.6%) had non-significant stenoses in at least 1 segment, and 2 (1.0%) had significant non-calcified stenoses. In 4 patients (1.9%) images were inconclusive because of motion artefacts.

**Conclusion:** Up to 18% of patients presenting with atypical chest pain and a OCCS exhibit signs of coronary artery disease. Significant soft plaque is present in 1% of patients with a OCCS, hence a OCCS score does not exclude clinically relevant atherosclerotic coronary artery disease.

08.4

### DIFFUSION WEIGHTED IMAGING IN VENOUS THROMBOSIS OF THE LEG. COMPARISON WITH MR DIRECT THROMBUS IMAGING AND CONTRAST ENHANCED MRA TO VISUALIZE THROMBUS AND ROLE IN DIAGNOSIS

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UMC Groningen, GRONINGEN

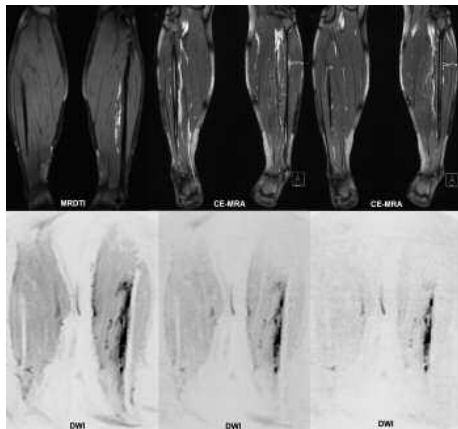
**Purpose:** To evaluate the value of diffusion weighted imaging (DWI) in patients with deep venous thrombosis, compared to MR direct thrombus imaging (MRDTI) and contrast enhanced MRA (CE-MRA).

**Materials and methods:** 15 patients were evaluated retrospectively with symptoms of calf vein thrombosis. Duration of symptoms varied between 2 days and 12 weeks. Examinations were performed on a 1.5T MRI system with the T1-MRDTI, EPI-2D DWI with b-values 50, 400, 800 and CE-MRA using gadofosveset trisodium (Vasovist®). In every patient the same imaging protocol was performed. Results were compared to ultrasound (14/15) and contrast-venography (1/15) results in presence of DVT.

The examinations were scored by an experienced cardiovascular radiologist, who was blinded from any clinical information, regarding to image quality and presence of thrombosis.

**Results:** In 8 patients, thrombosis was found, corresponding to ultrasound (n=7) and venography (n=1). DWI was positive in all patients with thrombosis (8/8), but there was no clear relation between thrombus load and extent of signal abnormalities on DWI or ADC. DWI changes were mainly prominent when thrombosis was present in a single compartment (for example m. gastrocnemius). In 4 patients, MRI and ultrasound were negative. In 3 patients, DWI was positive due to edema despite absence of thrombosis. ADC maps had no added value to DWI.

**Conclusion:** A clear relation was seen between abnormalities on MRDTI and DWI although until now, DWI has no added value in the diagnosis compared to MRDTI, because of its ease of use and information on thrombus age.



**Image 1:** MRDTI, CE-MRA and DWI images in 1 patient

08.5

### THE AMOUNT OF CALCIFICATIONS DOES NOT REPRESENT THE TOTAL PLAQUE BURDEN IN THE CAROTID ARTERY: AN ANALYSIS WITH MULTIDETECTOR CT ANGIOGRAPHY

S. Rozie, M. van Gils, D. Vukadinovic, D.W.J. Dippel, W. Niessen, A. van der Lugt  
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**Purpose:** Calcifications in the coronary arteries are used as an estimator of atherosclerotic plaque burden and is a predictor of clinical events. This study evaluates whether the volume of the calcifications is an accurate estimator of the total carotid plaque volume.

**Methods:** 351 consecutive patients (60% male, mean age  $61.70 \pm 13.78$  years) with a recent TIA or minor stroke in the anterior circulation were prospectively studied. Scanning was performed on a 16-slice MDCT scanner (Siemens, Sensation 16, Erlangen, Germany). Plaque presence was scored using these MDCTA images. Additionally, a novel semi-automatic method was used to segment the plaque and the calcifications in the carotid bifurcation. Two observers performed the volume measurements in consensus.

**Results:** 351 patients, of whom 229 (65%) had atherosclerotic plaque in the carotid bifurcation. The mean plaque volume of 375 plaques (165 bilateral, 45 unilateral) was  $871 \pm 645 \text{ mm}^3$ , and calcified plaque volume was  $137 \pm 187 \text{ mm}^3$  ( $= 14 \pm 13 \%$ ). Correlation coefficient between absolute calcified plaque volume and total plaque volume was 0.22.

**Discussion:** Calcified volume does not reflect the amount of atherosclerotic disease in the carotid artery, so carotid calcifications can not be used as an estimator of atherosclerotic carotid plaque burden. Plaque volume may be a better predictor of events than calcified volume.

08.6

### MULTISPECTRALE MRI TOONT NATTE THROMBUS AAN IN DE ANEURYSMAZAK TOT TEN MINSTE EEN JAAR NA ENDOVASCULAIRE BEHANDELING VAN INFRARENAAL ANEURYSMA

S.A.P. Cornelissen<sup>1</sup>, M.J. van der Laan<sup>2</sup>, K.L. Vincken<sup>1</sup>, F.L. Moll<sup>1</sup>, W.P.Th.M. Mali<sup>1</sup>, M.A. Viergever<sup>1</sup>, L.W. Bartels<sup>1</sup>  
<sup>1</sup>UMC Utrecht, UTRECHT  
<sup>2</sup>Academisch Medisch Centrum, AMSTERDAM

**Doel:** Inzicht verkrijgen in processen in de aneurysmazak na EVAR door afbeelden van thrombus organisatie in de tijd met multispectrale MRI.

**Methoden:** Deelnemende patiënten voor endovasculaire aneurysma behandeling (EVAR) ondergingen naast de jaarlijkse CTA follow-up 4 MRI-onderzoeken, te weten pre-operatief, 1 dag postoperatief, 6 maanden en 1 jaar na EVAR. Er werden precontrast T1-, T2- en postcontrast T1-gewogen beelden gemaakt. Vervolgens werd de aneurysmazak minus de stentgraft handmatig gesegmenteerd. Deze voxels werden geïdentificeerd in de categorieën endoleak, natte thrombus en georganiseerde thrombus op basis van de intensiteiten (SI) op de verschillende MRI-beelden (zie tabel). Hierna werden de relatieve volumes per categorie bepaald.

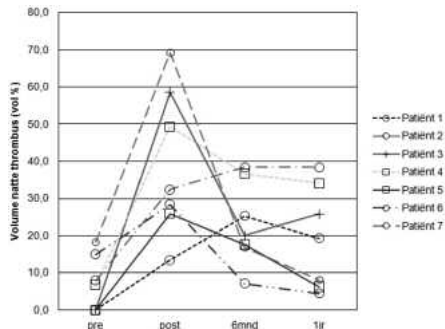
**Resultaten:** De resultaten van de eerste 7 patiënten zijn beschikbaar, bestaande uit 28 MRI scans. Van 1, 4 en 2 patiënten is respectievelijk 1-jaar, 2-jaar en 3-jaar CT follow-up beschikbaar. 1 aneurysma nam toe in volume, 4 hielden hetzelfde aneurysmavolume en 2 krompen. In alle patiënten was nog natte thrombus aanwezig in de aneurysmazak na 1 jaar, variërend van 4 - 38 volume % (zie diagram). De figuur demonstreert een patiënt zonder endoleak met even groot blijvend aneurysma. De groep patiënten was te klein om veranderingen in aneurysmavolume te correleren aan veranderingen in natte thrombusvolume en endoleakvolume.

**Discussie:** 1 jaar na EVAR wordt nog een aanzienlijk volume natte thrombus waargenomen in de aneurysmazak. Dit is onverwacht, bij normale thrombi zou dit niet het geval zijn. Een mogelijke verklaring kan zijn oedeem ten gevolge van fibrinolyse of inflammatie. Dit wordt thans verder onderzocht in een grotere patiëntengroep.

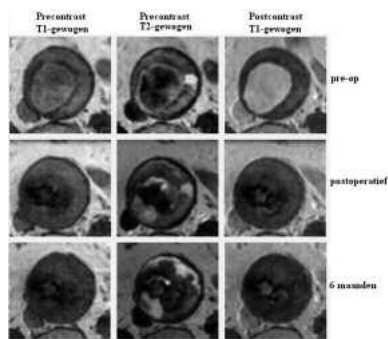
Categorie	T1-gewogen	T2-gewogen	T1 na gado
endoleak	laag SI	laag/hoog SI	hoog SI
natte thrombus	laag/hoog SI	hoog SI	laag/hoog SI*
georganiseerde thrombus	laag SI	laag SI	laag SI

SI = signaalintensiteit  
 \* = zelfde SI als op T1-gewogen beeld voor gado

**Tabel 1:** Classificatieschema voor voxels in de aneurysmazak



**Figuur 1:** Verandering in volume natte thrombus in de tijd



**Afbeelding 1:** MRI opnamen van 1 patiënt in de tijd

08.7

## ECG-GATED THORACO-ABDOMINAL CTA FOR PRE-OPERATIVE WORK-UP OF TRANSCATHETER AORTIC VALVE INSERTION: INITIAL EXPERIENCE ON 64 AND 256 DETECTOR-ROW CT SCANNERS

R.P.J. Budde, P.R. Stella, G.T. Sieswerda, J. Kluin, L.A. van Herwerden, M. Prokop  
 UMC Utrecht, UTRECHT

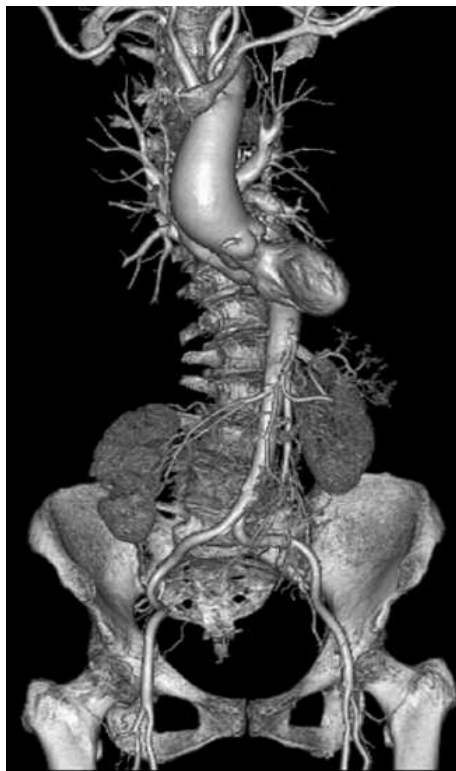
**Background:** Transcatheter aortic valve insertion (AVI) is an emerging minimally invasive catheter-based alternative to traditional aortic valve (AV) replacement. We used ECG-gated thoraco-abdominal CTA for comprehensive cardiovascular assessment to optimize selection of suitable candidates.

**Methods:** Eighteen patients underwent ECG-gated thoraco-abdominal CTA on a 64 or 256 detector-row scanner (Philips

Brilliance-64 and iCt) using 120 kV, 200-250mAs. Data sets were reconstructed at each 12.5% of the ECG-interval. Image analysis included 3D volume rendered images of the aorto-iliac vasculature and 2D static and dynamic AV leaflet motion. Image quality (IQ) of both was scored on a 4-point scale: (poor, moderate, good, excellent). Maximal AV area (AVA) as well as left ventricular outflow tract (LVOT) long and short axis and the distance of the AV leaflets to the ostium of the left coronary artery (LCA) were measured in systole.

**Results:** Nine patients were scanned on the 256 scanner and nine on the 64. Mean patient age was 77 years (range 64-92). IQ of 3D aorto-iliac vasculature was excellent or good in 17 patients (94%). IQ for AV assessment was excellent or good in 15 patients (83%) and moderate in 3 (17%). Mean maximal AVA was 0.7 cm<sup>2</sup> (range 0.35-1.70) and could not be measured in 2 patients. Long and short axis LVOT diameters were 27mm (23-33mm) and 22mm (17-25mm). AV to LCA distance was 9.8mm (5-15mm).

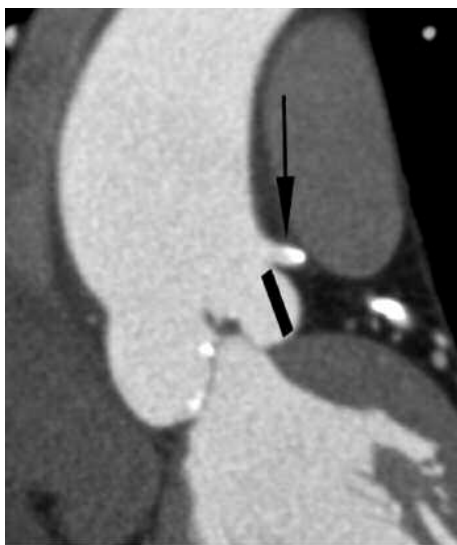
**Conclusion:** ECG-gated thoraco-abdominal 64 and 256 detector-row CTA allows comprehensive cardiovascular analysis prior to transcatheter AVI and promises to provide vital information for selecting suitable candidates.



**Image 1:** 3D volume rendering of the aortoiliac vessels



**Image 2:** Aortic valve in three perpendicular view planes



**Image 3:** Left coronary (arrow) to AV distance (line)

pective triggering with or without padding (heart rate  $\leq 65$  bpm). Tube current and energy setting were adjusted based on body habitus. Radiation exposure and diagnostic scan quality (using a four-point scale) were measured for each patient and compared.

**Results:** Twenty-three patients (13 male, mean age  $55.8 \pm 13$  years) were scanned with retrospective gating. Mean radiation dose was 10.9 mSv. Thirty-four patients (17 male, mean age  $52.7 \pm 9$  years) were scanned using prospective triggering, with a mean dose of 4.5 mSv. Difference in radiation dose was significant between the two acquisition techniques ( $p < 0.001$ ). There were no differences in diagnostic scan quality.

**Conclusion:** Prospective ECG-triggering acquisition gives a significant reduction in radiation dose. With emphasis on minimizing radiation exposure during cardiac CT imaging heart rate regulation plays an important role in radiation dose reduction.

08.8

### **RADIATION REDUCTION IN NONINVASIVE CORONARY MULTIDETECTOR COMPUTED TOMOGRAPHY USING PROSPECTIVE ECG-TRIGGERING COMPARED TO RETROSPECTIVE ECG-GATING**

J.B. Houwers, H.W. Wiersma, M.M.J.J.R. Jaspers, K. Koster  
Deventer Ziekenhuis, DEVENTER

**Purpose:** In noninvasive coronary angiography with current generation multidetector computed tomography scanners (MDCT) cardiac images are obtained with high temporal and spatial resolution. However, cardiac imaging still leads to high radiation exposure using retrospective ECG-gating, even with tube-current modulation and cardiac phase-specific scanning. This study was performed retrospectively to investigate the effects of prospective ECG-triggering on radiation reduction and diagnostic scan quality compared to retrospective ECG-gating.

**Material and methods:** Fifty-seven consecutive patients (30 male, mean age  $53.9 \pm 11$  years) who underwent CT coronary angiography were included. Scans were made with a 64-MDCT using two acquisition techniques: retrospective gating with dose modulation (heart rate  $> 65$  bpm) or pros-

## Sessie 9

## Neuroradiologie

Vrijdag 18 september 2009, 13.30 - 15.00 uur

09.1

**CEREBRAL AUTOREGULATIVE IMPAIRMENT MEASURED AT BRAIN TISSUE LEVEL WITH ARTERIAL SPIN LABELING MRI IN PATIENTS WITH A CAROTID ARTERY STENOSIS**R.P.H. Bokkers<sup>1</sup>, M.J.P. van Osch<sup>2</sup>, H.B. van der Worp<sup>1</sup>, G.J. de Borst<sup>1</sup>, W.P.Th.M. Mali<sup>1</sup>, J. Hendrikse<sup>1</sup><sup>1</sup>UMC Utrecht, UTRECHT<sup>2</sup>Leids Universitair Medisch Centrum, LEIDEN

**Purpose:** In patients with a stenosis of the internal carotid artery (ICA), impairment of the dilatory capacity of the brain vasculature is an important measure of hemodynamic compromise. Herein, we non-invasively assessed the cerebral autoregulative status at brain tissue level with arterial spin labeling (ASL) perfusion MRI in patients with a symptomatic ICA stenosis.

**Methods:** Twenty-three patients (69.0±7.9 years) with a symptomatic ICA stenosis and 20 healthy control subjects (66.8±6.3 years) underwent perfusion and flow territory selective ASL MRI before and 15 minutes after intravenous administration of 14mg/kg acetazolamide at 3T. The cerebrovascular reactivity was measured at tissue level, throughout the brain, in the gray-matter fed by the individual ICAs and basilar artery. For region-of-interest placement, probabilistic gray-matter segmentations were combined with segmented ASL flow territory maps.

**Results:** The cerebrovascular reactivity was, respectively, 35.9±3.0% and 44.6±3.5% in the flow territory of the symptomatic and non-stenosed ICA, and 47.9±3.1 in the healthy control group. The cerebrovascular reactivity was lower in the flow territory of the symptomatic stenosed ICA when compared to the control group (mean difference, -12.0%; 95% confidence interval (CI), -20.7 - -3.3). There was no difference between the flow territory of the non-stenosed and stenosed ICA (-8.7%; 95% CI, -18.0 - 0.6), and the healthy control group (4.7%; 95% CI, -12.9 - 6.3).

**Conclusion:** ASL perfusion MRI demonstrated impaired cerebrovascular reactivity in the flow territory of the ICA artery in patients with an ipsilateral symptomatic stenosis.

With ASL-MRI it is possible to non-invasively visualize and quantify autoregulative impairment at brain tissue level.

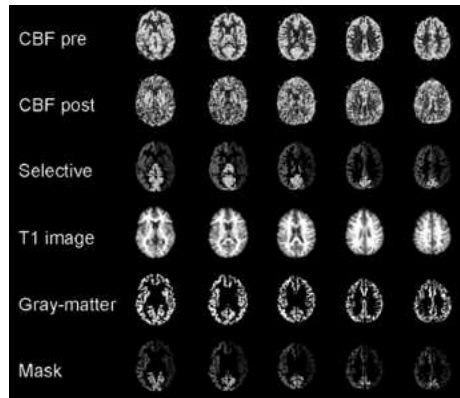


Image 1: Masking technique pictorial

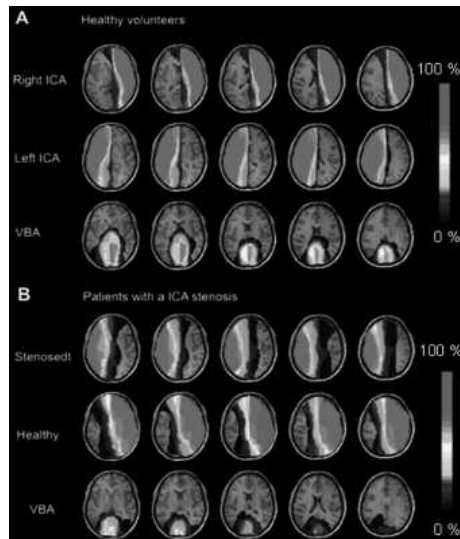
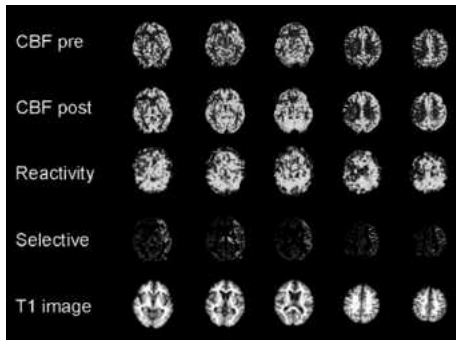


Image 2: Perfusion territory maps



**Image 3:** Example of CBF in ml/min/100gr

09.2

### TRAUMATISCH-SCHEDEL-HERSENLETSEL: EEN VERGELIJKING VAN VIER MRI SEQUENTIES OP INTER-BEOORDELAAR-BETROUWBAARHEID, WEERGAVE VAN SCHADE EN FUNCTIONELE UITKOMST

B.M. Goraj, B.H.J. Geurts, T.M.J.C. Andriessen, P.E. Vos  
UMC St Radboud, NIJMEGEN

**Doel:** Vergelijking van de T2-gewogen (T2), Fluid Attenuated Inversion Recovery (FLAIR), T2\*-Gradient Recalled Echo (T2\*-GRE) en Susceptibility Weighted Imaging (SWI) MRI sequenties op inter-beoordelaar betrouwbaarheid, laesie detectie en relatie met functionele uitkomst, bij patiënten met Traumatisch Schedel-Hersenletsel (TSH).

**Methoden:** Retrospectief zijn de MRI beelden van 58 patiënten geëvalueerd. De individuele sequenties werden visueel gescoord op aantal puntlaesies (PL's) en laesievolumen (LV). De MRI's van 20 patiënten werden door vier onafhankelijke beoordelaars gescoord, de overige door een beoordelaar. Initiële ernst van het trauma werd ingedeeld met de Glasgow Coma Scale (GCS) score bij aankomst in onze kliniek. De uitkomst ten tijde van de MRI werd gedefinieerd met de Glasgow Outcome Scale-Extended (GOSE).

**Resultaten:** Inter-beoordelaar betrouwbaarheid was hoog voor het gemeten LV voor alle sequenties en PL's op T2\*-GRE en SWI (ICC  $\geq$  .84), maar laag voor T2 en FLAIR (ICC  $\leq$  .13). SWI toonde de meeste PL's, gevolgd door T2\*-GRE, die sensitiever was dan T2 en FLAIR. T2\*-GRE toonde het minste LV. Het aantal PL's op T2\* ( $r=.51$ ,  $p<.001$ ) en SWI ( $r=.56$ ,  $p<.001$ ) waren gecorreleerd aan de GCS. LV op SWI was gecorreleerd aan de GOSE ( $r=.41$ ,  $p=.002$ ).

**Conclusie:** De beoordeling van PL's gedetecteerd met T2 en FLAIR moet behoedzaam worden verricht, aangezien er aanzienlijke onenigheid tussen beoordelaars is. Hierin kunnen T2\*-GRE en SWI hulp bieden. Aangezien SWI, vergeleken

met de andere sequenties het best gecorreleerd is aan de ernst van het trauma en functionele uitkomst, zou deze sequentie, indien beschikbaar, in het MRI protocol voor TSH moeten worden opgenomen.

09.3

### SPONDYLOLYSIS EN SPONDYLOLISTHESIS OP MRI EN CONVENTIONELE RÖNTGEN-FOTO IN DE LUMBALE WERVELKOLOM

J.J. Hof, C.J.L.R. Vellenga, J.H.W. van den Hout  
Ziekenhuis Groep Twente, ALMELO

**Doel:** Spondylolysis en spondylolisthesis wordt meestal gediagnosticeerd middels conventioneel röntgenonderzoek. In deze studie wordt de detectie van spondylolysis en spondylolisthesis op MRI onderzocht.

**Materiaal en methode:** De MRI-lwk van 396 patiënten die in de periode december 2005 - mei 2006 kwamen, werd gereviseerd op de aanwezigheid van defecten in het pars interarticularis. Tevens werd gekeken naar afglijden van het wervelcorpus, al dan niet secundair aan spondylolysis. Inclusievereiste was een recente X-lwk (<6 mnd). Middels de beschikbare opnamen en sequenties werden beide modaliteiten beoordeeld op spondylolysis en spondylolisthesis door zowel een arts-assistent radiologie als door 2 ervaren radiologen.

Geëxcludeerd werden patiënten waarbij het onderzoek niet beoordeelbaar was. Dit om uiteen lopende redenen, bijvoorbeeld uitgebreide metastasering.

**Resultaten:** Bij de 378 onderzoeken na exclusie, blijkt er voor de genoemde criteria een goede correlatie te bestaan tussen MRI-lwk en X-lwk. De MRI toonde 20 gevallen van spondylolysis, bij conventioneel onderzoek waren dit er 16. MRI blijkt gevoeliger voor eenzijdige lysis en beginnende lysis. Interpretatieproblemen zijn bij MRI terug te leiden tot houdingsafwijkingen en facetartrose. (Pseudo)spondylolisthesis werd op beide modaliteiten ongeveer even goed aangetoond (MRI: 68 vs 76 conventioneel). Tevens is de MRI in staat om botoedeem rondom eventuele spondylolysis in beeld te brengen en daarmee de activiteit.

**Conclusie:** De meerwaarde van het conventioneel onderzoek zit met name in de lumbale wervelkolom met houdingsafwijkingen en ernstige facetartrose. Op MRI-lwk is alle informatie aanwezig die ook op de X-lwk aanwezig is, en meer. Een X-lwk is dus initieel niet nodig bij een MRI-lwk.

09.4

### HYPERINTENSE CAROTID PLAQUE ON T1-WEIGHTED TFE MRI IN SYMPTOMATIC PATIENTS WITH LOW GRADE CAROTID STENOSIS AND CAROTID OCCLUSION

A.G. van der Kolk<sup>1</sup>, G.J. de Borst<sup>1</sup>, A. den Hartog<sup>1</sup>, H.B. van der Worp<sup>1</sup>, M.E. Kooi<sup>2</sup>, W.P.Th.M. Mali<sup>1</sup>, J. Hendrikse<sup>1</sup>

<sup>1</sup>UMC Utrecht, UTRECHT

<sup>2</sup>Maastricht Universitair Medisch Centrum, MAASTRICHT

**Background and purpose:** In addition to stenosis grading magnetic resonance imaging (MRI) may provide valuable information about plaque "status", for instance hyperintense vulnerable carotid plaque, associated with higher morbidity and mortality. In the present study we investigated the prevalence, clinical and radiological correlates of hyperintense carotid plaques on T1-weighted turbo-field echo (T1w-TFE) MRI in patients with ischemic symptoms.

**Methods:** Hundred and fifty-three patients presenting with TIA or ischemic infarction, studied with Contrast-Enhanced Magnetic Resonance Angiography (CEMRA), were retrospectively examined. Stenosis grade was obtained from CEMRA images, presence or absence of hyperintense carotid plaque from T1w-TFE MRI. Stenosis grade and baseline characteristics were compared between patients with and without a hyperintense plaque.

**Results:** Twenty-eight patients (18%) showed one or more hyperintense internal carotid (ICA) plaques. Hyperintense plaques were found in patients with 0-49% stenosis (6 of 158 ICAs), 50-69% stenosis (4 of 11), 70-99% stenosis (14 of 74) and carotid occlusion (4 of 24). Presence of hyperintense plaque was associated with older age (70 versus 62 years;  $p<0.05$ ), higher prevalence of cardiovascular disease (61% versus 28%;  $p<0.01$ ), ischemic infarction as presenting symptom (37% versus 14%;  $p<0.01$ ), ischemic cerebral lesions on MRI (63% versus 32%;  $p<0.01$ ), and the ICA on the patients' symptomatic side (70% versus 42%;  $p<0.01$ ).

**Conclusion:** Half of all hyperintense carotid plaques occur in symptomatic patients presenting with either 0-69% stenosis or occlusion, with more than one third of patients with 50-69% stenosis presenting with a hyperintense plaque. This subgroup of patients could in future possibly benefit from revascularization.

09.5

### ASSOCIATION BETWEEN MANIFESTATIONS OF NEURODEGENERATION ON MRI AND COGNITIVE PERFORMANCE IN ELDERLY HYPERTENSIVE PATIENTS

A. Brandts, A. de Roos, M.A. van Buchem, J. van der Grond  
Leids Universitair Medisch Centrum, LEIDEN

**Purpose:** Although hypertension is recognized as risk factor for lacunar brain infarcts, white matter hyperintensities (WMHs), microbleeds and atrophy, less is known about the hypertensive effects on cognitive performance. The purpose of our study was to assess the association between these manifestations of neurodegeneration on MRI and cognitive performance in elderly hypertensive patients.

**Methods:** Lacunar infarcts, periventricular and subcortical WMHs, microbleeds and atrophy were assessed in 542 elderly subjects with known history of cardiovascular disease ( $n=343$  with hypertension, 70-81 years old) on MRI. Cognitive performance was assessed by the mini mental state examination and a battery of psychometric tests: picture-word learning test, Stroop colour word tests, letter digit coding test and verbal learning test. Disability was assessed with Barthel and IADL (instrumental activities of daily living) questionnaires. Spearman rank correlations were used for statistical analyses.

**Results:** Patients with hypertension showed a significantly higher number of total WMHs ( $p<0.01$ ), periventricular WMHs ( $p<0.006$ ) and microbleeds ( $p<0.001$ ), compared to patients without hypertension. IADL was significantly associated with total number of periventricular WMHs ( $r=-0.15$ ,  $p<0.01$ ), subcortical WMHs ( $r=-0.20$ ,  $p=0.03$ ) and grey matter atrophy ( $r=-0.16$ ,  $p<0.01$ ). Stroop color-word test was associated with total number of WMHs ( $r=0.16$ ,  $p<0.01$ ), and periventricular WMHs ( $r=0.17$ ,  $p<0.01$ ). Furthermore, the Verbal learning test was associated with total number of WMHs ( $r=-0.12$ ,  $p=0.03$ ), periventricular WMHs ( $r=-0.12$ ,  $p=0.03$ ) and gray matter atrophy ( $r=-0.16$ ,  $p<0.01$ ).

**Conclusion:** Diminished cognitive performance in elderly hypertensive patients is mainly associated with the presence of WMHs and grey matter atrophy.

09.6

### PERFORATING ARTERIES ORIGINATING FROM THE POSTERIOR COMMUNICATING ARTERY: A 7.0 TESLA MRI STUDY

M.M.A. Conijn, J. Hendrikse, J.J.M. Zwanenburg, T. Takahara, M.I. Geerlings, W.P.Th.M. Mali, P.R. Luijten  
UMC Utrecht, UTRECHT

**Aim:** Aim of this study was to investigate the ability of time-of-flight (TOF) MR angiography at 7.0-Tesla to show the perforating branches of the posterior communicating artery (PCoA), and to investigate the presence of these visible branches in relation to the size of the feeding PCoA. Secondary aim was to visualise the perforating branches of the P1-segment of the posterior cerebral artery (P1), to describe these branches and to describe the anterior choroidal artery (AChA).

**Methods:** Forty-six healthy volunteers underwent TOF MR angiography at 7.0-Tesla with a resolution of 0.6x0.6x0.6mm<sup>3</sup> or 0.4x0.5x1.0mm<sup>3</sup>. On thin 3mm maximum intensity projections of transversal slabs and sagittal slabs, the diameter of the P1, the AChA, the PCoA and the perforating artery from the PCoA were measured by taking the full-width-at-half-maximum of the intensity profiles. Perforating branches from the P1 were counted.

**Results:** A perforating artery from the PCoA was found in a large proportion of the PCoAs (64%). The presence was associated with a larger diameter of the feeding PCoA (1.23mm versus 1.06mm, p=0.03). The AChA was visible bilaterally in all participants. In 83% of all P1's one or two perforating branches were visible.

**Conclusion:** With 7.0-Tesla imaging, we visualised for the first time perforating arteries originating from the PCoA in vivo, without the use of contrast agents. Non-invasive assessment of the perforating arteries of the PCoA together with the AChA and the perforating arteries of the P1 may increase our understanding of infarcts in the deep brain structures supplied by these arteries.

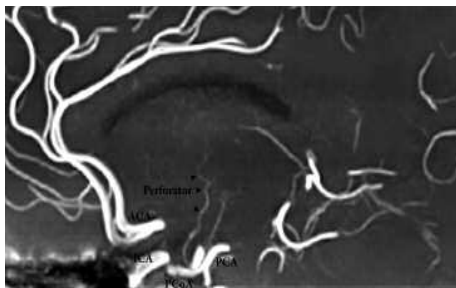


Image 1: PCoA with one perforating artery at 7T angiography

09.7

### DE BEHANDELING VAN HET ACUTE HERSEN-INFARCT MET INTRA-ARTERIËLE THROMBOLYSE: WAAROM MOETEN WE VAAK AFWIJKEN VAN HET BEHANDELPROTOCOL?

H.M.H. Duijsens, L.C. van Dijk, F.E.E. Treurniet, H. van Overhagen, A. Mosch  
HagaZiekenhuis, DEN HAAG

**Doel:** Evaluatie van een, sinds ruim 1 jaar geleden, in ons ziekenhuis gestarte strategie - volgens de huidige standaard inclusief intra-arteriële thrombolysen - voor de behandeling van het acute herseninfarct. In deze analyse hebben we gekozen, die gevallen te belichten, waarbij bewust afgeweken is van het protocol.

**Inleiding:** Intra-arteriële thrombolysen heeft voordelen boven intraveneuze toediening van rt-PA bij patiënten met een acuut herseninfarct. Het wordt lokaal en niet systemisch toegediend waardoor het tijdsinterval waarbinnen de behandeling kan worden uitgevoerd ruimer is en de kans op rekanalisatie groter.

**Methode:** De patiënten waarbij werd afgeweken van het behandelprotocol werden per casus geëvalueerd door het beantwoorden van de volgende vragen:

- 1: Was het protocol toepasbaar voor de patiënt?
- 2: Wat was de hoofdreden om af te wijken van het protocol?
- 3: Wat is de "evidence" in de huidige literatuur om de gekozen strategie te onderbouwen?
- 4: Is de klinische uitkomst in lijn met de literatuur?
- 5: Moet het protocol worden aangepast?
- 6: Zou "Penumbra-Imaging" het behandelplan en de uitkomst verbeterd hebben?

**Bespreking:** Van april 2008 tot en met april 2009 werden 24 patiënten behandeld voor een acuut herseninfarct. Bij 7 patiënten werd afgeweken van het protocol: 2 patiënten werden behandeld buiten de 6-uur tijdslimiet. Bij 2 patiënten werd additioneel behandeling van een carotisstenose of occlusie verricht en bij 3 patiënten werd afgezien van intra-arteriële thrombolysen. In de presentatie worden bij elk van de 7 patiënten de 6 evaluatievragen besproken.

09.8

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**PROGRESSION OF COGNITIVE DECLINE AND CEREBRAL SMALL VESSEL DISEASE IN ELDERLY DIABETES MELLITUS PATIENTS, A 3 YEAR FOLLOW-UP STUDY**

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S.G.C. van Elderen, A. de Roos, M.A. van Buchem,  
J. van der Grond

*Leids Universitair Medisch Centrum, LEIDEN*

The purpose of the present study was to investigate the course of cognitive decline as well as the progression of manifestations of cerebral small vessel disease on MRI in a population of elderly DM patients compared to age-matched non-DM controls.

In a randomized controlled trial 185 DM patients and 915 non-DM control subjects, aged 70-82 years, were included for neuropsychological testing at baseline and re-testing after 3-years. A random study sample of 90 DM patients and 453 controls underwent MRI scanning for quantitative evaluation of white matter hyperintensities (WMHs) and total brain atrophy. To identify the 3-year additive effect of DM independent of normal aging and learning, changes in neuropsychological test results, WMHs and brain atrophy were first determined in non-DM subjects. Each individual DM study outcome was corrected for the mean change in non-DM subjects, and subsequently tested with paired sample t-tests.

DM patients showed worse decline in cognitive performance on Mini Mental State Examination ( $p < 0.001$ ), Stroop part III ( $p = 0.008$ ) and Letter-Digit Coding testing ( $p < 0.001$ ) within 3 year follow-up in comparison with non-DM controls. Furthermore, DM patients showed increased progression of white matter hyperintensities (WMHs) ( $p < 0.001$ ) and total brain atrophy ( $p < 0.001$ ).

In conclusion, the results of this 3 year follow-up study show elderly DM patients having accelerated cognitive decline as well as progression of cerebral small vessel disease as compared to non-DM controls. These study results suggest an additive effect of DM on manifestations of cerebral damage in the elderly population.

## Sessie 10

Kinderradiologie /  
Nucleaire radiologie

Vrijdag 18 september 2009, 13.30 - 15.00 uur

010.1

**IS ROUTINEMATIGE SCREENING OP HEUP-DYSPLASIE MET BEHULP VAN ECHOGRAFIE GEÏNDICEERD BIJ KINDEREN GEBOREN IN HOOFDLIGGING NA VERSIE VAN EEN STUITLIGGING?**S.E.H. Cremers<sup>1</sup>, A.F. Lambeek<sup>2</sup>, G.S. Kooi<sup>1</sup>, I. Hellendoorn<sup>1</sup>, M.P. den Breejen<sup>1</sup>, E.M.J. Brouwers<sup>1</sup><sup>1</sup>Albert Schweitzer Ziekenhuis, DORDRECHT<sup>2</sup>Erasmus MC, ROTTERDAM

**Doel:** Kinderen geboren in stuitligging hebben een verhoogde kans op congenitale heupdysplasie (CHD) (3-6/100 versus 1/100 bij de algehele populatie). Wij onderzochten of kinderen in stuitligging, die na een uitwendige versie in hoofdligging zijn geboren, ook een verhoogde kans op CHD hebben.

**Methode:** Alle gezonde zwangeren die zich in onze kliniek presenteerden met een kind in stuitligging bij een amenoroe duur vanaf 34 weken, gedurende de periode 03/2006 tot 10/2008, werden geïncludeerd (n=248). Bij 195 vrouwen (79%) werd een versiepoging ondernomen. Bij alle kinderen (n= 248, m:j=142:106) is bij 3 maanden een echo van de heupen verricht en werd de alfahoek volgens de methode Graf bepaald. Statistische analyse werd verricht met de loglikelihood ratiotest.

**Resultaten:** Bij 79 (41%) van de 195 vrouwen slaagde de versiepoging. Dus 79 (32%) van de in totaal 248 kinderen werden in hoofdligging geboren. De overige 169 (68%) kinderen werden in stuitligging geboren. Van de kinderen geboren in stuitligging bleken 10 (5,9%) CHD te hebben. Van de kinderen geboren in hoofdligging had 1 (1,3%) CHD. Dit verschil was significant (p<0,001).

**Conclusie:** Kinderen die in het derde trimester van de zwangerschap in stuitligging liggen, maar na een uitwendige versie in hoofdligging zijn geboren, hebben geen grotere kans op congenitale heupdysplasie. Screening met echografie is bij deze kinderen derhalve niet geïndiceerd

010.2

**STRALINGSHYGIËNE IN DE KINDERRADIOLOGIE: HOE VAAK BEVINDT DE OOGLENS ZICH BINNEN HET SCANBEREIK VAN EEN CT-CEREBRUM?**R.A. Nieuwenhuizen, J. Hendrikse, R.A.J. Nievelstein  
UMC Utrecht, UTRECHT

**Doel:** Eén van de meest voorkomende CT-scans bij kinderen is de CT-cerebrum, en een deel van de kinderen ondergaat de CT bij herhaling. Gewoonlijk wordt een CT-cerebrum op het scanogram gepland aan de hand van de orbitomeatale lijn waarbij getracht wordt de ooglenzen buiten het scanbereik te houden, aangezien de lens van het oog relatief gevoelig is voor ioniserende straling (cataractvorming). Het doel van dit onderzoek was na te gaan hoe vaak de lens bij kinderen toch binnen het scanbereik van de CT-cerebrum viel.

**Methoden:** Dit is een retrospectieve studie (periode 1998-2009) in een gespecialiseerd Nederlands kinderziekenhuis bij patiënten onder de 15 jaar met de diagnose hydrocephalus, waarvoor een ventriculo-peritoneale drain werd geplaatst. Bij deze patiënten werd gekeken of de lens niet, partieel of geheel binnen het scanbereik van de CT-cerebrum viel.

**Resultaten:** Voor de beoordeling waren 517 CT-scans beschikbaar bij 149 patiënten met een hydrocephalus. Daarbij bleek dat in 60,8% van de CT-scans de lens geheel of gedeeltelijk werd afgebeeld. Leeftijd, geslacht en oorzaak van de hydrocephalus bleken hierbij geen rol te spelen.

**Discussie:** Uit het onderzoek blijkt dat de lens toch opvallend vaak wordt afgebeeld op een CT-cerebrum. Bij goede planning en angulatie van het hoofd zou de lens (tenminste grotendeels) buiten het scangebied moeten vallen, echter dit blijkt niet bij elk kind even gemakkelijk. Dit zou kunnen samenhangen met de deformatie van het hoofd door de hydrocephalus. Deze data kunnen wellicht na communicatie en voorlichting aan de laboranten bijdragen aan een kwaliteitsborging op de afdeling.

010.3

### ASSESSMENT OF NON-ALCOHOLIC FATTY LIVER DISEASE IN MORBIDLY OBESE CHILDREN USING 3.0T MAGNETIC RESONANCE SPECTROSCOPY

J.R. van Werven<sup>1</sup>, B.G. Koot<sup>1</sup>, A.J. Nederveen<sup>1</sup>, M.A. Benninga<sup>1</sup>, T.H. Pels Rijcken<sup>2</sup>, J. Stoker<sup>1</sup>  
<sup>1</sup>Academisch Medisch Centrum, AMSTERDAM  
<sup>2</sup>Tergooiziekenhuizen, HILVERSUM

**Purpose:** Non-alcoholic fatty liver disease (NAFLD) is strongly related to obesity, especially visceral fat. Paediatric NAFLD is presumed to have a high prevalence (38-53%) due to the obesity epidemic. Exact knowledge about paediatric NAFLD is lacking. Magnetic Resonance Spectroscopy (MRS) is a non-invasive method to detect hepatic fat. Therefore the purpose of this study was to investigate NAFLD in obese children using MRS.

**Methods:** 34 obese children were included. All children underwent ultrasound (US) measurement of visceral fat thickness and 3.0T MRS of the liver. A ratio from the MR spectra was defined as the fat peak versus the reference water peak and converted to % hepatic fat. Normal upper limit of MRS hepatic fat content is 5.6%. We correlated hepatic fat content with visceral fat thickness and studied differences between groups.

**Results:** Mean age was 13.8 years and mean SDS-Body Mass Index (BMI) was 3.2, meaning all children weight more than the 95th percentile of normal BMI. Six out of 34 (18%) children had NAFLD (hepatic fat content >5.6%). We found a significant correlation between MRS determined hepatic fat and US determined visceral fat thickness ( $r=0.72$ ,  $p=0.004$ ). In children with NAFLD visceral fat thickness was significantly higher ( $p=0.015$ ) than in children without NAFLD.

**Conclusion:** Using MRS the prevalence of NAFLD in obese children was 18%, lower than reported in the literature. This could be due to a cut off value based on adult MRS data. We found that NAFLD in obese children is associated with increased visceral fat thickness.

010.4

### MRI FINDINGS IN THE KNEE IN CHILDREN WITH JUVENILE IDIOPATHIC ARTHRITIS (JIA): EXPERIENCE WITH A NEWLY DEVELOPED JUVENILE ARTHRITIS MRI SCORING SYSTEM (JAMRIS)

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**Method and materials:** In this prospective cohort study both knees of 29 children (mean age 12 years [range 6-17]) were examined using an open-bore MRI (1.0T).

Imaging protocol consisted of T1, T2 and T2-fatsat sequences in all three anatomical directions. A literature-based MR scoring system was constructed, focused on structural damage, anatomical location of pathology and signal intensity changes.

**Results:** Synovial hypertrophy was seen in 12 (21%) of the 58 knees. Hydrops of the suprapatellar bursa was seen in 37 (64%) effusion in the lateral recess was seen in 15 (26%), Baker's cyst in 9 (15%) and effusion anterior to the anterior cruciate ligament (ACL) was seen in 41 (71%) of the 58 knees. Erosions were seen in 3 (5%), subcortical bone marrow edema in 18 (31%) and epiphyseal bone marrow edema in 18 (31%) of the 58 knees. Cartilage lesions were seen in 8 (14%) knees and tendinopathy / internal derangement in 5 (9%) knees. Abnormalities of the infrapatellar fat pad were seen in 44 (76%) of the knees and popliteal lymph nodes in 37 (64%) of the 58 knees.

**Conclusion:** Effusion anterior to the ACL is a new and common phenomenon observed upon MR imaging of one of the major target joints in JIA patients. Hydrops in the bursa suprapatellaris, abnormalities of the infrapatellar fat pad and popliteal lymph nodes are also common MR findings. Bone erosions and tendinopathy/internal derangement were infrequent. Soft tissue abnormalities were not seen and hence removed from our scoring list.

010.5

### ABDOMINALE ANATOMIE NA GIANT OMFALOCLE

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**Inleiding:** Giant omfalocle (GO) is een congenitale aandoening waarbij de abdominale organen inclusief de lever buiten de buik liggen, en waarbij de peritoneale holte onderontwikkeld is. Kort na de geboorte wordt deze afwijking operatief gecorrigeerd. Er is weinig bekend over de ligging en grootte van de abdominale organen op de lange termijn. Wij onderzochten de abdominale anatomie bij kinderen en jong volwassenen bij status na GO.

**Methoden:** Patiënten met GO, geopereerd in het UMCN St. Radboud tussen 1970 en 2004 werden opgeroepen voor een abdominale echografie, met state-of-the-art apparatuur, ter bepaling van ligging en grootte van de abdominale organen. Gezonde controles ondergingen hetzelfde onderzoek.

**Resultaten:** 17 van 22 patiënten konden worden geïncludeerd en ondergingen echografie (5M, 12V; 3 - 30 jaar). Elf patiënten hadden een mediane breuk van de buikwand. Tien patiënten hadden een abnormale ligging en vorm van de lever, vaak als plat orgaan direct onderhuids gelegen in de ventrale hernia. Bij 6 patiënten was er een abnormale ligging van de nieren, vaak subdiafragmaal. Vijf patiënten hadden een abnormale milt. Bij de controle personen werden geen afwijkingen gevonden.

**Conclusie:** De meerderheid van de patiënten met status na GO heeft een abnormale anatomie van het abdomen. Het verdient aanbeveling de abdominale anatomie van GO patiënten op lange termijn te controleren, bijvoorbeeld ter voorbereiding op een eventuele acute situatie later in het leven.

O10.6

### WHOLE-BODY MRI, INCLUDING DIFFUSION-WEIGHTED IMAGING, FOR THE INITIAL STAGING OF MALIGNANT LYMPHOMA: COMPARISON TO CT AND PET/CT

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**Purpose:** To prospectively assess the value of whole-body magnetic resonance imaging (MRI), including diffusion-weighted imaging (DWI), for the initial staging of malignant lymphoma, compared to CT and PET/low-dose CT.

**Materials and methods:** Sixteen consecutive patients (12 male; mean age, 59.3 years; age range, 22-81 years) with newly diagnosed malignant lymphoma (15 NHL, 1 HD) prospectively underwent diagnostic FDG-PET/CT and whole-body MRI (T1-weighted, short inversion time inversion recovery [n=16], and DWI [n=15]). Ann Arbor stages were assigned by one experienced radiologist according to whole-body MRI findings, by another experienced radiologist according to diagnostic CT findings, and by a nuclear medicine physician according to FDG-PET/low-dose CT. Differences in staging between the three modalities were resolved using all modalities, bone marrow biopsy, and follow-up studies.

**Results:** Staging results of whole-body MRI were equal to diagnostic CT vs FDG-PET/low-dose CT in 12 vs 11 patients, higher in 4 vs 5 patients, and lower in 0 patients, respectively. Overstaging of whole-body MRI relative to diagnostic CT was correct in 2, and incorrect in 2 patients. Overstaging of whole-body MRI relative to FDG-PET/low-dose CT was correct, incorrect, and unresolved in 2 (PET: physiologic FDG-uptake), 2 and 1 patient(s).

**Conclusion:** Our results indicate that WB-MRI, including DWI, might be a feasible technique for the initial staging of malignant lymphoma. A larger sample size will be needed to obtain more definite conclusions on the value of whole-body MRI relative to CT and FDG-PET/CT.

O10.7

### CORRELATION BETWEEN THE APPARENT DIFFUSION COEFFICIENT AND THE POSITRON EMISSION TOMOGRAPHY STANDARDIZED UPTAKE VALUE IN PATIENTS WITH MALIGNANT LYMPHOMA - INITIAL RESULTS

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**Purpose:** The apparent diffusion coefficient (ADC) and the positron emission tomography (PET) standardized uptake value (SUV) relate to cellular density and metabolic activity, respectively. This study investigated the correlation between mean ADC (ADCmean) and maximum SUV (SUVmax) in patients with malignant lymphoma.

**Materials and methods:** Twenty consecutive patients (13 male; mean age, 60.5 years; age range, 22-81 years; 19 NHL, 1 HD) with newly diagnosed malignant lymphoma prospectively underwent diagnostic FDG-PET/CT and whole-body MRI, including diffusion-weighted imaging at b-values of 0 and 1000 s/mm<sup>2</sup>. ADCmean and SUVmax of the largest lesion in each patient were measured and correlation was assessed using Pearson correlation statistics.

**Results:** 11 patients (no pathologic FDG-uptake on PET: n=5; no pathology on PET and MRI: n=3; no DWI: n=1) had lesions visible on both FDG-PET/CT and MRI. ADCmean (in 10-3 mm<sup>2</sup>/s) and SUVmax ranged between 0,50 and 1,06 (mean 0,69) and between 6,98 and 33,94 (mean 16,78), respectively. There were no significant correlations between ADCmean and SUVmax (Pearson's r of 0.1; P = 0,77).

**Conclusion:** Our results suggest that the value for cellular density (ADCmean) and metabolic activity (SUVmax) are not correlated and may be used as independent measures in the evaluation of patients with malignant lymphoma. Nonetheless, the precise role and value of ADC measurements in patients with malignant lymphoma still have to be established.

# Samenvattingen Radiologendagenprijs

RP1

## COMPARISON OF IMAGING MODALITIES FOR THE ASSESSMENT OF HEPATIC STEATOSIS IN PATIENTS UNDERGOING LIVER RESECTION

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**Purpose:** Hepatic steatosis is a risk factor in liver surgery. Liver biopsy is the gold standard for histopathological steatosis assessment. Ultrasound (US), Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and Magnetic Resonance Spectroscopy (MRS) are non-invasive imaging techniques to assess steatosis. Therefore the purpose of this study was to compare these techniques in patients undergoing liver resection.

**Methods:** US, CT, MRI and MRS were performed preoperatively in 47 patients undergoing liver resection. Peroperative liver biopsies were taken for histopathological and biochemical assessment of steatosis. US (liver echogenicity), CT (liver/spleen attenuation) 3.0T MRI (Dixon chemical shift imaging) and 3.0T MRS (fat/water ratio) were correlated with histopathological and biochemical steatosis assessment. Imaging modalities were compared in a spectrum of patients with steatosis to investigate discriminative power.

**Results:** At histopathology 26 patients had none (0-5%), 9 had mild (5-33%), 9 had moderate (33-66%) and 3 had severe (>66%) steatosis. MRI and MRS measurements of steatosis showed stronger correlation with histopathological ( $r=0.92, p<0.001$  and  $r=0.91, p<0.001$ ) and biochemical ( $r=0.76, p<0.001$  and  $r=0.77, p<0.001$ ) steatosis than US ( $r=0.57, p<0.001$  and  $r=0.46, p<0.001$ ) and CT ( $r=-0.61, p<0.001$  and  $r=-0.48, p<0.001$ ). Only MRI and MRS showed significant discriminative power for all steatosis grades. None vs. mild ( $p=0.009, p=0.005$ ), mild vs. moderate ( $p<0.001, p<0.001$ ) and moderate vs. severe ( $p=0.002, p=0.005$ ).

**Conclusion:** In contrast to US and CT, MRI and MRS strongly correlate with histopathological and biochemical steatosis assessment. MRI and MRS can accurately discriminate

between all steatosis grades. Therefore we conclude that MRI and MRS are the best non-invasive techniques for steatosis assessment in patients undergoing liver resection.

RP2

## T2W SUBTRACTION MR IMAGING IN PHASE II MS TRIALS: A POWERFUL NEW OUTCOME MEASURE

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<sup>2</sup>*Harvard Medical School, BOSTON, USA*

**Objective:** To explore the applicability of long-interval T2-weighted (T2w) subtraction imaging to 1) detect active lesions, 2) assess treatment efficacy, and 3) secure statistical power, compared with serial gadolinium(Gd)-enhanced T1-weighted (T1w) imaging, in a multiple sclerosis (MS), phase II, clinical trial.

**Methods:** MRI data over 9 months from 116 patients (58 treatment, 58 placebo) from the oral temsirolimus trial were used. Treatment efficacy was evaluated by using the non-parametric Mann-Whitney U test, and a parametric negative binomial(NB)-regression model. Power calculations were conducted using a parametric resampling and simulation method.

**Results:** The mean number of T2w subtraction lesions identified in the treatment group was  $3.0(\pm 4.6)$  vs.  $5.9(\pm 8.8)$  in the placebo group; mean cumulative number of new Gd-enhancing T1w lesions identified in the treatment group was  $5.5(\pm 9.1)$  vs.  $9.1(\pm 17.2)$  in the placebo group. T2w subtraction imaging showed increased power to assess treatment efficacy compared with Gd-enhanced T1w imaging, when evaluated by: Mann-Whitney U test ( $P=.017$  vs.  $P=.177$ ), NB-regression ( $P=.011$  vs.  $P=.092$ ), and NB-regression adjusted for the baseline number of Gd-enhancing T1w lesions and T2 lesion load ( $P<.001$  vs.  $P=.002$ ). Moreover, sample size calculations showed reductions of 22% to 34%

in the number of patients needed to detect a significant treatment effect in favor of T2w subtraction imaging.

**Interpretation:** Long-interval T2w subtraction MR imaging, compared with serial Gd-enhanced T1w imaging, exhibited increased power to assess treatment efficacy, and could greatly increase the cost-effectiveness of phase II MS trials, by limiting the number of patients, contrast injections and MRI scans needed.

RP3

### WHOLE-BODY MR IMAGING, INCLUDING DIFFUSION-WEIGHTED IMAGING, FOR STAGING MALIGNANT LYMPHOMAS IN CHILDREN: DIRECT COMPARISON TO CT - INITIAL EXPERIENCES

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**Background:** Computed tomography (CT) is the most commonly used method for staging malignant lymphoma in children, but its ionizing radiation may cause secondary cancers. Whole-body magnetic resonance imaging (WB-MRI) does not have this disadvantage and may be an attractive alternative to CT. In addition to conventional WB-MRI sequences, diffusion-weighted imaging (DWI) may facilitate staging of malignant lymphoma.

**Objective:** To evaluate the feasibility of WB-MRI, including DWI, for the initial staging of malignant lymphomas in children, and assess its equivalence to CT.

**Methods:** 10 children (5 males, 5 females; mean age [range], 14.9 [12-17] years) with newly diagnosed malignant lymphoma prospectively underwent WB-MRI (T1-weighted and T2-STIR [n=10], and DWI [n=9]) and CT. One pediatric radiologist assessed the WB-MRI, another pediatric radiologist assessed the CT images. Both readers were blinded to other imaging findings. Staging results (Ann Arbor stages) according to WB-MRI (with/without DWI) were compared to those of CT.

**Results:** Staging results of WB-MRI without DWI were equal/higher/lower to those of CT in 80% (8/10), 20% (2/10), and 0% (0/10) of patients, respectively. Staging results of WB-MRI with DWI were equal/higher/lower to those of CT in 78% (7/9), 22% (2/9), and 0% (0/9) of patients, respectively.

**Conclusion:** Our initial results indicate that staging using WB-MRI (with/without DWI) is equal to staging using CT in

the majority of patients. WB-MRI never understaged relative to CT. FDG-PET and follow-up studies should validate and determine possible consequences of overstaging relative to CT. Nonetheless, WB-MRI, including DWI, is feasible for staging malignant lymphoma in children.

RP4

### CONSEQUENCES OF DIGITAL MAMMOGRAPHY IN POPULATION-BASED BREAST CANCER SCREENING: INITIAL CHANGES AND LONG TERM IMPACT ON REFERRAL RATES

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**Purpose:** To investigate the referral pattern after the transition to full-field digital mammography (FFDM) in the Dutch population based breast cancer screening program.

**Materials and methods:** In a pilot setting a FFDM system was introduced in a screening centre in 2003. One team of screening radiologists was involved in reading both conventional and digital mammograms. Detection and recall rates obtained with both modalities in the first 4 years were compared for first and subsequent screening examinations. Furthermore, characteristics of all lesions referred with FFDM were analysed.

**Results:** A total of 312,414 screening mammograms were performed (43,913 digital and 268,501 conventional), of whom 4473 women were referred (966 with FFDM). Overall referral rates were significantly higher with FFDM in both first and subsequent exams ( $p = .00$ ).

The referral rate in FFDM screening peaks in the first months after implementation to decline again and reach a steady state, which was higher than the mean referral rate in SFM. In FFDM this was accompanied by a significant increase in cancer detection. However, in the first months after digitalisation a high proportion of false-positive results was seen, as a consequence of pseudolesions and the superior depiction of microcalcifications by FFDM as compared to SFM.

**Conclusion:** Implementing FFDM without dedicated training into a breast cancer screening program may lead to a strong, but temporary increase in referral and false-positive findings. Referral rates decrease (learning curve effect), but stabilise at a higher level than in conventional screening, yet with enhanced cancer detection.

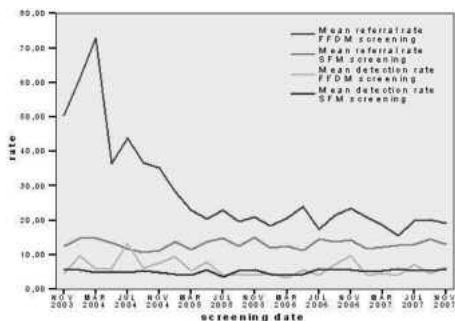


Figure 1: Course of detection and referral in SFM and FFDM

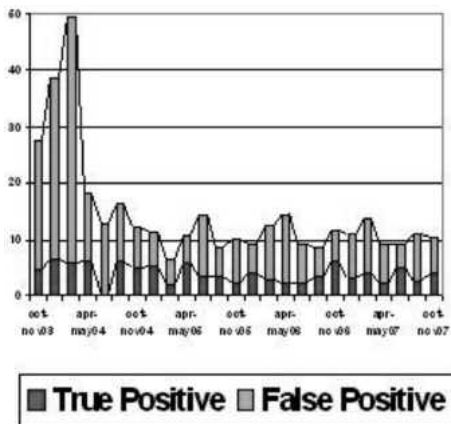


Figure 2: Results of referred masses (rates / 1000)

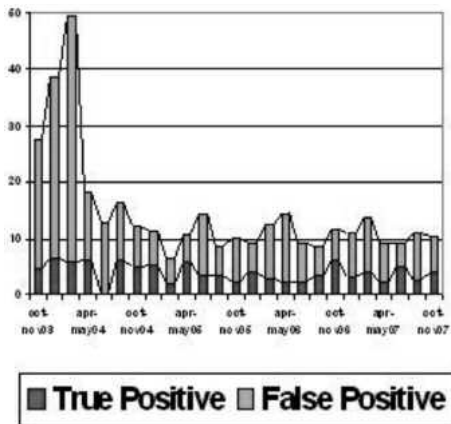


Figure 3: Results of referred calcifications (rates / 1000)

RP5

## BEPALING VAN CALCIUM SCORES VERKREGEN MET CT-CORONAIRANGIOGRAFIE

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**Doel van de studie:** Evalueren in hoeverre de Agatston calcium score uit CT- coronairangiografie (CTA) verkregen kan worden.

**Materiaal en methode:** Vijftig patiënten met een negatieve Agatston score (=0) en 50 patiënten met een positieve Agatston score ( $\geq 1$ ) bij traditionele non-contrast CT waarbij ook CTA was verricht werden opeenvolgend geselecteerd. Alle scans werden verricht met een 320-multi-detector dynamic volume CT-scanner (Aquilion One, Toshiba Medical Systems, Otawara, Japan). Contouren rondom calcium in de coronairarteriën werden handmatig getekend in 3.0 mm slice CTCS en 3.0 mm slice CTA reconstructies waarna de Agatston score automatisch bepaald werd. Voor de overeenkomst tussen CTA en CTCS werd de intraclass correlatie berekend. Als diagnostische uitkomstmaten werden sensitiviteit, specificiteit, positief voorspellende waarde en negatief voorspellende waarde bepaald.

**Resultaten:** In 41 van de 50 (82%) patiënten met een positieve CTCS Agatston score was ook de CTA Agatston score positief (gemiddelde score van  $115 \pm 210$ , CTCS score:  $281 \pm 505$ ). In 49 van de 50 patiënten (98%) met een negatieve CTCS Agatston score was ook de CTA Agatston score negatief.

De intraclass correlatie tussen de CTCS en CTA Agatston scores was 0.79 ( $p < 0.01$ ), waarbij een systematische onderschatting werd gevonden voor CTA Agatston scores boven de 100 ( $p = 0.05$ ). De sensitiviteit, specificiteit, positief voorspellende waarde en negatief voorspellende waarde waren respectievelijk 82%, 98%, 98% en 84%.

**Conclusie:** Een goede correlatie werd gevonden tussen CTA- en CTCS verkregen Agatston scores. Echter, voor Agatston scores groter dan 100 was er een systematische onderschatting met CTA.

RP6

**IMPACT OF A CAD PROTOTYPE ON THE DETECTION OF ACUTE PULMONARY EMBOLISM USED AS SECOND READER FOR OFF-HOURS CTPA STUDIES**

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**Purpose:** To assess the impact of a computer assisted detection (CAD) prototype on observer performance for detection of acute pulmonary embolism (PE).

**Methods and materials:** Six observers of varying experience evaluated 209 CTPA scans (158 negative, 51 positive) consecutively obtained during off-hours. Observers were asked to rate their diagnostic confidence without and with CAD as second reader using a 9 point scale ranging from 1 (definitely no PE), 5 (inconclusive scan) to 9 (definite PE). Reader data and CAD lesions were compared with an independent standard established by two readers and a third chest radiologist in case of discordant results. Statistical evaluation was performed on a per-patient and a per-reader basis.

**Results:** Detection rates were high: the average area under the ROC curve increased from 0.95 without to 0.97 with CAD ( $P > 0.05$ ). Sensitivity with CAD increased for 3 of the 6 readers (87% to 91%, 89% to 94% and 90% to 94%) and remained constant for three readers (91%, 92% and 89%). Out of 6x209 evaluations CAD was beneficial in 24%, with correction of diagnosis in 29 and increase of confidence in the correct diagnosis in 270 cases. CAD was detrimental in 2%, with change towards the wrong diagnosis in 11 and decrease of confidence in the correct diagnosis in 18 cases. The number of inconclusive ratings remained constant (38 vs. 36). Reading time was on average extended by 22% using CAD.

**Conclusions:** Reader performance was not significantly improved with CAD but reader confidence in the correct diagnosis increased.

# Samenvattingen Posterpresentaties

P01

## COMPARISON OF CT AND MRI IN THE PRE-OPERATIVE ASSESSMENT OF COLORECTAL LIVER METASTASES TREATED WITH NEO-ADJUVANT CHEMOTHERAPY

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**Background:** Optimal delineation of colorectal liver metastases (CRLM) after neoadjuvant chemotherapy (NAC) is crucial for accurate surgical decision-making. The purpose of this study was to compare the accuracy of contrast-enhanced CT and MRI after NAC for lesion detection, characterization and delineation.

**Materials and methods:** 15 consecutive patients that were treated in our hospital with NAC for CRLM between 2004 and 2008 were included. All patients received contrast-enhanced liver CT and MRI after chemotherapy. Both scans in each patient were retrospectively scored for lesion number, lesion type (benign/malignant), lesion size (cm) and location (Couinaud classification) independently by two experienced Radiologists. Afterwards a consensus reading was performed. 13/15 patients underwent surgery, in these cases intra-operative ultrasound and histopathologic findings were used as standard of reference (SoR). In 2 non-surgical candidates a six months follow-up scan was used as SoR. Kappa's were calculated for lesion characterization and paired t-tests were performed to compare diameter measurements.

**Results:** In total, 79 lesions were detected at the SoR. CT detected 60 lesions (76%), whereas 62 lesions (78%) were detected with MRI. Sensitivity for lesion characterization by MRI differed significantly from CT, i.e. 89% (kappa 0.747,  $p=0.001$ ) vs. 77% (kappa 0.235,  $p=0.005$ ), respectively. Both Radiologists described superior delineation on MRI, reflected by lesion diameter measurement which was comparable between the two observers on MRI ( $p=0.909$  [95%CI -1.245 to 1.395]), but variable on CT ( $p=0.028$  {95%CI -3.349 to -2.007}).

**Conclusion:** MRI is superior to CT for pre-operative assessment of CRLM after NAC regarding lesion characterization and delineation.

P02

## MR FOR RECTAL CANCER AT 1.5 TESLA IS SUFFICIENT FOR T STAGING: 3.0 TESLA MRI DOES NOT NECESSARILY IMPROVE RADIOLOGISTS' PERFORMANCE

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**Purpose:** Accurate preoperative prediction of rectal tumours confined to the bowel wall (pT1-2) could select patients for local excision instead of a rectal excision, aiming at reducing morbidity. The goal of this study was to evaluate whether rectal MRI at 3.0T increases radiologists' performance for the selection of pT1-2 tumours, as compared to MRI at 1.5T.

**Materials and methods:** 13 patients underwent MRI (standard T2W FSE; sagittal, axial and coronal) at 3.0T and 1.5T followed by surgery. Two expert MR-rectum readers and 2 general radiologists without specific MR-rectum expertise predicted T-stage on 1.5T and 3.0T MRI subsequently, blinded for each others and histological results. Likelihood of tumour confined to bowel wall was scored using a confidence level score (0=definitely outgrowing wall to 4=definitely confined to wall). ROC-analyses were performed to compare results for 1.5T and 3.0T MRI.

**Results:** 7/13 patients had T1-2 tumours at histology. Mean PPV, NPV and area under the ROC-curve (AUC) for the expert MR-rectum readers were 78% 60% and 0.786 at 1.5T versus 66%, 53% and 0.714 at 3.0T ( $p>0.05$ ). Mean PPV, NPV and AUC for the non-expert-readers were 78%, 72% and 0.733 at 1.5T versus 77%, 67% and 0.715 at 3.0T ( $p>0.05$ ).

### Conclusions:

1. MRI at 1.5T is sufficient for predicting tumours confined to the bowel wall with sufficient PPV independent of the readers' experience.
2. MRI at 3.0T does not improve performance for prediction of tumour confinement to the bowel wall as compared to 1.5T regardless of the reader's experience.

P03

### WHOLE BODY DIFFUSION WEIGHTED IMAGING FOR DISTANT STAGING IN COLORECTAL CANCER - FEASIBILITY AND FUTURE CHALLENGES

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**Purpose:** To evaluate the feasibility of whole-body diffusion-weighted-imaging (WB-DWI) for (local and) distant staging in rectal cancer and compare the lesion detectability with conventional methods for distant staging (CT and/or PET-CT)

**Materials and methods:** 6 healthy volunteers and 7 rectal cancer patients with known distant metastases (5 scanned at primary staging, 2 after chemoradiation) underwent WB-DWI (b-values 0,800 s/mm<sup>2</sup>, STIR-fatsuppression). Scantime was 20 minutes. 3D-MIP-reconstructions in inverted greyscale were generated for image evaluation. An experienced reader analysed all images for suspected lesions. Histology was reference for the primary tumor. CT (n=3) and PET-CT (n=4) were reference for distant staging.

**Results:** Image quality was good in all 13 subjects. All rectal tumors were accurately identified on WB-DWI. On (PET-)CT, the 7 patients had a total of 61 distant tumour lesions (42 liver metastases, 19 distant lymph-node metastases). 50/61 lesions (82%) were identified with WB-DWI. In two patients after chemotherapy, residual liver lesions (3-17 mm) that were still visible on CT were not identified on DWI. However, histology was not available to confirm viable residual tumour in these lesions. In all volunteers pronounced axillary and inguinal lymph nodes were visible, that could not be distinguished visually from nodal metastases in patients (and were thus considered false positives).

**Conclusions:** WB-diffusion images of adequate quality can be obtained within an acceptable timeframe. Lesion detectability seems comparable to (PET-)CT, but with a risk for false positives. In the future WB-DWI might compete with PET-CT as a non-invasive screening tool in colorectal cancer, but several challenges need to be addressed.

P04

### FREQUENT SECUNDAIR CT SCANNEN ALS GEVOLG VAN INCOMPLETE AFBEELDING VAN DE CERVICALE WERVELKOLOM OP CONVENTIONELE RÖNTGENOPNAMEN

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Het doel van deze studie was om de waarde van primaire röntgenopnames van de cervicale wervelkolom te bepalen en de frequentie van het secundair CT scannen vanwege incompleteid van de X-CWK. Ook zijn potentiële voorspelers voor incompleteid geanalyseerd.

**Methoden:** Van een prospectief verzamelde database zijn alle stompe trauma patiënten, die gedurende 2 jaar gepresenteerd werden op de traumakamer, geanalyseerd. In deze populatie is gekeken hoeveel primaire röntgenopnames zijn vervaardigd. Vervolgens is bepaald hoeveel secundaire scans er zijn gemaakt volgens de volgende classificatie; niet-evalueerbaar (matige kwaliteit), incomplete afbeelding, vervolgevaluatie vanwege bevindingen op de röntgenopnames of vanwege onvoldoende verklaarde, aanhoudende symptomen. Verder zijn binnen deze serie van incomplete röntgenopnames potentiële voorspelers voor incompleteid geanalyseerd.

**Resultaten:** In 1283 stompe trauma patiënten werden 88 letsels gediagnostiseerd (6.9%). Bij 159 patiënten werd de CWK obv de NEXUS criteria vrij gegeven. Bij 717 patiënten werden primaire röntgenopnames gemaakt en bij 395 patiënten een primaire CT scan. Bij 249 patiënten (35%) was de X-CWK herhaaldelijk incompleet. In 72% was het afbeelden van de cervicothoracale overgang incompleet. Met secundaire CT scans werden 10 letsels gediagnosticeerd in het niet eerder afgebeelde deel van de CWK. Aanwezigheid van clavicula fracturen (p<0.001) en rib fracturen (p=0.008) waren geassocieerd met incomplete afbeelding van de CWK.

**Conclusie:** Op meer dan een derde van de primair gemaakte röntgenopnames wordt de CWK incompleet afgebeeld. Voor het grootste deel van de incomplete röntgenopnames is nog geen verklaring gevonden maar wij adviseren bij patiënten met een clavicula en/of ribfractuur om primair een CT scan te maken.

P05

**STANDARDIZED RIGHT VENTRICULAR QUANTIFICATION ON CARDIAC MRI: INTERPLATFORM REPRODUCIBILITY**

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**Purpose:** Reproducibility, irrespective of analysis platform, is important for generalization of results. Can cardiac MRI (CMR) results of normal and abnormal right ventricular volumetric values be reproduced on independent analysis platforms?

**Methods:** 30 persons underwent short-axis breath-hold Steady State Free Precession sequence CMR: 10 arrhythmogenic right ventricular cardiomyopathy (ARVC) patients, 10 healthy controls, and 10 healthy endurance athletes. Right ventricular (end-diastolic (RV-EDV) and end-systolic volumes) contours were traced on two independent analysis platforms by an observer trained in CMR analysis. Measurements were performed blinded within 4 months with at least 2 months time in-between. Agreement between the two platforms was assessed using the Bland-Altman method.

**Results:** No systematic bias was observed and measurements showed excellent agreement. Maximum disagreement was  $\leq 5\%$  (R square 0.99). (figure)

**Conclusions:** Right ventricular volumes and function in healthy persons, athletes, and ARVC patients can be reliably quantified independent of the analysis platform used.

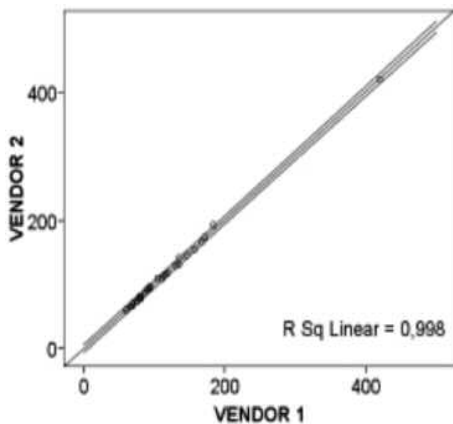


Figure 1: RV EDV inter-platform reproducibility

P06

**SCREENING FOR ANOMALOUS PROXIMAL CORONARY ARTERY TREES IN 360 COMPETITIVE ATHLETES AND NON-ATHLETES WITH 3-DIMENSIONAL MR CORONARY ANGIOGRAPHY: FEASIBILITY FOR CLINICAL IMPLICATION AND FINDINGS**

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**Purpose:** Under 35 years of age, 15% of sudden cardiac death is caused by a coronary artery anomaly (CAA). Although rare and mostly asymptomatic, only a 'malignant' coronary artery course between aorta and pulmonary artery can lead to fatal ischemia during exercise.

Can free-breathing 3-dimensional magnetic resonance coronary angiography (3D MRCA) be used to identify the proximal anatomy of CAA in competitive athletes and non-athletes?

**Methods:** 360 healthy asymptomatic men and women aged 18-60 years (37% women) were selected and underwent free-breathing 3D MRCA angiography with the Steady State Free Precession protocol: 55 elite endurance athletes (exercising >18 hrs/wk), 152 regular endurance athletes (9-18 hrs/wk), and 153 healthy matched non-athletes (exercising  $\leq 3$  hrs/wk). The 3D dataset was screened for CAA.

**Results:** Technically satisfactory 3D MRCA's were obtained in 335 subjects (93%). 14 (4%) showed an abnormality 4 (1%) had a malign variant CAA with a right coronary artery origin from the left sinus of Valsalva coursing between the aorta and pulmonary artery. 6 showed bridging of a left coronary artery segment; 3 had asymptomatic stenosis of the right coronary, 1 of the left.

CAA diagnosis was confirmed by multidetector CT coronary angiography. Overall 3D MRCA quality was better in athletes than controls due to lower heart rates with longer diastolic resting periods.

**Conclusion:** 3D MRCA can be used as part of the standard Cardiac MRI protocol to screen young competitive athletes and non-athletes for anomalous proximal coronary arteries.

	non-athletes		regular athletes		elite athletes	
	n	%	n	%	n	%
unsatisfactory	12	8	8	5	5	9
moderate	26	17	16	11	5	9
good	107	70	106	70	35	64
excellent	8	5	22	14	10	18

Table 1: CAA judgeability on 3D MRCA

P07

### SPORT-SPECIFIC ADAPTATION ON CARDIAC MRI

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**Purpose:** When screening athletes for cardiac abnormalities, sport-specific adaptation (specified by dynamic and static components) of the healthy athlete's heart should be considered. Our aim is to determine if high static (HS) or high dynamic (HD) athletes exceed the expected upper limits in cardiac volume and mass of HD-HS athletes.

**Methods:** 140 healthy male professional athletes (aged 18-40 years) underwent cardiac MRI (CMR): 80 high dynamic (racket and field sports) and 60 high static (strength trained) athletes. CMR data is analysed by experienced blinded observers and indexed for body surface area (BSA). Results were compared to previously acquired CMR data of 56 controls (non-athletes) and 46 high dynamic-high static (HDHS) elite athletes (cycling, rowing).

**Results:** The preliminary results of 20 high dynamic and 20 high static athletes and reference controls and HDHS elite athletes are presented in the table.

**Conclusions:** Ventricular volumes and wall mass in high dynamic or high static sports do not exceed those found in HDHS sports. The complete data of this study will provide CMR reference values that allow for adjustment to the type of sport performed. Exceeding the maximum reference value (e.g. mean+2SD) warrants further investigation.

	Controls	High Static	High Dynamic	HDHS
LV (ml)	46	46	46	46
LV EDV (ml/m <sup>2</sup> )	101 (15)	106 (18)*	114 (22)**	128 (17)
LV SDV (g/m <sup>2</sup> )	48 (8.4)	51 (13)	56 (12)**	60 (11)
RV EDV (ml/m <sup>2</sup> )	114 (18)	111 (20)*	132 (28)**	144 (20)
RV SDV (g/m <sup>2</sup> )	12 (2.3)	9.0 (2.0)**	12 (2.4)	15 (2.3)

Data are presented as mean (SD). HDHS = high dynamic-high static; LV = left ventricle; RV = right ventricle; EDV = end diastolic volume; SDV = end diastolic mass. Significant difference ( $P < 0.05$ ) as compared to controls (\*), HDHS (\*\*).

Table 1: BSA corrected CMR results

P08

### CARDIAC MR REFERENCE VALUES IN ENDURANCE ATHLETES AND MATCHED NON-ATHLETES: THE IMPORTANCE OF CORRECTION FOR GENDER, BODY SURFACE AREA, AND TRAINING INTENSITY

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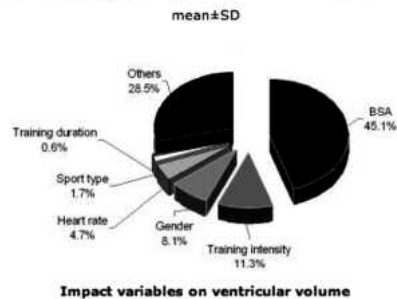
**Purpose:** To establish cardiac MRI (CMR) reference values for endurance athletes and non-athletes, and study the impact of variables related to ventricular volumes, and mass.

**Methods and results:** 336 persons (mean age 26 years, 46% women) underwent CMR: 79 elite (>18 hrs/wk exercise), 143 regular-athletes (9-18 hrs/wk), and 114 matched non-athletes ( $\leq 3$  hrs/wk). Body surface area (BSA) corrected ventricular end diastolic volumes and mass were significantly higher ( $P < 0.0005$ ) in regular and elite athletes than in non-athletes. (table)

**Conclusions:** CMR reference values demonstrate increased ventricular volumes and mass (and diameters and inter-ventricular-septal-wall-thickness) for endurance athletes compared to non-athletes. BSA, male gender, and training intensity correction are required in the MR evaluation of endurance athletes. (figure)

**BSA corrected volumes and mass**

	Controls	Regular athletes	Elite athletes
Male/Female (n)	56/58	83/60	46/33
Male RV Volume (mL/m <sup>2</sup> )	111±18	136±16	144±20
Male RV Mass (g/m <sup>2</sup> )	12±2.3	14±2.7	15±2.3
Male LV Volume (mL/m <sup>2</sup> )	101±15	123±13	129±17
Male LV Mass (g/m <sup>2</sup> )	48±9.4	62±11	69±13
Female RV Volume (mL/m <sup>2</sup> )	96±12	115±15	118±17
Female RV Mass (g/m <sup>2</sup> )	10±2.2	13±2.0	14±2.7
Female LV Volume (mL/m <sup>2</sup> )	90±11	107±14	107±14
Female LV Mass (g/m <sup>2</sup> )	34±6.2	46±9.2	50±7.6



P09

### INTRA-THORACIC BLOOD VOLUME MEASUREMENT BY CONTRAST MAGNETIC RESONANCE IMAGING

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**Introduction:** The intra-thoracic blood volume (ITBV) is an important parameter related to the cardiac function and to the cardiovascular condition. Congestive heart failure is usually related to an increase of cardiac preload and, therefore, ITBV.

In clinical practice, pulmonary blood volume measurements require the employment of invasive thermo- or dye-dilution techniques, where a double catheterization is needed.

In this paper, a minimally invasive method for the ITBV measurement by contrast MRI is presented and validated *in vitro* as well as *in vivo*.

**Methods:** The approach that we propose for the ITBV assessment consists of a peripheral intravenous injection of a small bolus of Gadolinium in five volunteers and its subsequent MRI detection in the right ventricle and left ventricle in a four-chamber view.

A simple *in vitro* model of the transpulmonary circulation, consisting of a network of plastic tubes whose volume could be changed by clamping tubes at specific sites, was built to validate the developed methods. A pump generated a flow of 2,0 L/min and the system was filled with 0.12 mM MnCl<sub>2</sub> diluted in water to reproduce the magnetic properties of blood.

**Results:** The results of the volume measurements were excellent, showing a correlation coefficient  $R = 0.99$  between real and estimated volumes. Feasibility tests in the volunteers were also promising. The average correlation coefficient for both models was 0,992.

**Conclusions:** Assessment of the ITBV by MRI is a reliable method, opening new possibilities for non-invasive quantitative cardiovascular diagnostics.

observers; an experienced cardiovascular radiologist (as reference) and a non-experienced first-year resident. Both observers were blinded from any clinical information.

**Results:** Eight patients were diagnosed with thrombosis. All cases were identified on MRDTI by the non-experienced observer, but two were missed on CE-MRA series. Using MRDTI, inter-observer agreement was 93%, with a very good kappa of 0.86 and strong correlation (Spearman's  $R=0.87$ ;  $p<0.001$ ). In contrast, using CE-MRA, agreement was lower at 80%, with a kappa of 0.65 and medium correlation of  $R=0.37$  ( $p=NS$ ). Including CE-MRA interpretation, duration was  $25\pm 8$  minutes for the non-experienced observer ( $p<0.01$  vs. the experienced observer at  $14\pm 6$  minutes).

**Conclusion:** MRDTI can be easily interpreted by a non-experienced observer in patients suspected for venous thrombosis in the leg.

P10

**EASY INTERPRETATION OF MR-DIRECT THROMBUS IMAGING IN DIAGNOSING THROMBOSIS IN THE LEG**

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**Purpose:** Ultrasonography is clinical routine in diagnosing deep vein thrombosis (DVT), but has limitations, in particular in recurrent thrombosis and in the hands of a non-experienced ultrasonographer. MR-Direct Thrombus Imaging (MRDTI) may overcome these limitations. However, it is unknown how MRDTI performs when interpreted by a non-experienced observer. Therefore, we aimed to evaluate the performance of MRDTI in the leg when interpreted by a non-experienced observer.

**Materials and methods:** 15 patients (8 male; median age 41 years; 60% with positive history of DVT) with clinical suspicion of calf vein thrombosis were examined on a 1.5 T MRI system with the T1-weighted MR Direct Thrombus Imaging sequence and Contrast Enhanced MRA (CE-MRA) using gadofosveset trisodium (Vasovist®). For study purposes, the examinations were retrospectively interpreted by 2

P11

**MRI BEVINDINGEN BIJ PATIËNTEN MET HYPERTROFISCHE CARDIOMYOPATHIE (HCM)**

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**Doel:** Studie naar de MRI bevindingen bij HCM.

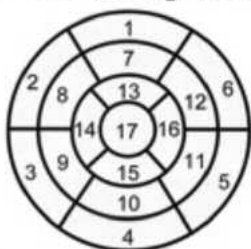
**Methoden:** Er werd een retrospectieve analyse verricht over een periode van oktober 2006 t/m november 2008. In deze periode ondergingen 19 HCM patiënten een MRI. Alle MRI's werden verricht met een 1,5 T Philips Achieva. Bij alle patiënten werden cine b-TFE opnamen verricht in verschillende cardiale projecties; bij 16 ook delayed enhancement (DE) opnamen. De MRI's werden beoordeeld door één radioloog en cardioloog, waarbij gebruik werd gemaakt van een 17-segmentsmodel voor de linker ventrikel (LV) (zie figuur). De ventrikelmassa's, -volumina en ejectiefracties werden bepaald en vergeleken met een controlegroep van 38 gezonde personen.

**Resultaten:** De HCM-groep had in vergelijking met de controles een grotere maximale einddiastolische LV wanddikte (mean 21 mm [range 15-28 mm] versus mean 10 mm [7-14 mm];  $p<0,001$ ) en een grotere LV massa (mean 133 gr. [65-250 gr.] versus 85 gr. [39-139 gr.];  $p<0,001$ ). Bij alle HCM patiënten werd asymmetrische wandverdikking gezien en betrof deze tenminste het gebied van segmenten 2, 3, 8 en 9. Bij 8 patiënten was er LVOT obstructie (42,1%). Wandbewegingstoornissen (WBS) werden gezien bij 57,9% (0% in de controlegroep ( $p<0,001$ )), ook voornamelijk in het

gebied van segmenten 2, 3, 8 en 9 (52,2%). DE werd gevonden bij 15 van de 16 patiënten (93,8%), bevond zich in 92,8% in het gebied van segmenten 1, 2, 7 en 8 (76,9% t.p.v. de aanhechting van de rechter ventrikel) en was tenminste midmyocardiaal (100%) en meestal vlekkelig (86,7%).

**Conclusie:** De bevindingen zijn in overeenstemming met reeds bestaande literatuur.

### Left Ventricular Segmentation



- |                        |                       |                     |
|------------------------|-----------------------|---------------------|
| 1. basal anterior      | 7. mid anterior       | 13. apical anterior |
| 2. basal anteroseptal  | 8. mid anteroseptal   | 14. apical septal   |
| 3. basal inferoseptal  | 9. mid inferoseptal   | 15. apical inferior |
| 4. basal inferior      | 10. mid inferior      | 16. apical lateral  |
| 5. basal inferolateral | 11. mid inferolateral | 17. apex            |
| 6. basal anterolateral | 12. mid anterolateral |                     |

P12

### 3.0T VERSUS 1.5T MR ANGIOGRAPHY IN PERIPHERAL ARTERIAL DISEASE: COMPARISON TO DSA

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**Purpose:** To prospectively evaluate diagnostic performance of 3 Tesla (T) Contrast-Enhanced MR angiography (CE-MRA) in patients with peripheral arterial disease compared to 1.5T CE-MRA using digital subtraction angiography (DSA) as reference standard.

**Material and methods:** Eighteen patients (12 men, 6 women; mean age 67, range 53-83), referred for suspected peripheral arterial disease, were included. All patients underwent CE-MRA of the aorto-iliac tract and lower limb arteries both at 3T and 1.5T (Philips, Achieva), followed by DSA within 10-25 days. A 3-station single-injection protocol was employed, injection volume 0,2 mmol/kg BW Gadoterate meglumine (Gd-DOTA, Guerbet). MRAs and DSAs were independently assessed by two MR radiologists and two interventional radiologists. The arterial tree was divided into 27 segments. The most severe stenosis in each segment was chosen for classification and stenoses showing >50% luminal diameter reduction were considered significant.

**Results:** In all, 486 segments were evaluated; 29 segments could not be evaluated due to patient movement or venous enhancement. For stenosis detection, both 3T CE-MRA ( $\kappa=0.96$ ) and 1.5T CE-MRA ( $\kappa=0.93$ ) showed excellent concordance with DSA. For discriminating significant stenosis (>50%) from non-significant stenosis, 3.0T MRA had a sensitivity and specificity of 97% and 95%, respectively, against 92% and 95% for 1.5T. The contrast-to-noise ratio (CNR) of the 3T MRA was significantly higher as compared to 1.5T ( $98 \pm 29$  vs  $30 \pm 10$ ,  $p<0.001$ ).

**Conclusion:** 3T CE-MRA was characterized by a better image quality than 1.5T CE-MRA, but 3T CE-MRA was comparable to 1.5T CE-MRA for the detection of significant stenoses.

P13

### MULTIDETECTOR-ROW COMPUTED TOMOGRAPHY COMPLEMENTS ECHOCARDIOGRAPHY AND FLUOROSCOPY FOR THE EVALUATION OF PROSTHETIC VALVE OBSTRUCTION - INITIAL EXPERIENCE

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**Background:** For evaluation of prosthetic heart valve obstruction echocardiography and fluoroscopy provide primarily functional information but may not unequivocally establish the cause of dysfunction. Multidetector-row CT (MDCT) may provide a morphological substrate for such functional abnormalities.

**Methods:** Fourteen patients with 16 prosthetic valves, in whom prosthetic valve obstruction was suspected from echocardiography or fluoroscopy but no etiologic correlate could be found, underwent ECG-gated MDCT. MDCT data were retrospectively reconstructed at every 10% of the ECG interval and analyzed using multiplanar reformatting in anatomically adapted planes. MDCT images were evaluated for morphologic prosthetic and periprosthetic abnormalities. Results could be compared to intraoperative findings or autopsy in 7 patients.

**Results:** MDCT found a morphological substrate for obstruction in 9 of 14 patients. MDCT findings compatible with obstruction were confirmed at surgery or autopsy in 6 patients. In a seventh patient, incomplete leaflet closure found with MDCT was confirmed at surgery. The most commonly identified causes for obstruction were subprosthetic tissue (6 patients) and abnormal anatomic orientation (3 patients). Despite an indication for surgery, 3 patients were

not operated due to recurrent bacteremias, prohibitive comorbidity, or patient refusal. MDCT detected leaflet motion restriction in 7 patients compared to 4 by fluoroscopy. Confirmation of leaflet restriction was available in 6 patients. MDCT missed one periprosthetic and one prosthetic leak.

**Conclusions:** In conclusion, MDCT can identify causes of prosthetic valve obstruction that constitute indications for surgery but are missed at echocardiography or fluoroscopy. MDCT complements these techniques in patients with unexplained prosthetic valve obstruction.

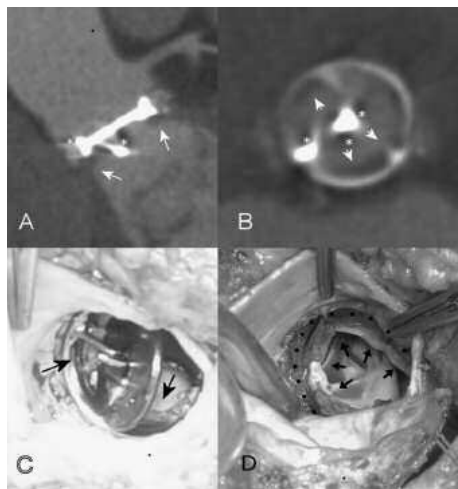


Image 1: MDCT and surgical views of subprosthetic tissue

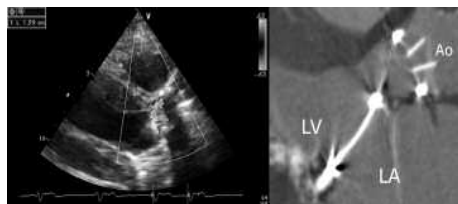


Image 2: Mitral prosthesis protruding into LVOT

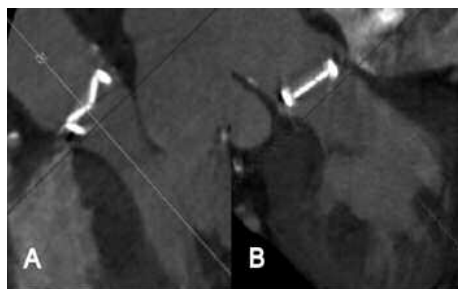


Image 3: Tilted position of aortic prosthesis in LVOT

P14

**BREATH-HOLD VELOCITY-ENCODED MRI WITH SPIRAL K-SPACE SAMPLING AT 3T PROVIDES ACCURATE AND REPRODUCIBLE RIGHT CORONARY ARTERY FLOW ASSESSMENT**

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**Purpose:** To evaluate the accuracy and reproducibility of a breath-hold velocity-encoded (VE) cine sequence with spiral k-space sampling at 3T for assessment of coronary flow.

**Materials and methods:** Accuracy was tested in a phantom set-up. Ten constant flow rates (pump settings 0.9ml/s to 7.3ml/s) measured with MR, were compared with volumetric flow measurements recorded distal to the phantom. For reproducibility nineteen healthy volunteers (11 men, mean age 25.4-1.2years) underwent breath-hold (16-24s) VE coronary flow imaging with spiral k-space sampling of the right coronary artery (RCA). The acquisition was repeated twice. From flow velocity maps peak systolic and diastolic velocity (PSV and PDV)(cm/s), meanVmax per cardiac cycle (cm/s), coronary flow (ml/cycle), ratio of PSV and PDV to mean Vmax (pulsatility Vmax-pattern) and ratio of peak systolic and diastolic velocity (PSV/PDV) were assessed. Repeated acquisitions were compared using the paired t-test and reproducibility was evaluated using intraclass correlation coefficients (ICCs).

**Results:** Phantom experiments showed less than 7% error for the applied flow rates. MRI-measured flow was strongly correlated with volumetric flow (ICC=0.99).

Flow assessment was successfully repeated in 15 volunteers. Mean difference between the repeated acquisitions was not significant for any of the parameters describing the velocity pattern. Good agreement was found between the repeated acquisitions: ICCs were significant for all parameters describing the velocity pattern, except PDV/meanVmax. ICC's concerning intraobserver, interobserver and interscan reproducibility were excellent for PSV (0.99, 0.98, and 0.88, respectively).

**Conclusion:** Fast, reproducible and accurate MR assessment of flow velocity patterns in the RCA is feasible at 3Tesla.

P15

### **CORONARY ARTERY DISEASE BURDEN IN PATIENTS UNDERGOING RF ABLATION FOR ATRIAL FIBRILLATION**

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*Maastricht Universitair Medisch Centrum, MAASTRICHT*

**Purpose:** To assess the prevalence of coronary artery atherosclerosis in patients scheduled to undergo percutaneous radiofrequency (RF) ablation for atrial fibrillation.

**Method and materials:** We assessed coronary calcium scores (CCS) as well as coronary plaque burden in 55 patients (mean age  $56 \pm 10$  yrs; 43M) referred for imaging prior to RF pulmonary venous isolation. Examinations were performed on a 64-slice spiral CT-scanner (Philips Brilliance 64) and the coronary arteries were analyzed for presence and severity of non-calcified, mixed and calcified plaques using the standard 16-segment scoring system. Degree of stenosis was classified as wall irregularities, non-significant (<70%) or significant (>70%) luminal narrowing.

**Results:** The mean CCS ( $\pm$  SD) in the current cohort was  $125 \pm 236$ . In 1 patient (1.8%) images were inconclusive because of arrhythmia. 27 patients (49%) had no evidence of coronary artery disease, 1 (1.8%) had mild vessel wall irregularities, 23 (42%) had non-significant stenoses in at least 1 segment, and 3 (5.4%) had significant stenoses. 26 patients had OCCS. In 7.7% of patients with OCCS, coronary plaque was found despite the absence of calcifications. In 22 (85%) of the 27 patients with stenoses the presence of CAD was not previously documented. In this subgroup the mean CCS ( $\pm$  SD) in the current cohort was  $153 \pm 241$  and 2 patients (9.1%) had significant stenoses.

**Conclusion:** Up to 47.3% of patients undergoing imaging of the heart prior to pulmonary venous RF ablation for AF exhibit signs of coronary artery disease. A OCCS does not exclude clinically relevant atherosclerotic coronary artery disease.

P16

### **SERIAL IMAGING OF CAROTID ATHEROSCLEROTIC PLAQUE MORPHOLOGY WITH MDCTA IN PATIENTS WITH ISCHEMIC CEREBROVASCULAR DISEASE**

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**Purpose:** Atherosclerotic plaque rupture is thought to lead to carotid artery thrombosis and acute ischemic cerebrovas-

cular events. The aim of this study was to get insight into the natural history of plaque ulceration with serial MDCT angiography.

**Methods:** In this retrospective study we selected patients with ischemic cerebrovascular disease and more than one MDCTA of the carotid arteries. Plaque surface morphology at the carotid bifurcation was classified as smooth, irregular or ulcerated. Changes in morphology over time were evaluated.

**Results:** We selected 84 patients (63% men, aged  $61.8 \pm 12.4$  years). The mean time period between the two MDCTA scans was  $21 \pm 13$  months. Of the 155 arteries available for analysis, 3 (1.9%) were occluded at the first MDCTA and 114 (73.6%), 23 (14.8%) and 15 (9.7%) arteries had smooth, irregular and ulcerated luminal surfaces respectively. On the second MDCTA the surface morphology was unchanged in 91% of the arteries, whereas 5.2% showed progression and 3.9% regression of plaque morphology. Remarkably, the majority (10 out of 15) of ulcerated plaques showed no changed morphology over a period of  $20 \pm 15$  months. One ulcerated plaque showed progression (in 21 months), 4 showed regression (in  $20 \pm 17$  months), whereas in two non-ulcerated plaques an ulceration developed ( $34 \pm 9$  months).

**Conclusion:** MDCTA is useful for the evaluation of temporal changes in plaque morphology. On serial MDCTA, atherosclerotic carotid plaque morphology did not change in most cases and healing of ulcerated plaques is not a common phenomenon.

P17

### **THE ASSOCIATION BETWEEN ILIAC FIXATION AND PROXIMAL STENT-GRAFT MIGRATION DURING EVAR FOLLOW-UP: MID-TERM RESULTS OF 154 TALENT DEVICES**

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<sup>3</sup>University Medical Centre Stanford, STANFORD, USA

**Objective:** This study investigated the importance of iliac fixation to secure endograft fixation.

**Materials and methods:** Computed tomography (CT) scans of patients who underwent endovascular aneurysm repair with an endoprosthesis of great columnar strength (Talent stent graft) were analysed retrospectively. Patients were enrolled consecutively between June 2000 and January 2007 and prospectively followed up with serial CT imaging. The superior mesenteric artery was used as a reference

point to determine endograft migration (centerline endograft displacement of >10 mm). Proximal and distal fixation lengths were defined as the length of the endograft that was in full apposition to the aortic neck or common iliac arteries, respectively.

**Results:** Proximal endograft migration occurred in 32 of 154 patients (21%) at a follow-up duration of  $32 \pm 14$  months; 13 migrations required treatment (8%). Migration was more frequent in patients treated with aorto-uniliac devices than bifurcation devices ( $p < 0.008$ ). The migrator and non-migrator groups had similar demographic and abdominal aortic aneurysm (AAA) characteristics.

The migrator group had significantly shorter proximal ( $30 \pm 12$  mm vs.  $41 \pm 13$  mm,  $P < 0.001$ ) and distal endograft fixation lengths ( $31 \pm 18$  mm vs.  $47 \pm 15$  mm,  $P < 0.001$ ). By multivariate regression analysis, proximal and distal endograft fixations were significant predictors for endograft migration at follow-up ( $P < 0.001$ ).

**Conclusion:** Iliac endograft fixation, along with proximal fixation, is a significant predictor for endograft migration.

P18

**ACUTE PERIPHERAL BYPASS OCCLUSION: OUTCOME OF MECHANICAL THROMBOLYSIS COMBINED WITH INTRA-ARTERIAL PHARMACOLOGICAL THERAPY**

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**Introduction:** Acute occlusion of a peripheral bypass results in critical limb ischemia. Vessel recanalization is crucial to improve clinical outcome. We studied combined use of mechanical thrombolysis (MT) with pharmacological therapy (PT).

**Methods:** We prospectively treated 12 patients (9M/3F) with critical limb ischemia due to acute (< 2 weeks) occluded peripheral bypass in our hospital from January - April 2009. Mechanical Thrombolysis was performed with Angiojet Ultra system (Possis Medical Inc, Minneapolis) followed by intra - arterial pharmacological therapy (Urokinase 250.000 IE bolus and infusion 100.000 IE/hr). Technical success was defined as a patent bypass within 72 hrs of start treatment. Clinical success was defined as limb salvage.

**Results:** 14 MT procedures combined with PT were performed in 12 patients resulting in a technical success rate of 10/12 (83,3%). Additional interventions were needed in 7/10 (70%) patients including PTA (n=5) and stent (n=6). Clinical success was obtained in 7/12 patients (58,3%).

Implying that 5 patients (41,7%) underwent amputation, in 3 of these patients crural vessels occluded due to MT (ATA n=2, AP n=1). Mean treatment time in all patients was 2.5 days. No procedure related complications occurred.

**Conclusion:** The combined use of MT and PT for treatment of patients with acute peripheral bypass occlusion is technically feasible and safe with an overall limb salvage rate of 58%.

P19

**FEASIBILITY OF INTRACRANIAL FLOW VELOCITY AND PRESSURE MEASUREMENTS USING AN INTRA-ARTERIAL DUAL-SENSOR GUIDEWIRE**

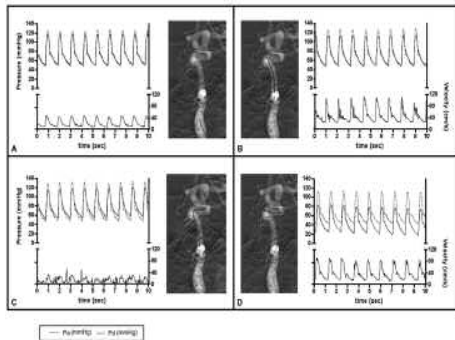
S.P. Ferns, J.J. Schneiders, M. Siebes, R. van den Berg, H.A. Gratama van Andel, E.T. van Bavel, C.B.L.M. Majoie  
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**Purpose:** Although hemodynamic stress is thought to play a role in growth and rupture of intracranial aneurysms, limited information is available about actual pressure (P) and blood flow velocity (BFV) in intracranial vessels. We simultaneously measured BFV and P using a guidewire with a pressure and Doppler velocity sensor at the tip.

**Materials and methods:** We included 4 patients scheduled for elective coiling of unruptured intracranial aneurysms. Pulsatile BFV and P were recorded at 4 locations in the inlet and outlet vessels and within the aneurysm, if possible.

**Results:** Two aneurysms were located at the ophthalmic artery and two at the posterior communicating artery with a mean size of 6.8mm, range 5-9mm. High-fidelity BFV and P measurements were feasible in 14 of 16 locations(88%). Systolic BFV ranged from 45-95cm/s in the proximal internal carotid arteries (ICA) and was 42.8cm/s(range 12-74cm/s) higher in the inlet vessels in all patients. Complex flow fields limited capture of good BFV waveforms within the aneurysms. ICA systolic P ranged from 117-141mmHg and decreased by 10.7mmHg (range 3-26mmHg) within aneurysms. Pulse pressure declined by 7.0mmHg (range 6-10mmHg) at more distal locations. No adverse events related to the use of the guidewire occurred.

**Conclusion:** Local hemodynamic measurements in vessels surrounding unruptured intracranial aneurysms are feasible using a dual-sensor pressure and Doppler velocity guidewire. Local BFV can serve as boundary conditions for computational fluid dynamics, while P recordings provide direct information on the mechanical load imposed upon the aneurysm. Both measurements may add to patient-specific rupture risk assessment.



**Figure 1:** ComboWire measurements in one patient

P20

### TRANSINUSOIDAL PORTAL VEIN EMBOLIZATION WITH ONYX: A FEASIBILITY STUDY IN PIGS

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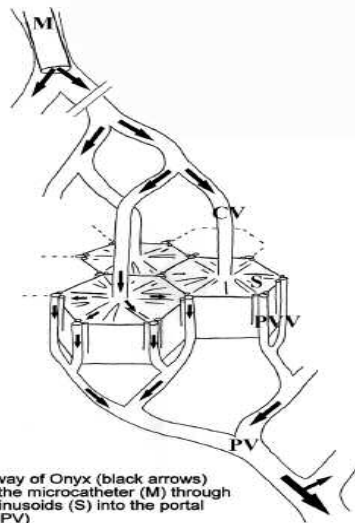
**Purpose:** Portal vein embolization (PVE) is widely used to preoperatively enlarge the future liver remnant (FRL) in patients with hepatic malignancies. This study assesses the feasibility of a Transsinusoidal approach for PVE (TS-PVE) with the liquid embolic agent Onyx (Ethylene-vinyl-alcohol, ev3, Irvine, CA, USA).

**Method and materials:** Procedures were performed in 4 pigs. An indirect portogram was obtained to visualize the anatomy of the portal vein (PV). A microcatheter was placed in wedge in the hepatic vein after which wedged hepatic venography was performed. Onyx was then injected and advanced through the liver lobules into the portal system. The progression of Onyx was followed under fluoroscopy and the extent of embolization was monitored by indirect portography. Two pigs were euthanized directly after the procedure and two pigs after 7 days. The resected livers were macroscopically and histopathologically analysed.

**Results:** TS-PVE was successfully performed in all pigs. In 8 out of 11 injections (73%), a segmental PV could be embolized completely. Per pig, an average of 3.5 segments were embolized. There were no peri-procedural complications. On the resected livers, two capsular irregularities were macroscopically visible, yet the capsule remained intact. On histopathology, there was no recanalization or abscess formation. Mild inflammatory reaction to Onyx could be noted.

**Conclusion:** Transsinusoidal portal vein embolization is a feasible and safe procedure in swine. The complications of

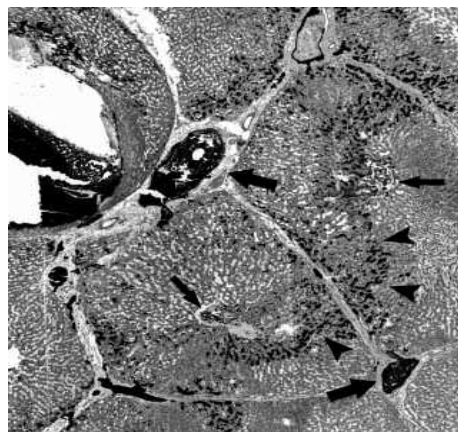
TS-PVE, the required level of analgesia and the effect on contralateral hypertrophy need to be further studied.



**Image 1:** Pathway of Onyx through the liver sinusoids



**Image 2:** Resected liver postembolization, injection site



**Image 3:** Presence of Onyx (black) throughout the lobules

P22

## RADIOLOGICAL FINDINGS IN SPONDYLOEPI-PHYSEAL DYSPLASIA, OMANI TYPE

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Spondyloepiphyseal dysplasia (SED), Omani type (OMIM 608637) is a recessively inherited skeletal dysplasia previously described in two distantly related families from the Republic of Oman. The phenotype consists of short stature, severe kyphoscoliosis, arthritic joints (elbows, wrists, knees), secondary large joint dislocations, rhizomelia, fusion of carpal bones and mild brachydactyly. Here we describe a Turkish family and extend the clinical phenotype of SED-Omani type to include congenital joint dislocation, club feet, metacarpal shortening and accessory carpal ossification centers.

P23

## DE POSITIEF VOORSPELLENDE WAARDE VAN MAMMOGRAFISCH BI-RADS III-V GECLASSIFICEERDE MAMMA LAESIES

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**Doel:** Het Breast Imaging Reporting And Data System (BI-RADS) wordt internationaal gebruikt voor classificatie van mammografische bevindingen. De doelstelling van dit onderzoek was te analyseren wat de positief voorspellende waarde is van de BI-RADS categorieën III, IV en V binnen ons instituut.

**Methode:** De uitkomsten van alle diagnostische mammabiopten verricht in 2008 werden retrospectief geanalyseerd. Per laesie werden de mammografisch afgegeven BI-RADS classificatie en de bijbehorende pathologie-uitslagen opgezocht in het Ziekenhuis Informatie Systeem. De pathologie-uitslagen werden als volgt gecategoriseerd: 1) benigne, 2) high-risk, 3) maligne of 4) niet representatief. Voor de BI-RADS categorieën III-IV werd de positief voorspellende waarde (PVW) berekend.

**Resultaten:** Van 239 patiënten (99,2% vrouw, gemiddelde leeftijd 51,7 jaar) werden in totaal 278 BI-RADS III-IV laesies geanalyseerd. Op basis van het mammogram werden 149 (53,6%) laesies geïdentificeerd als BI-RADS III, 84 (30,2%) als BI-RADS IV en 45 (16,2%) als BI-RADS V. Na biopsie waren er 104 (37,4%) maligne. Uitgesplitst per BI-RADS categorie was het aantal maligniteiten 17 (PVW = 11,4%) voor categorie III, 42 (PVW = 50,0%) voor categorie IV en 45 (PVW = 100,0%) voor categorie V.

**Conclusie:** De PVW van categorieën IV en V waren conform de verwachte percentages volgens het BI-RADS (respectievelijk 2-95% en  $\geq 95\%$ ). De PVW van categorie III lag met 11,4% hoger dan verwacht op basis van de richtlijnen van het ACR (<2%). Dit laatste roept vragen op omtrent het huidige conservatieve beleidsadvies voor een BI-RADS III laesie.

P24

## OPTIMALISATIE SPATIËLE EN TEMPORELE RESOLUTIE VAN MRI MAMMAE DOOR TOEPASSING VAN PROFILE-SHARING, CENTRA EN SENSE

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<sup>2</sup>Philips Healthcare Benelux, EINDHOVEN

**Doel:** Voor de detectie van mamma carcinoom is een hoge spatiële en temporele resolutie nodig (respectievelijk  $\leq 1 \times 1 \times 2,5$  mm en 1-2 min per dynamische serie Eur Radiol 2008;18:1307-18). Bij MRI gaat een hoge spatiële resolutie doorgaans ten koste van temporele resolutie en/of signaal. Wij presenteren een techniek waarbij beide bereikt wordt, door profile-sharing, CENTRA en SENSE.

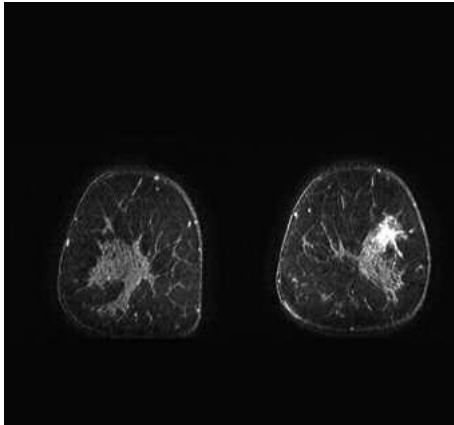
**Methode:** In September 2008 werden 60 opeenvolgende patiënten geïncludeerd (1,5T, Philips Intera, 7elementen Mammapoel of 4 elementen synergiespoel). Scanparameters van de dynamische 3D- T1-gradient-echo met vetsuppressie; TR:8.0 ms, TE 3.7 ms, FA 12°, turbofactor 50, FOV 340x340 cm, acquisitie-matrix 524x524, 231 transversale overcontiguous slices van 0,65mm, SENSE factor 4 (links-rechts), proset vetsuppressie. Dit resulteert in een in-plane resolutie van 0,65x0,65 mm. Voor en 3 en 6,5 minuut na start contrastinjectie wordt een geheel k-vlak geacquireerd (Reference-scan van 2,5 minuut). Bij de start van contrastinjectie (t=0) en op 1, 2 en 5,5 minuut worden "keyhole-scans" gemaakt (alleen het centrale deel van het k-vlak), scanduur 1 minuut. Vervolgens wordt de periferie van het k-vlak van de reference-scan gecombineerd met een keyhole-scan om een volledig k-vlak te reconstrueren. Onderzoeken werden beoordeeld op reconstructie artefacten, detail en signaal-ruis verhouding.

**Resultaten:** Alle onderzoeken toonden een uitstekend detail, ook van de 10 gevonden maligniteiten, met een goede signaal-ruis verhouding. Enig toegenomen ruis was zichtbaar buiten de mammae. Er werden geen reconstructie fouten waargenomen.

**Conclusie:** Profile-sharing, SENSE en Centra maken het mogelijk om MR Mammae te vervaardigen met een hoge temporele en spatiële resolutie met behoud van beeldkwaliteit.



**Afbeelding 1:** T1 3D Thrive, t=3 min. Lobulair ca.



**Afbeelding 2:** Cor MPR, zelfde patiënt als figuur 1

P25

### **DE ROL VAN SUBTRACTIE SCINTIGRAFIE EN SPECT-CT BIJ HYPERPARATHYREOIDIE**

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**Doel:** Hoe betrouwbaar is subtractie scintigrafie en SPECT-CT bij detectie van een bijschildklieradenoom?

**Methoden:** 29 patiënten met hyperparathyreoïdie ondergingen scintigrafie met vroege en late beelden na i.v. Tc-Sestamibi en subtractie van het schildklierbeeld m.b.v. Tc-Pertechnetaat. Bij de laatste 9 van deze patiënten werd het onderzoek met SPECT gedaan. Meestal werd daarna ook echografie van de hals verricht. In sommige gevallen (met name bij twijfel) bovendien CT. Indien een bijschildklieradenoom werd vastgesteld, werd dat na echografische markering mini-invasief verwijderd.

**Resultaten:** Bij 10 patiënten detecteerde het scintigram een bijschildklieradenoom. Bij 9 van deze patiënten werd de plaats echografisch bevestigd, gemarkeerd en met succes operatief verwijderd. Bij 1 patiënt was de echografie negatief; bij operatie werden 4 hypertrofische bijschildklieren verwijderd, waarvan de 2 grootste het positieve scintigram verklaarden. Bij slechts 4 patiënten werd ook CT gedaan; 2 hiervan waren negatief.

Bij 19 patiënten was het subtractie scintigram negatief. Bij 17 van hen werd echografie gedaan, waarvan 5 vals positief waren, meestal door verwarring met schildklier nodi; later werden de echografische resultaten beter door ervaring.

Bij SPECT verbeterden zowel het scintigrafisch beeld, als de differentiatie van multinodulair struma, als de lokalisatie van het bijschildklieradenoom. Van deze 9 patiënten werden 6 bijschildklieradenomen correct gedetecteerd.

**Discussie:** subtractie scintigrafie met Tc-Sestamibi en Tc-pertechnetaat is zeer betrouwbaar, vooral indien gecombineerd met SPECT.

P26

### **LIFE THREATENING RETROPERITONEAL BLEEDING CAUSED BY RUPTURE OF THE CORONA MORTIS AFTER UNSUCCESSFUL PLACEMENT OF A CENTRAL VENOUS CATHETER IN THE RIGHT FEMORAL ARTERY: CORONA MORTIS, AN IMPORTANT VASCULAR ANOMALY EVERY RADIOLOGIST SHOULD RECOGNIZE**

E. Ghazi, K. Horsthuis, S. Kolkman

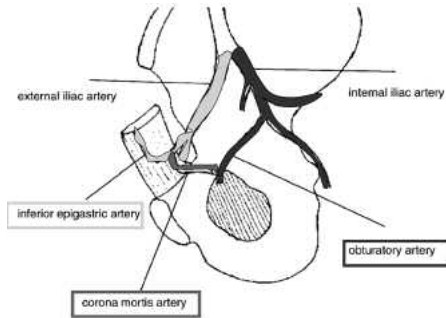
Academisch Medisch Centrum, AMSTERDAM

**Background:** Corona mortis, also known as crown of death, is a vascular anomaly extensively described in the surgical and orthopaedic literature. The incidence varies between 30-45% in the literature. The most common presentation of the corona mortis (70%) is an anastomosis between the obturator artery, arising from the internal iliac artery, and the inferior epigastric artery arising from the external iliac artery. Sometimes there is a direct anastomosis between the EIA and the IIA. The corona mortis runs close to the superior ramus of the pubic bone and can be the cause of bleeding during pelvic surgery, inguinal surgical approach and pelvic trauma.

**Clinical findings:** A 52 year old man with Kahler's disease was admitted for plasmapheresis. After several attempts, by the haematologist, to insert a central venous catheter in the right femoral vein the patient became hemodynamically unstable with signs of active bleeding.

CT revealed a large retroperitoneal haematoma with active contrast extravasation around the inferior epigastric artery. Because of severe hemodynamic instability surgery was performed. Rupture of the corona mortis was identified and adequately treated.

**Conclusion:** The corona mortis is an important vascular anomaly and should be recognized by radiologists in patients with active bleeding after pelvic trauma, pelvic surgery or placement of femoral catheters. When embolization is the choice of treatment superselective angiography of both the internal and external iliac artery, including the obturator artery and the inferior epigastric artery, should be performed in cases of prolonged bleeding or suspicion of corona mortis injury.



P27

**DESCRIPTIVE RESEARCH: MAC-BASED OPEN-SOURCE DICOM VIEWER OSIRIX IN A HOSPITAL SETTING**

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Imaging workstations are increasingly dominant in the radiologic workflow. The increase use of 3D datasets require advanced workstations. Traditionally powerfull but expensive system are used.

**Purpose:** Merging the existing PACS software with an inexpensive 3D program.

**Methods:** Review of existing open source programs demonstrated OsiriX (version 3.3.2 64-bit) as a superior candidate. This limits the choice of operating system to Macintosh OS (10.5.6). View Pro-X (3.2.1.1, Rogan Delft) was installed on a Mac Pro (Xeon 64-bit, 2 quad core) using VM Ware Fusion (1.1.2) on which OsiriX was running. For dictation G2 MediSpeech (4.1.5.0) was installed in a similar manner, with the help of the hospital IT department. To compare this systems with the PACS station we normally use, a daily

amount of data was loaded on both systems.

**Results:** The system setup enabled us to read studies in a similar manner as our standard PACS workstation. OsiriX added the possibility to create 3D reconstructions, curved reformats and surface and 3D volume rendering images, during the dictation process. On the Mac system View Pro was loading a little slower because it was running on a virtual Windows (XP Home, SP2). OsiriX works with local data so images must be on the harddrive before it can be viewed. Loading is about three times as time consuming, but re-accessing the data is very fast. This disadvantage can be overcome with prefetching.

**Conclusion:** The presented approach speeds up the daily workflow by integrating an inexpensive 3D workstation software with a standard PACS reading system.

P28

**MRI AND RADIOGRAPHIC FINDINGS AFTER 10 YEARS IN PATIENTS WITH NON-ACUTE KNEE COMPLAINTS; DETERMINATION OF MRI IDENTIFIED RISK FACTORS FOR THE DEVELOPMENT OF OSTEOARTHRITIS**

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Leids Universitair Medisch Centrum, LEIDEN

**Purpose:** To identify the significance of anterior cruciate ligament (ACL) and meniscus lesions, detected on MRI a decade ago, as risk factors for the development of knee osteoarthritis (OA) in patients with sub-acute knee complaints.

**Material and methods:** Patients were retrieved from the database of a previous study on the impact of MRI guided treatment in 859 patients with sub-acute knee complaints. The mean follow-up was 10 years. 326 patients (38%) were included. All participants had knee radiographs and 3.0T MRI scans performed. Initial MRI scans were compared with the follow-up radiographs and MR scans. Odds ratios with 95% confidence intervals were used to show associations between risk factors and the presence of OA features.

**Results:** Patients with ACL tears have an increased risk of developing joint space narrowing (JSN) cartilaginous defects, osteophytes, bone marrow lesions, and subchondral cysts medially or laterally (OR 2.3-9.8). Patients with lateral meniscus (LM) tears show an increased risk of developing JSN cartilaginous defects, osteophytes, bone marrow lesions and subchondral cysts laterally (OR 2.1-10.7). Patients with medial meniscus (MM) tears have an increased risk of developing JSN, osteophytes and bone marrow lesions

medially (OR 2.8 and 4.1) but not cartilaginous defects. Meniscectomy had no effect on the risk of developing OA.

**Conclusion:** ACL and LM tears increase the risk of developing all the features of OA in all compartments. MM tears and meniscectomies have a limited impact on the development of OA.

P29

### DIFFUSION-WEIGHTED WHOLE-BODY IMAGING WITH BACKGROUND BODY SIGNAL SUPPRESSION (DWIBS) BIJ WERVEL-METASTASEN: ZINNIG OF ONZINNIG? KLINISCHE ERVARING BIJ VOORALSNOG EEN SELECTE GROEP

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*Medisch Spectrum Twente, ENSCHEDE*

**Doel van het onderzoek:** Vaststellen van de toegevoegde waarde van de diffusion-weighted whole-body imaging with background body signal suppression (DWIBS)-techniek bij MRI onderzoek van metastasen in de wervelkolom.

**Methode:** Bij 63 patiënten verwezen voor een MRI van de gehele wervelkolom in het kader van metastase screening/controle, werd naast de conventionele sequenties (sagittale T2 TSE, sagittale T1 TSE en sagittale T2 SPIR [ slice dikte 3mm, in-plane resolutie 0.89 x 1.19mm ] ) ook een sagittale DWIBS [ slice dikte 4mm, in-plane resolutie 1.5 x 1.88mm ] sequentie geacquireerd. Onderzoeken zijn verricht op een 1,0T of 1,5T MR systeem. De DWIBS sequentie werd op een later tijdstip beoordeeld door 2 MRI radiologen en 1 AIOS, zonder inzage in de bijbehorende conventionele sequenties of de bevindingen van de andere readers. Per gevonden laesie werden de bevindingen van de DWIBS gecorreleerd met de conventionele sequenties. De resultaten van de 1,0 en 1,5T werden onderling vergeleken op beeldkwaliteit en sensitiviteit.

**Resultaten:** Door middel van de DWIBS sequentie werd slechts 80% van de metastasen gedetecteerd. De detectie verschilde niet-significant tussen het 1,0T en het 1,5T systeem.

**Conclusie:** De DWIBS-techniek lijkt vooralsnog geen toegevoegde waarde te hebben boven de conventionele MR sequenties ten aanzien van de detectie van wervelmetastasen. De huidige resultaten zijn echter gebaseerd op een kleine groep patiënten. Uit verder onderzoek moet blijken of de DWIBS sequentie kan differentiëren tussen oude en nieuwe/actieve metastasen.

P30

### DIAGNOSTISCHE PERFORMANCE VAN MR ARTHROGRAFIE VAN DE SCHOUDER VOOR ROTATOR CUFFLETSEL EN LABRUM-PATHOLOGIE

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**Doel:** Het vaststellen van de diagnostische performance van MR arthrografie voor rotator cuffletsel en labrumpathologie in vergelijking tot arthroscopie.

**Methode:** Retrospectieve studie van 76 patiënten (januari 2007 tot augustus 2008) die zowel arthroscopie als MR arthrografie van de schouder ondergingen. MR van de schouder werd verricht op een 1,5 T scanner na toedienen van intra-articulair Gadolinium. T2 FSE, PD FSE en T1FatSat opnamen werden verkregen in neutrale positie of lichte exorotatie. De MR verslagen werden gescoord op aanwezigheid van partieel of full thickness letsel van de rotator cuff en op letsel van het labrum. De MR bevindingen werden gecorreleerd aan de bevindingen bij arthroscopie. Bij fout negatieve bevinding voor labrumletsel werd het MR onderzoek gereviseerd om vast te stellen of het bij scopie vastgestelde letsel in retrospect toch te zien was.

**Resultaten:** Voor partiële cuffletsels, full thickness cuffletsels en labrumletsels heeft MR een sensitiviteit van respectievelijk 100%, 95%, en 76%; een specificiteit van resp. 97%, 100% en 100% en een accurate van resp. 97%, 99% en 88%. Bij 7 van de 9 fout-negatieve scans voor labrumletsel wordt ook bij revisie geen aanwijzing gezien voor letsel van het labrum.

**Conclusie:** MR arthrografie is gelijkwaardig aan arthroscopie in het diagnosticeren van rotator cuffletsels. Mogelijk kan deze in de toekomst de diagnostische arthroscopie vervangen. In de diagnose van labrumletsels blijft een grote rol weggelegd voor de diagnostische arthroscopie.

MR Arthrografie	Partieel cuffletsel	Full thickness cuffletsel	Labrumletsel
Waar-positief	3	19	29
Fout-positief	2	0	0
Waar-negatief	71	56	38
Fout-negatief	0	1	9

P31

### VALIDE METINGEN VAN DIAFRAGMA-FUNCTIE MIDDELS M-MODE ULTRASONOGRAFIE

M.N.F. Poulsen, M. Logtenberg, L. Jongen, P.E. Spronk, J.W.C. Gratama  
*Gelre Ziekenhuizen, APELDOORN*

**Achtergrond/doel:** NAVA (Neutrally Adjusted Ventilatory Assist) is een nieuwe beademingstechniek waarbij de con-

tractie van het diafragma wordt gebruikt om de beademingsmachine aan te sturen. Mogelijk bestaat er een correlatie tussen de mate van diafragmacontractie en de duur van ontwennen van beademing. Deze diafragmacontracties kunnen gemeten worden middels M-mode ultrasonografie. Echter de validiteit van deze meting is nog niet bekend. Het doel van deze studie is het bepalen van de inter-observer variabiliteit bij diafragrammetingen middels M-mode ultrasonografie.

**Method:** Drie onafhankelijk onderzoekers gebruikten M-mode ultrasonografie om bij twintig gezonde vrijwilligers, op gestandaardiseerde wijze, rechtzijdig de diafragma-amplitude te meten. Dit werd gedaan tijdens rustig ademen, tijdens maximaal in- en uitademen en tijdens een snelle geforceerde inspiratie. Uit deze gegevens werd de inter-observer variabiliteit berekend, uitgedrukt in de Pearson correlatiecoëfficiënt.

**Resultaten:** De Pearson correlatiecoëfficiënt voor observaties uitgevoerd door de drie onderzoekers bedroeg bij rustig ademen 0.518 ( $P=0.09$ ), bij maximaal in- en uitademen 0.638 ( $P=0.04$ ) en bij de snelle geforceerde inspiratie 0.935 ( $P<0.001$ ).

**Conclusie:** M-mode ultrasonografie is een snelle, zeer bruikbare, niet invasieve methode om diafragma functie te evalueren tijdens een snelle geforceerde inspiratie. In mindere mate is ook maximale in- en expiratie hiervoor bruikbaar. Er zal verder onderzoek gedaan moeten worden naar de vraag of deze meting eveneens betrouwbaar uitgevoerd kan worden bij minder coöperatieve patiënten, zoals spontaan ademende patiënten aan een beademingsmachine en ook tijdens diafragma disfunctie.

P32

**CAN AN ADAPTED CYSTIC FIBROSIS (CF) CT SCORING SYSTEM BE USED IN PRIMARY IMMUNODEFICIENCY (PID) PATIENTS FOR SEMI-QUANTIFICATION OF LUNG ABNORMALITIES? A PILOT STUDY**

A. Bruining, G.J.A. Driessen, P.M. van Hagen, H.A.W.M. Tiddens, I.J.C. Hartmann  
Erasmus MC, ROTTERDAM

**Aims:** A CT scoring system is used for evaluation of pulmonary status in CF patients. We aimed to identify pulmonary CT findings in PID patients to develop a disease specific CT scoring system.

**Method and materials:** This pro/retrospective study included 31 patients (14 female; mean age 24.5 yrs (range 3.7 - 63.3)) with PID (CVID n=23, XLA n=6, specific antibody defi-

ciency n=2). CTCF scoring system (items: bronchiectasis, bronchial wall thickening (BWT), mucus plugging, parenchymal abnormalities, air trapping) was used to score CT scans for extent and severity per abnormality, per lobe. Other prevalent features in PID such as lymphadenopathy, presence of nodules and their size (<5mm; 5-10mm; >10mm), and signs of fibrosis were also assessed. One trained senior resident in radiology scored all scans.

**Results:** CT indication was screening for bronchiectasis (n=8), thymoma (n=6), lymfadenopathy (n=3), unknown (n=2) or acute respiratory problems (n=2). In 5 patients, scoring was incomplete due to atelectasis of at least one lobe. Bronchiectasis and BWT were found in 73%. Furthermore, 52% of patients showed mucous plugging, 50% consolidations, 68% atelectasis, 53% linear densities, 23% ground glass opacities, 19% lymphadenopathy, 32% pleural tagging and 65% reticulation. Nodules were found in 19/29 (66%) patients, of whom 79% had <5 nodules/affected lobe and in 79% size was < 5mm. Expiratory scans were available in 6 patients, one showed air trapping.

**Conclusion:** Scoring of CT abnormalities using an adapted CFCT scoring system is feasible in PID. Its clinical relevance and the most useful parameters need to be further determined.

P33

**IMPACT OF GREY-SCALE REVERSAL OF SOFT COPY DISPLAY ON THE DETECTION OF SOLID PULMONARY LESIONS: AN OBSERVER STUDY**

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<sup>2</sup>AKH, VIENNA, Austria  
<sup>3</sup>Meander Medisch Centrum, AMERSFOORT

To evaluate the added value of grey-scale reversal (GSR) on the detection of solid pulmonary lesions in chest radiographs (CXR) of older patients with smoking related parenchymal changes.

Digital CXR of 129 patients (mean age 62y) were retrospectively selected. A varying degree of smoking related parenchymal changes was present in 69% (89/129). 75 patients had 129 CT proven solid pulmonary lesions (5-30mm, mean 13mm). Conspicuity was rated as low or very low in 57%. Images were read without and with GSR by three inexperienced and three experienced readers using commercially available PACS (Agfa 4.5). On per lesion basis, sensitivity and false positive rate (FPR = FP/FP+TP) were calculated. The ratio of beneficial and detrimental calls caused by GSR

(compared to normal reading) was calculated for pooled data of subgroups.

GSR had no significant impact on sensitivity (48% vs. 50%) and FPR (29% vs. 32%) of averaged reader performance. GSR had a higher ratio between beneficial and detrimental calls compared to normal reading for lesions  $\geq 10$ mm compared to smaller lesions (1.42 vs. 1.17). This higher ratio with GSR was also found for lesions with high compared to low conspicuity (1.71 vs. 1.12), for lesions with high than with low anatomical background noise (1.54 vs. 1.00) and for inexperienced compared to experienced readers (1.57 vs. 1.14).

Grey-scale reversal offers no significant general advantage for the detection of lung lesions. However, the results suggest advantages for the detection of larger lesions ( $>10$ mm), lesions in patients with pre-existing lung disease and for inexperienced radiologists.

P34

### TEMPORAL SUBTRACTION IN CHEST RADIOGRAPHY: HOW OFTEN DOES IT WORK AND HOW OFTEN DOES IT HELP: RESULTS OF A FEASIBILITY STUDY

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<sup>3</sup>Meander Medisch Centrum, AMERSFOORT

To assess the image quality and diagnostic impact of temporal subtraction in an unselected group of consecutively obtained chest radiographs (CXR).

Consecutively obtained CXR on a Thoravision unit during five days of clinical practise were included. Quality of temporal subtraction (TS) were assessed using a 4 point scale with artefacts not present = 1, present, but not disturbing = 2, disturbing = 3 and making an evaluation impossible = 4. TS using either rigid or non-rigid registration were compared side-to-side. Two radiologists assessed in consensus the presence of interval changes, its clinical relevance and whether TS were considered to represent an useful diagnostic adjunct.

225 CXR were obtained in 220 patients. 40% (87/220) of patients had at least one previous CXR. Nine patients had to be excluded because of failure of the subtraction algorithm. 69% (109/156) of both rigid and non-rigid TS images had no or non-disturbing artefacts, image quality of non-rigid TS was considered superior in 90% (70/78). Interval changes were seen in 40 patients, considered clinically relevant in 28

patients. In 6 of them, the TS images were found to increase perception of interval changes: they referred to focal opacities caused by pneumonia (1), atelectasis (1) nodular (3) or patchy (3) densities.

In an unselected group of CXR, the number of images that potentially take advantage of TS might be small and refer to focal interval changes. Image quality of TS proved to be sufficient in 69%, with non-rigid TS offering better image quality than rigid TS.

P35

### ATTENUATION OF RENAL CALCULI ON NON-CONTRAST CT, A PREDICTIVE VALUE FOR SUCCESS RATE AFTER ESWL?

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<sup>2</sup>UMC Utrecht, UTRECHT

**Introduction:** It's very hard to predict whether Extracorporeal Shock Wave Lithotripsy (ESWL) will be a successful therapy in patients suffering from urolithiasis. Literature reports a correlation between attenuation of renal calculi on non-contrast Computed Tomography (NCCT) and success of treatment with ESWL (stone-free). The aim of this study is to evaluate whether stone attenuation on NCCT can predict the outcome of treatment with ESWL.

**Methods:** This study was performed in all patients undergoing ESWL between January 2006 and December 2007. Inclusion criteria:

- renal calculus  $\geq 3$ mm
- NCCT before treatment
- $\geq 1$  treatment with ESWL

Attenuation, size and localization of the renal calculi on NCCT were measured by a single radiologist. Success rate after treatment with ESWL was evaluated by KUB. This was done after 1 treatment and after complete treatment with ESWL. Data were analyzed using SPSS.

**Results:** 86 patients were included, 53 male vs. 33 female. When attenuation was  $< 900$  HU, success rate was 71% (37/52). If attenuation was  $>900$  HU, success rate was 38% (13/34). Kaplan-Meier curve shows a predictive value of 0,7. Multivariate analysis showed that size and localization of the renal calculus did not have any significant added value in predicting the success rate after ESWL.

**Conclusion:**

- Success of ESWL can be predicted by measuring stone-attenuation in NCCT

- An attenuation <900 HU predicts a successful ESWL
- If attenuation is >900 HU alternative therapy should be considered

P36

**MR IMAGING OF ABDOMINAL WALL ENDOMETRIOSIS**

M.P.H. Busard, V. Mijatovic, C. van Kuijk, P.G.A. Hompes, J.H.T.M. van Waesberghe  
*VU Medisch Centrum, AMSTERDAM*

**Introduction:** Abdominal wall endometriosis (AWE) is defined as endometrial tissue superficial to the peritoneum. AWE is often difficult to diagnose, mimicking a broad spectrum of diseases. Treatment options include hormonal therapy and surgery. Regarding surgery, wide excision is recommended to avoid recurrence. The aim of this study is to evaluate the role of MR imaging in abdominal wall endometriosis.

**Materials and methods:** We present 10 cases of abdominal wall endometriosis, in which MR imaging was used for diagnosis. Most patients had a previous history of surgery (n= 8). MR imaging included T2-weighted imaging and T1-weighted imaging with fat saturation. In 5 patients additional diffusion-weighted imaging (DWI) was obtained. To calculate the apparent diffusion coefficient (ADC), b-values of 50, 400, 800 and 1200 s/mm(2) were used.

**Results:** Abdominal wall endometriosis was located at the corner site of the surgery scar in all cases (n= 8). In most cases the lesion was located ventrally or dorsally to the aponeurosis of the rectus oblique muscle (n =6) or in the rectus abdominis (n = 4). MR imaging of AWE lesions showed isointense or high signal intensity compared to muscle on T2-weighted images and showed isointense or high signal intensity compared to muscle on T1-weighted images with fat saturation with small foci of high signal intensity, indicative of hemorrhage. Mean ADC value of AWE was  $0,93 \times 10(-3)/\text{mm}(2)/\text{s}$ .

**Conclusion:** MR imaging is a useful imaging modality to diagnose abdominal wall endometriosis and accurately determine the location and depth of infiltration in surrounding tissues preoperatively.

**DIFFUSION-WEIGHTED IMAGING IN DEEP INFILTRATING ENDOMETRIOSIS**

M.P.H. Busard, V. Mijatovic, C. van Kuijk, P.G.A. Hompes, J.H.T.M. van Waesberghe  
*VU Medisch Centrum, AMSTERDAM*

**Introduction:** Deep infiltrating endometriosis is defined as

infiltration of the implant of endometriosis under the surface of the peritoneum. A radiographic finding of endometriosis infiltrating the bowel is marked overgrowth of the external muscular coat and may resemble findings of colonic carcinoma. The aim of this study was to evaluate the value of diffusion-weighted imaging (DWI) in endometriosis and in particular its value in differentiating colonic carcinoma and deep infiltrating endometriosis.

**Materials and methods:** In a prospective study of 55 consecutive patients (age range, 16-50; mean 33 years), DWI was added to the standard MR imaging protocol to detect endometriosis in the pelvis. Deep infiltrating endometriotic lesions (n=38) and colonic carcinoma (n=8) were analysed for location, size and appearance on T2-weighted images and T1-weighted images with fat saturation. ADC values were calculated using b-values of 50, 400, 800 and 1200 s/mm(2).

**Results:** Mean ADC values of colonic carcinoma ( $1.10 \pm 0.21 \times 10(-3)/\text{mm}(2)/\text{s}$  (range  $0.84-1.41 \times 10(-3)$ ) are significantly higher compared to mean ADC values of endometriosis infiltrating the bowel  $0.77 \pm 0.24 \times 10(-3)/\text{mm}(2)/\text{s}$  (range  $0.22-1.27 \times 10(-3)$ ). Mean ADC values of retrocervical endometriosis and bladder detrusor endometriosis were respectively  $0.77 \pm 0.08 \times 10(-3)/\text{mm}(2)/\text{s}$  (range  $0.13-1.01 \times 10(-3)$ ) and  $0.76 \pm 0.08 \times 10(-3)/\text{mm}(2)/\text{s}$  (range  $0.69-0.88 \times 10(-3)$ ).

**Conclusion:** Mean ADC values of deep infiltrating endometriosis are not significantly different between pelvic locations. In a small patient population of colonic carcinoma, mean ADC values are significantly higher compared to mean ADC values of endometriosis infiltrating the bowel.

P37

**MRI-BASED IDENTIFICATION AND MONITORING OF CLINICAL COMPLETE RESPONDERS AFTER NEOADJUVANT CHEMORADIATION IN RECTAL CANCER: THE FIRST RESULTS**

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**Purpose:** Neoadjuvant chemoradiation (CRT) for rectal cancer increasingly results in good response. Sometimes even a complete response (no residual tumour or malignant nodes) is encountered. Accurate selection of complete responders with imaging is crucial and could allow for minimal invasive treatment ('wait-and-see-policy'). Aim of this study was to determine whether patients with MRI-based clinical complete response (cCR) treated with 'wait-and-see' have a comparable prognosis to patients with pathological complete response (pCR) after surgery.

**Material and methods:** 120 patients underwent a restaging-MRI 6-8 weeks after completion of CRT, consisting of standard T2W-FSE and contrast-enhanced lymph-node imaging. Patients with a cCR underwent 'wait-and-see': omission of surgery with intensive follow-up (initially 6 to later on 24-weekly MRI, endoscopy with biopsy and laboratory examinations). Chemoradiation withheld 50.4 Gy radiotherapy + Capecitabine. The pCR control-group was identified from a prospective rectal cancer cohort-study.

**Results:** 9 patients had a cCR and underwent 'wait-and-see'. Median follow-up is 19 months (range 1-48). 15 patients with pCR after surgery were identified (median follow-up 17 months, range 2-53). Overall survival is 100% for both groups. In the 'wait-and-see'-group one patient had synchronous liver metastasis and possibly local recurrence after 2 years. In the 'pCR-after-surgery'-group one patient developed lung metastasis 3 years post-surgery.

**Conclusion:** New treatment options in rectal cancer treatment are a 'wait-and-see policy' in clinical complete responders to chemoradiation with favourable reported prognosis (Habr-Gama, 2004-2008). In our center MRI is routinely used for restaging after CRT. MRI-based identification for 'wait-and-see-policy' and follow-up of these patients with MRI seems promising.

### RESPONSE AFTER CHEMORADIATION IN RECTAL CANCER IS ASSOCIATED WITH IMPROVED RESECTABILITY AND PROGNOSIS: A META ANALYSIS

M. Maas, D.M.J. Lambregts, P.J. Nelemans, G.L. Beets, R.G.H. Beets-Tan

Maastricht Universitair Medisch Centrum, MAASTRICHT

**Purpose:** Neoadjuvant chemoradiation (CRT) for rectal cancer increasingly results in pathologic complete response (pCR). The prediction of pCR after CRT with MRI is one of the most challenging issues and is being studied extensively. When accurate selection of pCR-patients with imaging becomes feasible, this may allow for less invasive treatment, provided that prognosis is favourable for pCR-patients. The aim of this meta-analysis was to determine the prognostic value of pCR after CRT, regarding sphincter-preserving surgery, 5-year local recurrence, disease-free survival (DFS) and overall survival (OS).

**Methods:** Medline and Embase were searched. Articles (n=28) regarding short or long-term outcome specified for different pathologic response groups after chemoradiation for rectal cancer were included. Four authors provided individual patient data, four provided specific calculated data. Data were pooled to derive relative risks and hazard ratios

from the comparison of pCR-patients to patients with residual disease after CRT.

**Results:** 4906 patients were included, of which 792 had pCR. pCR-patients undergo significantly more sphincter-preserving procedures: RR 1.17 (95%CI 1.10-1.24). Hazard ratios for local recurrence, DFS and OS were 0.226 (95%CI 0.100-0.510), 0.488 (95%CI 0.336-0.709) and 0.466 (95%CI 0.296-0.735) respectively, in favour of patients with pCR.

**Conclusion:** Significantly more sphincter-preserving procedures are performed in pCR-patients. When compared to patients with residual disease, prognosis is significantly better for pCR-patients. These results prompt the development of non-invasive (MR,PET or combined PET-MR) imaging techniques that can accurately select the complete from the good responders after CRT. This is the most challenging task for the coming decade for us radiologists

P38

### 2-YEAR FOLLOW-UP STUDY OF 94 PATIENTS WITH MESENTERIC PANNICULITIS

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<sup>2</sup>Albert Schweitzer Ziekenhuis, DORDRECHT

**Purpose:** Mesenteric panniculitis is an uncommon idiopathic disorder characterised by chronic inflammation of the intestinal mesentery. A possible paraneoplastic origin has been suggested. There are however few data available on the natural history of mesenteric panniculitis. The purpose of this study was to assess clinical outcome of patient with mesenteric panniculitis after 2 years with specific attention to the development of malignancy.

**Methods:** As part of a large hospital based prevalence study consecutive abdominal CT examinations of in total 3820 patients were retrospectively evaluated for mesenteric panniculitis. Clinical characteristics, therapy and outcome of all patients with mesenteric panniculitis were retrospectively evaluated during a 2 year follow-up period.

**Results:** CT findings of mesenteric panniculitis were found in 94 patients (2.5%) with a male predominance (70%). Mesenteric panniculitis coexisted with malignancy in 45 (47.4%) patients and with a benign disorder in 35 (37.9%) patients. In 14 patients (14.7%), mesenteric panniculitis was the only diagnosed abnormality; common presenting symptoms in these patients included abdominal pain, diarrhea and weight loss. In 12 patients symptoms disappeared within a few months without treatment. One patient was treated with prednisone without clinical improvement. 5

patients with non-malignant disease developed a malignancy during the follow-up period.

**Conclusion:** Although a relatively benign condition, mesenteric panniculitis may be a first sign of malignancy. In view of the possible paraneoplastic origin, close follow-up studies in patients with mesenteric panniculitis are recommended to search for any hidden malignancy. Long-term follow-up is necessary to substantiate these results.

**Conclusie:** MRE lijkt een nauwkeurige en reproduceerbare methode om M.Crohn aan te tonen in een patiënten populatie met klinische verdenking op M.Crohn.

1. Lancet2008;371:660-667
2. RadiolClinNA2007;45:317-331
3. EurRadiol2008;18:438-447

P39

## DE WAARDE VAN MR ENTEROGRAFIE VOOR HET AANTONEN VAN MORBUS CROHN

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<sup>2</sup>Catharina-ziekenhuis, EINDHOVEN

**Doel:** Bij M.Crohn wordt steeds agressiever begonnen met medicamenteuze behandeling.1 Accurate noninvasieve detectie van de ziekte wordt steeds belangrijker en MR enterografie (MRE) lijkt een veelbelovend techniek.2,3 Deze studie evalueert de nauwkeurigheid en reproduceerbaarheid van MRE voor de detectie van M.Crohn in een patiënten populatie van een referentie centrum.

**Methoden:** 30 opeenvolgende patiënten met klinische verdenking M.Crohn werden door twee radiologen beoordeeld. Beelden werden beoordeeld op kwaliteit en darm distensie (5 punts schaal; 1=slecht - 5=goed). MRE criteria voor M.Crohn waren: pathologisch aankleurend en/of verdikte wand, stenose, dunne darm stenose / dilatatie en vergrote lymfeklieren. Locatie, lengte, en mate van aankleuring (mucosaal, gelaagd of transmuraal) van het zieke segment werden beoordeeld.

**Resultaten:** Gemiddelde leeftijd van 30 opeenvolgende patiënten was 43 (range 17-68, 15 mannen). Eén patiënt werd geexclueerd (incompleet onderzoek). Beeldkwaliteit en darmdistensie waren goed, respectievelijk score 4,7 en 4,5. In 69% (20/29) oordeelden de radiologen exact hetzelfde (6x werd een klein ziek segment door 1 beoordeeld, 1x gemist, 1x een kleine dilatatie, 1x discrepantie tussen mucosale versus transmurale aankleuring). Gemiddelde beoordeeltijd: 13 minuten. 15/29 (52%) patiënten toonden op MRE afwijkingen verdacht voor M.Crohn. PA was beschikbaar in 11/15 patiënten, waarvan in 9/11 PA M.Crohn bevestigde (bij 4/15 reikte endoscopie niet tot aan terminale ileum). Bij 2/15 MR positieve patiënten toonde PA slechts minimale ontstekingsactiviteit. Patiënten met een normale MRE waren ook endoscopisch en PA negatief.











## Routebeschrijving Amsterdam RAI



### Adresgegevens Amsterdam RAI

Europaplein 22 Postbus 77777  
 NL 1078 GZ NL 1070 MS Amsterdam  
 Amsterdam T: +31 (0) 20 549 12 12

### De Radiologendagen vinden plaats in het Forum Complex van de RAI (ingang E op plattegrond)

#### PER AUTO/MOTOR

Direct bij het naderen van Amsterdam via de autosnelweg A1 (Amersfoort/Amsterdam), A2 (Utrecht/Amsterdam) of A4 (Den Haag/Amsterdam) is op de ringweg rond de hoofdstad (A10) de RAI aangegeven op de ANWB-borden, die de route aangeven naar de RAI parkeergarages. De RAI ligt direct aan de ringweg (afslag S 109).

#### Voor routeplanner navigeer naar:

Europaplein 22, 1078 GZ Amsterdam

Parkeergarage P7 is voor congresbezoekers en direct bij het Forum Complex van de RAI gesitueerd.

#### PER TRAM EN BUS

Iedere tien minuten onderhoud tram 4 van Amsterdam een dienst tussen het centrum van Amsterdam, Amsterdam CS, en de RAI (halte Europaplein). Vanaf NS-station Amsterdam Amstel kunt u de RAI het beste bereiken via metrolijn 51 of bus 15. Metrolijn 51 heeft tevens verbinding met Amsterdam Centraal Station. Vanaf Amsterdam Sloterdijk kunt u de RAI het beste bereiken via sneltram 50.

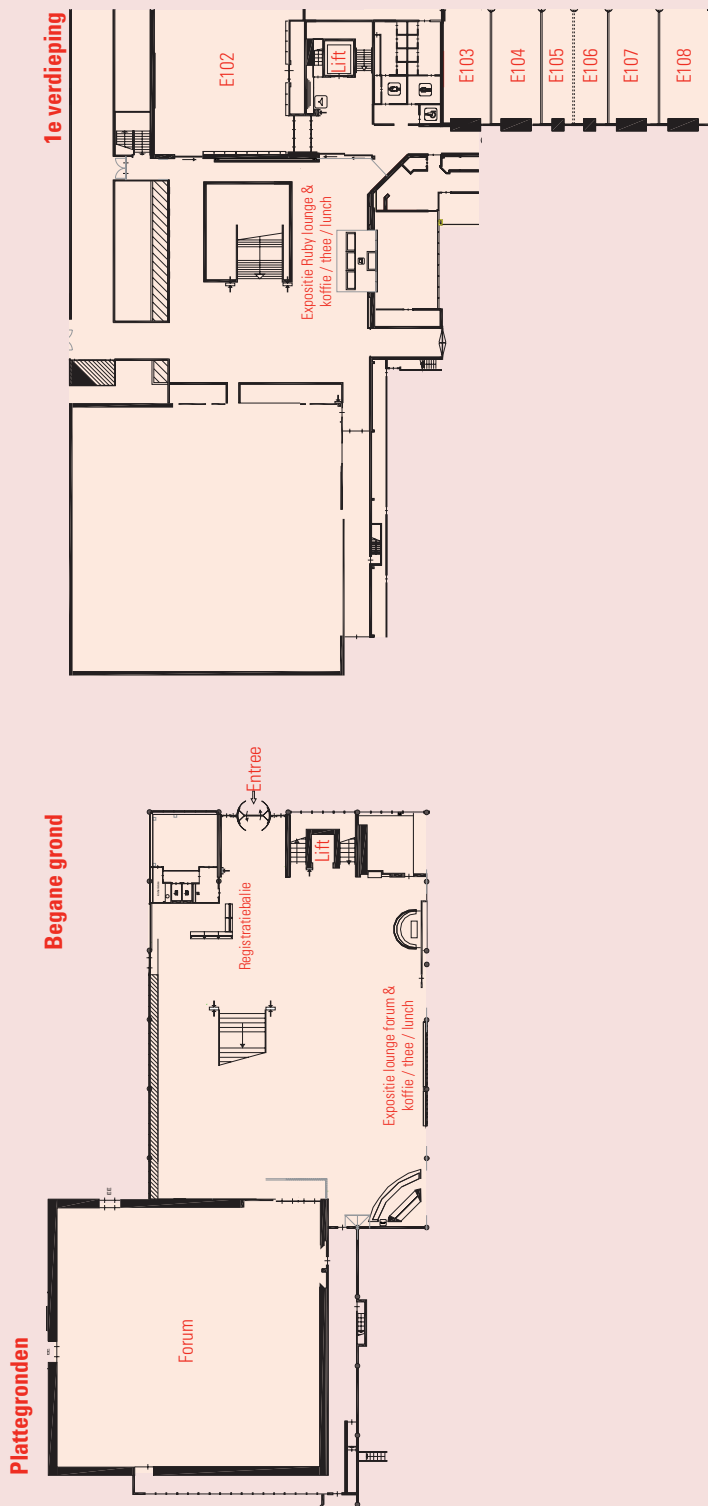
#### PER TREIN

NS-station Amsterdam RAI ligt op 300 meter van de RAI en heeft regelmatig verbinding met station Amsterdam-Duivendrecht, station Amsterdam-Amstel en station Schiphol, die zijn aangesloten op het internationale intercitynet.

(Voor meer informatie: [www.rai.nl/Route & Contact](http://www.rai.nl/Route & Contact))

# SYLLABUS

## PLATTEGROND EN PROGRAMMA



## Donderdag 17 september 2009

Forum & Ruby Lounge	Zaai: Forum	Zaai: E102	Zaai: E103	Zaai: E104	Zaai: E105/E106	Zaai: E107	Zaai: E108
Ontvangst & registratie							
09.00 - 09.45							
09.45 - 09.55	Opening						
09.55 - 11.00	plenair: <b>Botinterventies</b>						
11.00 - 11.30		Parallelsessie I <b>Abdominale/ Acute radiologie</b>	Parallelsessie II <b>Mammadiagnostiek</b>	Parallelsessie III <b>Cardiovasculaire radiologie 1</b>	Parallelsessie IV <b>Neurologische/ Hoofdhals radiologie</b>	Parallelsessie V <b>Interventieradiologie</b>	Emeritus sessie I <b>De geschiedenis van de Radiologie (deel 1)</b>
11.30 - 13.00		Refresher course II <b>Posterior fossa</b>	Refresher course III <b>'Is vet cool?' Bariatrische problematiek en leversteatosis</b>	Refresher course IV <b>Botscinigrafie (SPECT/CT) in de orthopedie</b>	Refresher course V <b>Coronaire calcium- score: wat moet de radioloog weten?</b>	Refresher course VI <b>Onderwijs is grensverleggend</b>	Emeritus sessie II <b>De geschiedenis van de Radiologie (deel 2)</b>
13.00 - 14.00							
14.00 - 15.15							
15.15 - 15.45							
15.45 - 16.00	Philipsprijs						
16.00 - 17.00	plenair: <b>Case Review Sessie</b>						
17.00 - 18.00	ALV thema: <b>Radiologie expertise centra in Nederland</b>						
18.00 - 19.30	Borrel						
v.a. 19.30	Aangeboden door: <b>AGFA</b>  Feestavond Strand Zuid						

## Vrijdag 18 september 2009

Forum & Ruby Lounge	Zaai: Forum	Zaai: E102	Zaai: E103	Zaai: E104	Zaai: E105/E106	Zaai: E107
Ontvangst & registratie						
08.15 - 08.45						
08.45 - 09.15	Richtlijn sessie I / II / III					
09.15 - 10.30	plenair: <b>lezing Ben Tiggelaar</b>					
10.30 - 11.00		Refresher course VII	Refresher course IX		Refresher course X	
11.00 - 12.15	<b>Interactieve BRADS training voor mammografie en MRI</b>	<b>Aortadissecties: diagnostiek en behandeling</b>	<b>Kinderoncologie</b>	<b>Topreferente radiologie in Nederland: een academisch overzicht</b>	<b>How to try not to be torn between ultrasound and MRI of the shoulder</b>	
12.15 - 13.30		Parallelsessie VI <b>Abdominale radiologie</b>	Parallelsessie VII <b>Thoraxradiologie/ Skeletradiologie</b>	Parallelsessie VIII <b>Cardiovasculaire radiologie 2</b>	Parallelsessie IX <b>Neurologische</b>	Parallelsessie X <b>Kinderradiologie/ Nucleaire radiologie</b>
13.30 - 15.00						
15.00 - 16.15	plenair: <b>Sessie Radio- logendagenprijs &amp; Lourens Penning Prijs, fellowshipdiploma's</b>					
16.15	Borrel					



Angio-Seal™ VIP  
Vascular Closure Device

Bioabsorbable Anchor

## ANCHORED PLACEMENT FOR CONSISTENT RESULTS.

The Angio-Seal™ VIP Vascular Closure Device features a fully bioabsorbable, intra-arterial anchor designed to enable faster, more reliable hemostasis. The anchor ensures precise placement and holds fast-absorbing collagen in place to create a secure, stable seal. The Angio-Seal Device is also easy to deploy, promoting consistency in successful vascular closure. **THIS IS VASCULAR CLOSURE.**

[www.sjm.com](http://www.sjm.com)



ST. JUDE MEDICAL™

MORE CONTROL. LESS RISK.

#### Rx Only

**Brief Summary:** Prior to using these devices, please review the Instructions for Use for a complete listing of indications, contraindications, warnings, precautions, potential adverse events, and directions for use.

**Indications:** St. Jude Medical Angio-Seal™ Vascular Closure Device product family, including the STS, STS Plus, and VIP platforms, is indicated for use in closing and reducing time to hemostasis at the femoral arterial puncture site in patients who have undergone diagnostic angiography procedures or interventional procedures using an 8 French or smaller procedural sheath for the 8F Angio-Seal™ device and a 6 French or smaller procedural sheath for the 6F Angio-Seal™ device. The Angio-Seal™ STS, STS Plus and VIP platform devices are also indicated for use to allow patients who have undergone diagnostic angiography to safely ambulate as soon as possible after sheath removal and device placement, as well as to allow patients who have undergone an interventional procedure to safely ambulate after sheath removal and device placement. Possible adverse events for vascular closure devices include, but are not limited to: bleeding or hematoma, AV fistula or pseudoaneurysm, infection, allergic reaction, foreign body reaction, inflammation, or edema.

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## Professionals werken met...



Standnummer

**19**

**NIEUW**

**ZILLION**  
PACS/RIS/XDS solutions by ROGAN-DELFT

## ...radiologie oplossingen van Oldelft Benelux

Oldelft Benelux staat bekend om haar innovatieve radiologie oplossingen. Zo was Oldelft Benelux de eerste met portable flatpanel detectoren en was zij de eerste ter wereld met een flatpanel C-boog.

De laatste innovatie van Oldelft Benelux is **Zillion: RIS/PACS/XDS** oplossingen voor de professional.

**Zillion** stroomlijnt de workflow en verbetert de communicatie op uw afdeling.

Hoe we dat doen, laten wij u graag zien op onze stand of in een persoonlijke demonstratie bij u op locatie.

Bezoek ons op [standnummer 19](#) om u te laten informeren over de laatste ontwikkelingen op uw vakgebied.



**Oldelft  
Benelux**