

15

16 EN 17 SEPTEMBER 2010

# RADIO LOGEN DAGEN

NH KONINGSHOF HOTEL, VELDHOVEN



SYLLABUS

Dames en heren van de NVvR,

Welkom op de Radiologendagen 2010!

Dit jaar betreft alweer het 3<sup>e</sup> lustrum en dus vanzelfsprekend dat u getraakteerd wordt met een gevarieerd en volwaardig programma, een uitzonderlijke start op woensdagavond en een knallende feestavond op de donderdagavond.

Het succes van de voorgaande edities in de Doelen te Rotterdam en de RAI te Amsterdam laat onverlet dat het organisatie comité meent dit jaar in het NH Koningshof Hotel te Veldhoven ook een uitstekende en ruime locatie gevonden te hebben voor deze bijeenkomst. De organisatie vindt wederom plaats in nauwe en gedegen samenwerking met Congress Company. In samenwerking met het wetenschappelijk comité is een boeiend programma samengesteld. In 10 refreshercourses, 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.

Op donderdagochtend beginnen we met het actuele onderwerp 'Hoofdzaken van de DWI'.

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. Het wetenschappelijk programma op donderdag zal worden afgesloten worden met een plenaire interactieve quiz, met het accent op infotainment.

En natuurlijk, donderdagavond, een heerlijk diner en groot feest met een geweldige band. De ideale gelegenheid om gezellig bij te praten met oude vrienden en nieuwe bekenden te ontmoeten!

De vrijdagochtend zal worden ingeluid door de topsporter Wilco van Rooijen, één van de weinige beroepsavonturiers die Nederland rijk is.

De geaccepteerde posters worden tentoongesteld op de expositie en zullen gedurende de lunchpauze op beide dagen worden toegelicht. Nieuw dit jaar is de plenaire Postersessie op vrijdagmiddag, waarin tevens de Posterprijs wordt uitgereikt door de geformeerde jury. De Radiologendagen 2010 zullen worden afgesloten met de sessie 'Best abstracts' en uitreiking van de Radiologendagenprijs. Aan het einde van deze sessie wordt ook de Lourens Penning Prijs uitgereikt 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 Medtronic, Philips, Sectra en Siemens als hoofdsponsors, hartelijk danken voor hun ondersteuning.

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

Het organiserend comité van de Radiologendagen 2010

**Bert-Jan de Bondt, voorzitter**

**Saskia Kolkman**

**Jan Albert Vos**

**Henk-Jan van der Woude**

## Organisatie

### ORGANISATIE COMITÉ

R.B.J. de Bondt, voorzitter

S. Kolkman

J.A. Vos

H.J. van der Woude

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### CONGRESSECRETARIAAT



Postbus 2428

5202 CK 's-Hertogenbosch

Tel 073 700 3500

Fax 073 700 3505

[info@congresscompany.com](mailto:info@congresscompany.com)

[www.congresscompany.com](http://www.congresscompany.com)




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# Woensdag 15 september 2010

Tijdstip	Onderwerp
19.00 – 20.00	Limburg Foyer Voorinschrijving
20.00 – 22.30	Baroniezaal <b>Wijnproeverij: exclusief aangeboden door</b> 

# Donderdag 16 september 2010

Tijdstip	Onderwerp
08.30 – 09.15	Limburg Foyer Ontvangst & registratie
09.15 – 09.30	Brabantzaal <b>Opening door voorzitter</b> R.B.J. de Bondt, Isala klinieken, Zwolle
09.30 – 10.30	Brabantzaal <b>Plenaire sessie: What's hot, what's new? Hoofdzaken van de DWI</b> Voorzitter: R.B.J. de Bondt, Isala klinieken, Zwolle Sprekers: J. Casselman, AZ Sint-Jan, Brugge-Oostende, België P. Parizel, Universitair Ziekenhuis Antwerpen, Edegem, België
10.30 – 11.00	Expositie Kempenhal Koffiepauze
11.00 – 12.30	<b>Parallelsessies Wetenschappelijke voordrachten</b> (Voorafgaand aan de wetenschappelijke voordrachten zal iedere sessie aanvangen met een keynote lecture) Auditorium <b>Sessie 1: Abdominale radiologie</b> Voorzitters: A.M. Spijkerboer, AMC, Amsterdam E.R. Ranschaert, Jeroen Bosch Ziekenhuis, 's-Hertogenbosch Keynote speaker: A.M. Spijkerboer, AMC, Amsterdam Zaal 80 <b>Sessie 2: Cardiovasculaire radiologie</b> Voorzitters: N.R.A. Mollet, Erasmus MC, Rotterdam M.F. Boomsma, Isala klinieken, Zwolle Keynote speaker: N.R.A. Mollet, Erasmus MC, Rotterdam Zaal 81 <b>Sessie 3: Interventieradiologie</b> Voorzitters: M.J.L. van Strijen, St. Antonius Ziekenhuis, Nieuwegein B.A.A.M. van Hasselt, Isala klinieken, Zwolle Keynote speaker: M.J.L. van Strijen, St. Antonius Ziekenhuis, Nieuwegein Zaal 82 <b>Sessie 4: Interventie-/ thorax-/ mammaradiologie</b> Voorzitters: C.E. van Die, Havenziekenhuis, Rotterdam M.W. Imhof-Tas, UMC St Radboud, Nijmegen Keynote speaker: C.E. van Die, Havenziekenhuis, Rotterdam Zaal 83 <b>Sessie 5: Musculoskeletale radiologie / Neuro- en Hoofdhals radiologie</b> Voorzitters: E.S. Sijbrandij, Isala klinieken, Zwolle A. van der Lugt, Erasmus MC, Rotterdam Keynote speaker: E.S. Sijbrandij, Isala klinieken, Zwolle
11.00 – 12.50	Baroniezaal <b>Radiologisch-historische sessie 1</b> Voorzitter: J. Vermeij <b>Onderzoek van Egyptische mummies: een historisch overzicht</b> Spreker: W.K. Iaconis <b>Geschiedenis mammografie</b> Sprekers: D.J. Dronkers & J.F.M. Panhuysen

Tijdstip	Onderwerp
	<p><b>Wie was Tesla?</b> Spreker: G. Rosenbusch</p> <p><b>Hendrik Zwaardemaker en zijn bioradioactiviteit. Een wetenschapshistorische verkenning van een experiment.</b> Spreker: K.J. Simon</p>
12.30 – 13.45	<p><b>Expositie Kempenhal</b> Lunch &amp; posterbezoek</p> <p><b>Brabantzaal</b> Satellietsymposium Philips Healthcare</p>
13.45 – 15.00	<p><b>Refresher courses</b> <b>Auditorium</b></p> <p><b>I: Bekkenbodemproblematiek</b> Voorzitter: B.M. Wiarda, Medisch Centrum Alkmaar, Alkmaar <b>MR Daefecografie: bekkenbodeminufficiëntie: basits, techniek en voorbeelden</b> Spreker: P. Seynaeve, AZ Groeninge / Universiteit Gent, België <b>Bekkenbodemproblematiek in de praktijk: casus met diagnostiek echo en MR en therapie</b> Spreker: K. Kluivers, UMC St Radboud, Nijmegen &amp; J. Fütterer, UMC St Radboud, Nijmegen <b>Zaal 80</b></p> <p><b>II: Mammadiagnostiek</b> Voorzitter: R.M. Pijnappel, Martini Ziekenhuis, Groningen <b>Birads 0 in de screening</b> Spreker: A. den Heeten, LRCB, Nijmegen <b>CAD</b> Spreker: N. Karssemeijer, UMC St Radboud, Nijmegen <b>Optimalisatie MRI van de mamma</b> Spreker: J. Veltman, UMC St Radboud, Nijmegen <b>Zaal 81</b></p> <p><b>III: Beeldvorming en behandeling van neuro-endocriene tumoren</b> Voorzitter: C.S.J. Duchateau, HagaZiekenhuis, Den Haag <b>Beeldvorming van neuro-endocriene tumoren: octreotide, MIBG en PE T tracers</b> Spreker: M.P.M. Stokkel, NKI-AvL, Amsterdam <b>Behandeling van neuro-endocriene tumoren</b> Spreker: B.L.R. Kam, Erasmus MC, Rotterdam <b>Zaal 82</b></p> <p><b>IV: Traumatisch schedel- en hersenletsel</b> Voorzitters: S.C.A. Steens, LUMC, Leiden M. Smits, Erasmus MC, Rotterdam <b>Pathofysiologie en radiologische bevindingen van traumatisch schedel-/hersenletsel</b> Spreker: P. Parizel, Universitair Ziekenhuis Antwerpen, Edegem, België <b>Beeldvorming bij schedel-/hersentrauma: wat verwacht de clinicus van ons?</b> Spreker: J. de Kruijk, Tergooiziekenhuizen, Hilversum <b>Waarom, wanneer en bij wie beeldvorming van schedel-/hersentrauma? De evidence.</b> Spreker: L. Van den Hauwe, AZ Klina, Brasschaat, België <b>Zaal 83</b></p> <p><b>V: Musculoskeletale radiologie</b> Voorzitter: P.R. Kornaat, Bronovo Ziekenhuis, Den Haag <b>MRI techniek</b> Spreker: J.L. Verwoerd, Philips Medical Systems, Best</p>
13.25 – 15.00	<p><b>Baroniezaal</b></p> <p><b>Radiologisch-historische sessie 2</b> Voorzitter: P.J. van Wiechen <b>Het archief</b> Spreker: J.F.M. Panhuysen <b>Het leven en werk van Wertheim Salomonson; het fonds en de medaille</b> Sprekers: K.J. Simon &amp; J. Vermeij <b>De 100e verjaardag van Prof. Dr. J.R. von Ronnen</b> Spreker: M. Oudkerk, UMC Groningen, Groningen <b>Oprichtingsvergadering van het Historisch Genootschap Radiologie: presentatie statuten, werving bestuursleden, overleg.</b> O.I.v.: C.J.L.R. Vellenga, ZGT Almelo, Almelo</p>
15.00 – 15.30	<p><b>Expositie Kempenhal</b> Theepauze</p>
15.30 – 16.00	<p><b>Brabantzaal</b></p>
16.00 – 16.45	<p><b>Uitreiking Philipsprijs</b> <b>Quiz</b> O.I.v.: J.A. Vos, St. Antonius Ziekenhuis, Nieuwegein &amp; H.J. van der Woude, OLVG, Amsterdam</p>
16.45 – 17.30	<p><b>Richtlijn sessie</b></p>
17.30 – 19.00	<p><b>Expositie Kempenhal</b> Borrel: exclusief aangeboden door <b>AGFA</b>  HealthCare</p>
19.00 – 02.00	<p><b>Beneluxhal</b> <b>Diner &amp; feest</b></p>

## Vrijdag 17 september 2010

Tijdstip	Onderwerp
08.00 – 08.30	<b>Limburg Foyer</b> Ontvangst & registratie
08.30 – 09.30	<b>Brabantzaal</b> Plenaire sessie: Topsporter aan het woord Voorzitter: M.F. Boomsma, Isala klinieken, Zwolle Spreker: Wilco van Rooijen, beroepsavonturier
09.30 – 10.45	<b>Refresher courses</b> <b>Auditorium</b> <b>VI: Aorta en multiorgaanimaging met CT en MRI en introductie richtlijn coronaire CT</b> Voorzitter: T. Leiner, UMC Utrecht, Utrecht <b>Imaging van de aorta met multislice CT: state of the art</b> Spreker: R.P.J. Budde, UMC Utrecht, Utrecht <b>Multiorgaan imaging met MRI bij patiënten met diabetes en hypertensie</b> Spreker: H.J. Lamb, LUMC, Leiden <b>Introductie richtlijn coronaire CT</b> Spreker: M. Oudkerk, UMC Groningen, Groningen <b>Zaal 80</b> <b>VII: Etaleren &amp; Presenteren</b> Voorzitter: H.J. Baarslag, Meander MC, Amersfoort <b>Kwaliteit van de opleiding/opleiders beoordeeld. En verbeterd?</b> Spreker: M.J.M.H. Lombarts <b>Publieksgericht presenteren</b> Spreker: K. Herrebout <b>Zaal 81</b> <b>VIII: Prospectieve gerandomiseerde interventie studies</b> Voorzitters: L.C. van Dijk, HagaZiekenhuis, Den Haag E. Ghazi, NKI-AvL, Amsterdam <b>Vertebroplastiek</b> Spreker: P.N.M. Lohle, St. Elisabeth Ziekenhuis, Tilburg <b>Nierstenting</b> Spreker: J.A. Reekers, AMC, Amsterdam <b>Carotisstenting</b> Spreker: H. van Overhagen, HagaZiekenhuis, Den Haag <b>Zaal 82</b> <b>IX: Thoraxradiologie</b> Voorzitters: I.J.C. Hartmann, Erasmus MC, Rotterdam <b>Pulmonary nodule: update</b> Spreker: W.M. Prokop, UMC St Radboud, Nijmegen <b>NSCLC: Nieuwe TNM stadiering</b> Spreker: I.J.C. Hartmann, Erasmus MC, Rotterdam <b>Longtumoren: rol van PET/CT in de work-up</b> Spreker: L. Meiss, Meander MC, Amersfoort <b>Zaal 83</b> <b>X: Spoedeisende radiologie op de kindertijd</b> Voorzitter: R.R. van Rijn, Emma Kinderziekenhuis - AMC, Amsterdam <b>Advanced Paediatric Life Support, wat de radioloog zou moeten weten</b> Spreker: N. McBeth Turner, Wilhelmina Kinderziekenhuis - UMC Utrecht, Utrecht <b>Een kind in de traumakamer, trauma van het skelet</b> Spreker: R.R. van Rijn, Emma Kinderziekenhuis - AMC, Amsterdam <b>Een kind in de traumakamer, thoraco-abdominaal trauma</b> Spreker: S.G.F. Robben, MUMC, Maastricht
10.45 – 11.15	<b>Expositie Kempenhal</b> Koffiepaauze
11.15 – 12.45	<b>Parallelsessies Wetenschappelijke voordrachten</b> <i>(Voorafgaand aan de wetenschappelijke voordrachten zal iedere sessie aanvangen met een keynote lecture)</i> <b>Auditorium</b> <b>Sessie 6: Neuro- en Hoofd-hals radiologie</b> Voorzitters: J. Hendrikse, UMC Utrecht, Utrecht M.E.S. Sprengers, AMC, Amsterdam Keynote speaker: J. Hendrikse, UMC Utrecht, Utrecht

Tijdstip

Onderwerp

Zaal 80

**Sessie 7: Cardiovasculaire radiologie / Nucleaire geneeskunde**

Voorzitters: M.J.W. Gotte, HagaZiekenhuis, Den Haag

C.S.J. Duchateau, HagaZiekenhuis, Den Haag

Keynote speaker: M.J.W. Gotte, HagaZiekenhuis, Den Haag

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**Sessie 8: Mammadiagnostiek**

Voorzitters: M.A.A.J. van den Bosch, UMC Utrecht, Utrecht

R.M. Pijnappel, Martini Ziekenhuis, Groningen

Keynote speaker: M.A.A.J. van den Bosch, UMC Utrecht, Utrecht

Zaal 82

**Sessie 9: Onderwijs & Diversen / Kinderradiologie**

Voorzitters: S.G.F. Robben, MUMC, Maastricht

R.A.J. Nievelstein, UMC Utrecht, Utrecht

Keynote speaker: S.G.F. Robben, MUMC, Maastricht

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**Sessie 10: Abdominale radiologie / Acute radiologie**

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

U.C. Lalji, MUMC, Maastricht

Keynote speaker: B.M. Wiarda, Medisch Centrum Alkmaar, Alkmaar

Expositie Kempenhal

Lunch & posterbezoek

12.45 – 13.45

Brabantzaal

**Postersessie & uitreiking Posterprijs**

13.45 – 14.15

14.15 – 15.30

**Sessie 'Best abstracts' & uitreiking Radiologendagenprijs**

**Value of DWI for treatment monitoring after chemoradiation in rectal cancer: can ADC be used as a parameter for response?**

Spreker: D.M.J. Lambregts, MUMC, Maastricht

**Dosisreductie in CT-coronairangiografie: effect op detectie van significante coronairstenosen**

Spreker: N. van der Bijl, LUMC, Leiden

**Characterization of dissected sentinel lymph nodes of breast cancer patients with high resolution 7 Tesla MRI**

Spreker: M.A. Korteweg, UMC Utrecht, Utrecht

**Late reopening of adequately coiled intracranial aneurysms: frequency and risk factors in 400 patients with 440 aneurysms**

Spreker: S.P. Ferns, AMC, Amsterdam

**De Voortgangstoets Radiologie (VGT), een betrouwbare en constructvalide kennistoets?**

Spreker: C.J. Ravesloot, UMC Utrecht, Utrecht

**Can short term feedback increase radiologist's performance using CAD for nodule detection in chest radiography?**

Spreker: D.W. de Boo, AMC, Amsterdam

**Uitreiking Lourens Penning Prijs**

**Uitreiking Fellowshipdiploma's**

Expositie Kempenhal

Afscheidsborrel

15.30

# Genomineerde abstracts voor de Radiologendagenprijs 2010

**BA01** **VALUE OF DWI FOR TREATMENT MONITORING AFTER CHEMORADIATION IN RECTAL CANCER: CAN ADC BE USED AS A PARAMETER FOR RESPONSE?**  
D.M.J. Lambregts, M. Maas, V.C. Cappendijk, F.C.H. Bakers, G.L. Beets, R.G.H. Beets-Tan  
*Maastricht University Medical Center, Maastricht*

**BA02** **DOSISREDUCTIE IN CT-CORONAIRANGIOGRAFIE: EFFECT OP DETECTIE VAN SIGNIFICANTE CORONAIRSTENOSEN**  
N. van der Bijl, R.M.S. Joemai, B.J.A. Mertens, A. de Roos, J. Geleijns, L.J.M. Kroft  
*Leids Universitair Medisch Centrum, Leiden*

**BA03** **CHARACTERIZATION OF DISSECTED SENTINEL LYMPH NODES OF BREAST CANCER PATIENTS WITH HIGH RESOLUTION 7 TESLA MRI**  
M.A. Korteweg, J.J.M. Zwanenburg, J.M. Hoogduin, P.J. van Diest, R. van Hillegersberg, W.P.Th.M. Mali, P.R. Luijten, W.B. Veldhuis  
*Universitair Medisch Centrum Utrecht, Utrecht*

**BA04** **LATE REOPENING OF ADEQUATELY COILED INTRACRANIAL ANEURYSMS: FREQUENCY AND RISK FACTORS IN 400 PATIENTS WITH 440 ANEURYSMS**  
S.P. Ferns<sup>1</sup>, M.E.S. Sprengers<sup>1</sup>, W.J.J. van Rooij<sup>2</sup>, W.H. van Zwam<sup>3</sup>, B.K. Velthuis<sup>4</sup>, G.A.P. de Kort<sup>4</sup>, J.D. Schaafsma<sup>4</sup>, R. van den Berg<sup>1</sup>, M. Sluzewski<sup>2</sup>, G.J.E. Rinkel<sup>4</sup>, C.B.L.M. Majolie<sup>1</sup>  
<sup>1</sup>*Academisch Medisch Centrum, Amsterdam*  
<sup>2</sup>*St. Elisabeth Ziekenhuis, Tilburg*  
<sup>3</sup>*Maastricht Universitair Medisch Centrum, Maastricht*  
<sup>4</sup>*Universitair Medisch Centrum Utrecht, Utrecht*

**BA05** **DE VOORTGANGSTOETS RADIOLOGIE (VGT), EEN BETROUWBARE EN CONSTRUCTVALIDE KENNISTOETS?**  
C.J. Ravestloot<sup>1</sup>, M.F. van der Schaaf<sup>2</sup>, Th.J. ten Cate<sup>1</sup>, C.L.J.J. Kruitwagen<sup>3</sup>, C. Haaring<sup>1</sup>, F.J.A. Beek<sup>1</sup>, J.P.J. van Schaik<sup>1</sup>  
<sup>1</sup>*Universitair Medisch Centrum Utrecht, Utrecht*  
<sup>2</sup>*Universiteit Utrecht, Faculteit sociale wetenschappen, Utrecht*  
<sup>3</sup>*Universiteit Utrecht, Faculteit geneeskunde, Utrecht*

**BA06** **CAN SHORT TERM FEEDBACK INCREASE RADIOLOGIST'S PERFORMANCE USING CAD FOR NODULE DETECTION IN CHEST RADIOGRAPHY?**  
D.W. de Boo, F. van Hoorn, J. van Schuppen, L. Schijf, M. Scheerder, N. Freling, O. Mets, C.M. Schaefer-Prokop  
*Academisch Medisch Centrum, Amsterdam*

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		Ghandi, A.	P10
		Ghaye, B.	04.2
		Gielkens, H.A.J.	010.1
		Gietema, H.A.	04.4
		Gilhuijs, K.G.	08.6
		Gils, M.J. van	02.6
		Ginneken, B.	04.4
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		Graaf, R. de	03.3
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		Groen, J.	010.8
		Groenewoud, J.H.	04.7
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		Haag, M.S.C.	09.5
		Haan, J.	05.8, 06.2
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		Haaring, C.H.	BA05
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		Hendrikse, C.A.	04.3
		Hendrikse, J.	01.8, 05.6, 05.7, 06.4, P01, P07
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		Herwerden, L.A. van	02.4
		Hightet, R.R.	09.2
		Hobbelink, M.G.G.	P04
		Hof, J.R.	06.8
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		Hofman, A.	07.3
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		Hooijen, M.J.H.H.	04.8
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## Samenvattingen Best Abstracts 2010

BA01

### VALUE OF DWI FOR TREATMENT MONITORING AFTER CHEMORADIATION IN RECTAL CANCER: CAN ADC BE USED AS A PARAMETER FOR RESPONSE?

D.M.J. Lambregts, M. Maas, V.C. Cappendijk, F.C.H. Bakers, G.L. Beets, R.G.H. Beets-Tan  
*Maastricht University Medical Center, Maastricht*

**Purpose:** To evaluate the value of ADC as a parameter for monitoring response to preoperative chemoradiation (CRT) in rectal cancer patients.

**Methods:** 30 locally advanced rectal cancer patients underwent neoadjuvant CRT followed by a 6-8 week time interval and subsequent surgery. All patients underwent MRI, including DWI (b-values 0,500,1000) before and 6-8 weeks after CRT. Mean ADC of the primary tumour was measured at both time-points. When after CRT no clear tumour/scar tissue could be identified, ADC of the primary tumour bed was measured. Histology was the standard reference. The relative

change ( $\Delta$ ) in ADC (%) after treatment, was compared for good and poor-responding tumours. A good response was defined as a histological tumour regression grade (TRG, Mandard) of 0-2 and a poor response as TRG 3-4.

**Results:** At histologic evaluation 17 patients had a TRG 0-2 and 12 patients a TRG 3-4. After chemoradiation, a significant increase in ADC was observed in all patients: mean pre-treatment ADC was  $1,11 \pm 0,22$  versus  $1,47 \pm 0,25 * 10^3$  mm<sup>2</sup>/s after treatment ( $p < 0,001$ ). The relative increase in ADC (%) was larger in the good responders (43% ADC-increase) than in the poor-responders (31%) but this difference was not statistically significant ( $p = 0,2$ ).

**Conclusion:**  $\Delta$ ADC tends to be higher for the good responders as compared to the poor responders to chemoradiation, although the difference was not significant. This could partly be attributed to the small number of patients. Larger studies will show whether relative changes in ADC will be useful to discriminate between good and poor-responding tumours.

BA02

### DOSISREDUCTIE IN CT-CORONAIRANGIOGRAFIE: EFFECT OP DETECTIE VAN SIGNIFICANTE CORONAIRSTENOSEN

N. van der Bijl, R.M.S. Joemai, B.J.A. Mertens, A. de Roos, J. Geleijns, L.J.M. Kroft  
*Leids Universitair Medisch Centrum, Leiden*

**Doel:** Evalueren in hoeverre verlaagde buisstroom (mA) instellingen de beoordeling van CT-coronairangiografie beïnvloedt.

**Materiaal en Methode:** Veertig patiënten die CT-coronairangiografie hadden ondergaan met retrospectief ECG-getriggerde 64-slice CT werden geïncludeerd. Inclusie vond plaats op basis van de aanwezigheid ( $n=20$ ) of afwezigheid ( $n=20$ ) van significante ( $\geq 50\%$ ) coronairstenosen (26 mannen, 14 vrouwen, gemiddelde leeftijd: 57 jaar). Beelden werden gereconstrueerd uit de ruwe CT data met buisstroom simulatie van 100%, 100%, 50%, 25% en 12.5%. De beelden werden op segment niveau en patiënt niveau beoordeeld op de aanwezigheid of afwezigheid van significante coronairstenosen. Beeldkwaliteit en diagnostische efficiëntie

(sensitiviteit, specificiteit, positief voorspellende waarde en negatief voorspellende waarde) werden bepaald.

**Resultaten:** Het gemiddelde dosis-lengte-product van de uitgangs CT (100% dosis) was  $927 \pm 192$  mGy-cm (man) en  $839 \pm 217$  mGy-cm (vrouw). De beeldkwaliteit en contrast-ruis verhouding nam significant af met de 25% en 12.5% dosis ( $P < 0,001$ ). Het aantal diagnostische segmenten nam significant af met de 25% en 12.5% dosis ( $P < 0,0001$ ). Sensitiviteit, specificiteit, positief en negatief voorspellende waarde voor identificatie van patiënten met  $\geq 50\%$  coronairstenose was voor de 50% dosis 90%, 90%, 90%, en 90%. Voor 25% was dit 55%, 85%, 79%, 65%, en voor de 12.5% dosis 25%, 95%, 83% en 56%. Onderschatting van het aantal patiënten met  $\geq 50\%$  coronairstenose was significant bij een buisstroom van 25% en 12.5% ( $P \leq 0,2$ ).

**Conclusie:** 50% buisstroom verlagings leidde niet tot significante verslechtering van diagnostische efficiëntie voor identificatie van  $\geq 50\%$  coronairstenosen. Beeldkwaliteit en diagnostisering van patiënten met  $\geq 50\%$  coronairstenosen nam significant af bij verdere dosisverlaging tot 25% en 12.5%.

BA03

## CHARACTERIZATION OF DISSECTED SENTINEL LYMPH NODES OF BREAST CANCER PATIENTS WITH HIGH RESOLUTION 7 TESLA MRI

M.A. Korteweg, J.J.M. Zwanenburg, J.M. Hoogduin, P.J. van Diest, R. van Hillegersberg, W.P.Th.M. Mali, P.R. Luijten, W.B. Veldhuis

Universitair Medisch Centrum Utrecht, Utrecht

**Purpose:** To characterize dissected axillary sentinel lymph nodes of breast cancer patients on 7 Tesla (7T) MRI and to correlate the findings with pathological analysis as a first step towards non-invasive staging of breast cancer in the future.

**Materials & Methods:** Inclusion; 27 consecutive breast cancer patients (stage  $\geq T2$ ), scheduled for a sentinel lymph node biopsy. Scan protocol; 3D T1-weighted fat-suppressed fast-field-echo (3D-T1W) [isotropic resolution 180  $\mu$ m] for morphological analysis and 2D T1-, 3D T2-, T2\*- and diffusion-weighted images for quantitative analyses. 3D nodal dimensions and presence of a fatty hilus were noted. The

nodes were mapped and dyed for correlation of MRI to pathology. Nodes were sliced, embedded, sectioned at 3 $\mu$ m, Haematoxylin & Eosin stained, and examined by a pathologist.

Statistical analyses; logistic regression analyses according to the generalized estimating equations method.

**Results:** All 95 nodes were matched to pathology. 23 nodes were malignant (24%). 72 were benign (76%). Figure 1 shows the quantitative analyses. 69% of benign and 65% of malignant nodes had a fatty center. On the 3D-T1W scans, lymph- and blood vessels, cortical fat, activated B-cell follicles and a metastasis in a lymph vessel were identified and correlated to pathology. Intranodal metastases could not be localized morphologically.

**Conclusion:** 7T MRI could not delineate the intranodal location of metastases, but there was a significant difference in T2 and T2\* relaxation times between metastatic and non-metastatic nodes. Also, the very high resolution scans allowed identification of structural nodal details and detection of a small in-transit metastasis inside a lymph vessel.

		Healthy	Metastatic	P-value
T1	Mean ( $\pm$ SD) ms	956 (309)	1071 (466)	0.13
T2*	Mean ( $\pm$ SD) ms	15 (2)	18 (4)	0.005
T2	Mean ( $\pm$ SD) ms	30 (3)	32 (7)	0.001
ADC	Mean ( $\pm$ SD) mm <sup>2</sup> /s	0.10 $\cdot$ 10 <sup>-3</sup> (0.1)	0.08 $\cdot$ 10 <sup>-3</sup> (0.1)	0.67
Wxhxd	Mean ( $\pm$ SD) mm <sup>3</sup>	761 (995)	1215 (1082)	0.14

**Figure 1.** Mean ( $\pm$  standard deviation (SD)) T1, T2, T2\*, apparent diffusion coefficient (ADC), width x height x depth (wxhxd) for all nodes.

Figure 1: Quantitative analysis for all lymph nodes

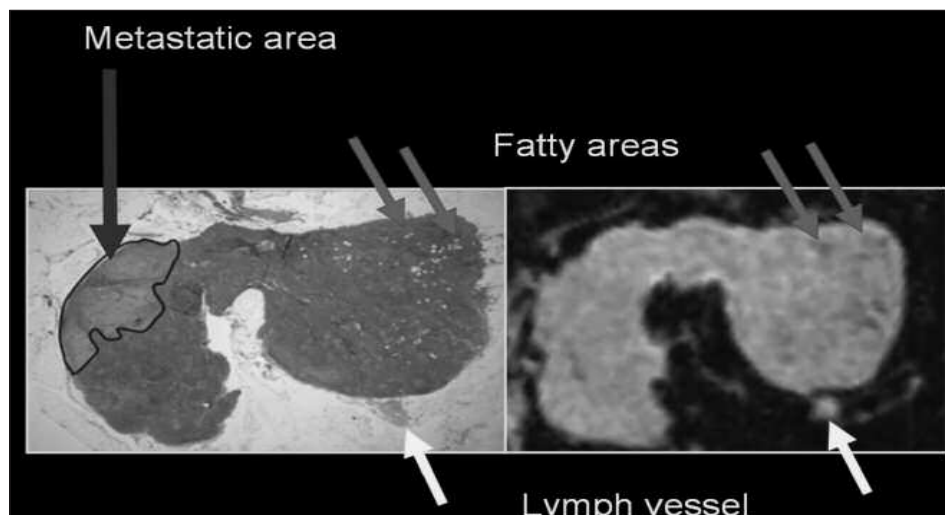


Image 1: Metastatic node on pathology slide and on 7T

BA04

## LATE REOPENING OF ADEQUATELY COILED INTRACRANIAL ANEURYSMS: FREQUENCY AND RISK FACTORS IN 400 PATIENTS WITH 440 ANEURYSMS

S.P. Ferns<sup>1</sup>, M.E.S. Sprengers<sup>1</sup>, W.J.J. van Rooij<sup>2</sup>, W.H. van Zwam<sup>3</sup>, B.K. Velthuis<sup>4</sup>, G.A.P. de Kort<sup>4</sup>, J.D. Schaafsma<sup>4</sup>, R. van den Berg<sup>1</sup>, M. Sluzewski<sup>2</sup>, G.J.E. Rinkel<sup>4</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>Maastricht Universitair Medisch Centrum, Maastricht

<sup>4</sup>Universitair Medisch Centrum Utrecht, Utrecht

**Background and Purpose:** In aneurysms that are adequately occluded 6 months after coiling, the risk of late reopening is largely unknown. We assessed frequency of late aneurysm reopening and possible risk factors.

**Methods:** From January 1995- June 2005, 1808 intracranial aneurysms were coiled in 1675 patients in 7 medical centers. At 6 months, 1066 aneurysms in 971 patients were adequately occluded. At mean 6.0 years after coiling, 400 patients with 440 aneurysms underwent 3 Tesla MRA to assess the occlusion status of the aneurysms. Frequency of aneurysm reopening and retreatment were calculated. Risk factors for late reopening were assessed by univariate and multivariate logistic regression analysis, including patient gender, rupture status of aneurysms, aneurysm size  $\geq 10$ mm, and aneurysm location.

**Results:** In 11 of 400 patients (2.8%, 95%CI:1.4-4.9%) with 440 aneurysms (2.5%, 95%CI:1.0-4.0%) late reopening had occurred; 3 reopened aneurysms were retreated (0.7%, 95%CI:0.2-1.5%). Independent predictors for late reopening were aneurysm size  $\geq 10$ mm (Odds Ratio (OR) 4.67, 95%CI:1.34-16.27), and location on basilar tip (OR 3.92,

	400 patients/ 440 aneurysms with long-term MRA follow-up	11 patients/ 11 aneurysms with aneurysm reopening	OR (95%CI), p
Women	276 (69%)	10 (91%)	4.66 (0.59-36.82), <b>0.14</b>
Mean age (yrs)	54.5	52.3	-
median, range	55, 23-70	54, 27-66	-
Ruptured aneurysms	344 (78%)	9 (75%)	1.26 (0.27-5.94), <b>0.77</b>
Mean size (mm)	6.5	8.8	-
median, range	6.0, 2-20	7.5, 3-20	-
Size $\geq 10$ mm	66 (15%)	5 (45%)	5.13 (1.52-17.32), <b>0.01</b>
Intraluminal thrombus	4 (1%)	1 (8%)	-
<i>Aneurysm location</i>			
Anterior circulation	327 (74%)	6 (55%)	-
ACA	143	0	-
MCA	44	2	-
ICA	140	4	-
Posterior circulation	113 (26%)	5 (45%)	2.51 (0.75-8.38), <b>0.14</b>
Basilar tip	61	4	3.73 (1.06-13.14), <b>0.04</b>

Figure 1: Patient and aneurysm characteristics

95%CI:1.05- 14.61). There were no late reopenings in 143 anterior cerebral artery aneurysms.

**Conclusions:** In patients with aneurysms that are adequately occluded at 6 months, the yield of long-term MRA follow-up for detection of reopened aneurysms that need

retreatment is very low. For these patients, extended imaging follow-up in the initial 5-10 years after coiling is in general not necessary. However, in the clinical context of the individual patient, longer follow-up may be considered in potential higher-risk patients.

BA05

### DE VOORTGANGSTOETS RADIOLOGIE (VGT), EEN BETROUWBARE EN CONSTRUCT-VALIDE KENNISTOETS?

C.J. Ravesloot<sup>1</sup>, M.F. van der Schaaf<sup>2</sup>, Th.J. ten Cate<sup>1</sup>, C.L.J.J. Kruitwagen<sup>3</sup>, C. Haaring<sup>1</sup>, F.J.A. Beek<sup>1</sup>, J.P.J. van Schaik<sup>1</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

<sup>2</sup>Universiteit Utrecht, Faculteit sociale wetenschappen, Utrecht

<sup>3</sup>Universiteit Utrecht, Faculteit geneeskunde, Utrecht

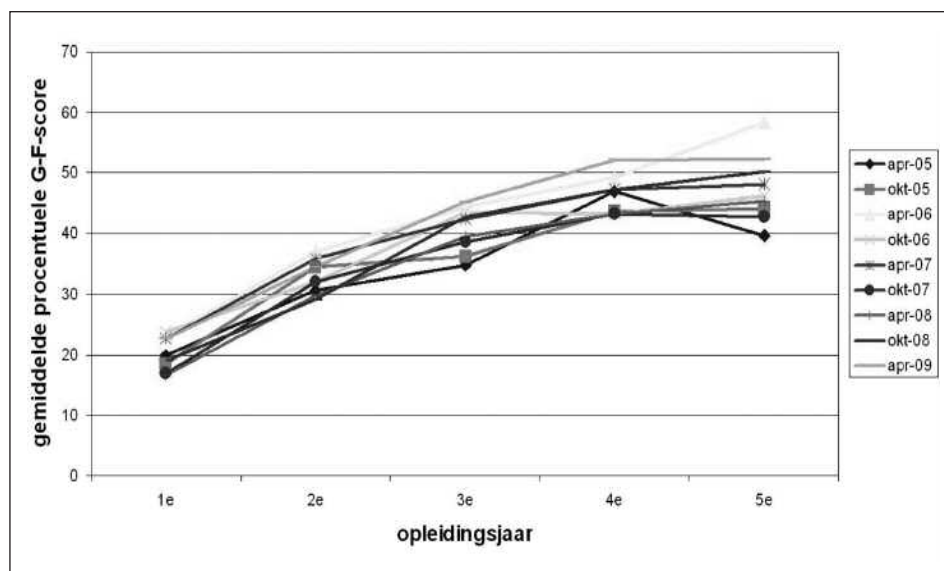
**Doel:** Voor de ontwikkeling tot medisch specialist is uitgebreide specialistische kennis noodzakelijk. Het evalueren van de kennisontwikkeling tijdens de opleiding is daarom van groot belang. In Nederland maken assistenten radiologie verplicht tweemaal per jaar de Voortgangstoets Radiologie (VGT). Er is nog weinig bekend over de validiteit en betrouwbaarheid van de VGT. Vooral inzicht in de construct validiteit van de VGT is essentieel, omdat dit facet van validiteit zich richt op in hoeverre de VGT meet wat ze beoogt te meten, namelijk de specialistische kennis van assistenten radiologie. Het valt te verwachten dat bij een constructvalide VGT ouderejaars assistenten hoger zullen

scoren op de VGT dan jongerejaars assistenten, omdat ze meer specialistische kennis hebben. In het onderzoek wordt deze verwachting nagegaan.

**Methoden:** De resultaten van negen toetsen van 2005 tot 2009 werden geïncludeerd. Per toets werden betrouwbaarheidsanalyses uitgevoerd. Daarna werden per toets verschillen in "goed-min-fout-toetscores"(G-F-scores) van assistenten uit de verschillende opleidingsjaren met variantieanalyses getoetst.

**Resultaten:** 2427 toetsresultaten van in totaal 525 assistenten radiologie uit 26 verschillende opleidingsziekenhuizen werden geanalyseerd. De Cronbachs alfa's voor alle toetsen lagen rond de 0.90. Bij ieder van de VGT's zien we dat de G-F scores gemiddeld hoger zijn naarmate de assistenten langer in opleiding zijn. Echter aan het eind van de opleiding vlak de kenniscurve af en is er tussen de laatste twee opleidingsjaren bij acht van de negen toetsen geen significant verschil in gemiddelde G-F-score meer.

**Discussie:** De VGT is een betrouwbare en constructvalide toets, waarbij vooral in de eerste opleidingsjaren de G-F-scores toenemen.



Figuur 1: Gemidd. G-F-scores (%) per opleidingsjaar per VGT

BA06

### **CAN SHORT TERM FEEDBACK INCREASE RADIOLOGIST'S PERFORMANCE USING CAD FOR NODULE DETECTION IN CHEST RADIOGRAPHY?**

D.W. De Boog, F. van Hoorn, J. van Schuppen, L. Schijf, M. Scheerder, N. Freling, O. Mets, C.M. Schaefer-Prokop  
*Academisch Medisch Centrum, Amsterdam*

**Purpose:** To assess whether short term feedback helps readers to increase their performance using CAD.

**Methods and Materials:** 140 patients; 56 with a solitary CT proven focal lesion and 84 negative controls were divided into four subsets that were read in different order by 6 readers with varying experience (1->15 years). Presence of lesions, their localization and diagnostic confidence using a 5 point ROC scale were scored without and with the availability of a commercially available CAD (xLNA Enterprise, Philips). All readers received individual feedback after the reading of each subset. Per reader sensitivity, specificity and Az-values were calculated for readings without CAD and

with CAD as second reader. Results for the readings with CAD were calculated with and without the possibility to discharge originally seen lesions.

**Results:** CAD had a stand-alone performance of 59% with an average of 1.9 FP per image. Detection rates of sessions 1+2 were compared with those of sessions 3+4 under the three reading conditions: without CAD, with CAD with discharge of originally seen lesions and with CAD without discharge of originally seen lesions. There was a general slight increase of sensitivity over time irrespective of the use of CAD (65%-70%, 66%-70% and 69%-71%, respectively). The mean Az non-significantly increased (0.76-0.82, 0.78-0.84 and 0.81-0.85). Specificity decreased over time under all three reading conditions (79%-74%, 80%-77% and 76%-74%).

**Conclusion:** Short term feedback does not significantly increase the ability of readers to differentiate between true and false positive candidate lesions in order to use CAD more effectively.

## Sessie 1

## Abdominale radiologie

Donderdag 16 september 2010, 11.00 - 12.30 uur

O1.1

**DIFFUSION-WEIGHTED MRI FOR THE DETECTION OF LOCALLY RECURRENT RECTAL CANCER**

D.M.J. Lambregts, M. Maas, V.C. Cappendijk, I.J.G. Rutten, G.L. Beets, R.G.H. Beets-Tan

*Maastricht University Medical Center, Maastricht*

**Purpose:** To assess the additional value of diffusion-weighted MRI (DWI) to standard T2W-MRI for the detection of a local recurrence after rectal cancer surgery.

**Materials and Methods:** 28 patients with clinical suspicion of a local recurrence (increased CEA, clinical symptoms and/or abnormal CT-findings) underwent MRI, consisting of standard T2-weighted FSE and additional DWI (DWIBS-method, b-values 0,500,1000) sequences. T2W+DWI fusion-images were generated on an offline workstation. A pelvic MR-expert scored the likelihood of tumour recurrence (using a confidence level score) first on T2W-FSE, then on T2W-

FSE + DWI and finally on T2W+DWI fusion-images. The reference standard consisted of histology (n=10), PET and/or endoscopy + clinical follow up.

**Results:** 12/28 patients had a local recurrence. All 12 were correctly identified, both on T2W-MRI and after addition of DWI (sensitivity 100%). On T2W-MRI, 2 patients without recurrence were overstaged (specificity 87%) but 1 out of these two was correctly staged after addition of DWI (specificity 93%). Fusion images did not improve accuracy compared to T2W+DWI, but were helpful for a better anatomical correlation with standard MRI. In 7 patients without recurrence, addition of DWI increased the reader's confidence in excluding a local recurrence.

**Conclusion:**

- Addition of DWI to standard T2W-MRI improves a radiologist's performance for excluding a local recurrence
- MR-fusion images do not improve accuracy, but are useful for a better anatomical correlation of DWI with standard T2W-MRI.

O1.2

**RIGHT SIDED COLONIC DIVERTICULITIS: HIGH FREQUENCY AND BENIGN NATURAL COURSE IN A WESTERN POPULATION**J.L.E. Tutein Nolthenius<sup>1</sup>, J.J. Hensen<sup>1</sup>, A. Marinelli<sup>2</sup>, O. Patho<sup>2</sup>, J.B.C.M. Puylaert<sup>2</sup><sup>1</sup>*Maasstad Ziekenhuis, Rotterdam*<sup>2</sup>*MCH Westeinde, Den Haag*

**Purpose:** Right sided colonic diverticulitis is common in Asian patients and is supposed to be rare in the Western population. Its clinical symptoms almost invariably mimic those of appendicitis. At exploratory laparotomy the diagnosis is not always clear, and in the majority of patients colonic resection is performed, because malignancy is suspected. Ultrasound (US) and computerized tomography (CT) have demonstrated a benign natural course in patients with right sided colonic diverticulitis, and some authors from Asian countries advocate conservative treatment. Nevertheless, there remains debate about the preferred treatment and even today most patients with right sided colonic

diverticulitis in Western countries are operated upon.

**Methods:** We conducted a retrospective study to all patients with right sided colonic diverticulitis in our institute over 23 years, and noted treatment and follow-up. Over this period we followed a policy of performing US in every patient with acute abdominal pain with optional CT.

**Results:** We found 110 patients with right sided colonic diverticulitis, of which 105 were treated conservatively with thin-liquid diet. Only six received antibiotics. There was complete recovery in all 105. Recurrence occurred in 9%, which again was treated conservatively with success.

**Conclusion:** Right sided colonic diverticulitis in the Western population is not rare with an incidence of one case for every 42 cases of appendicitis. It can be diagnosed reliably by US and/or CT, has a well-predictable, benign natural course and can safely be treated conservatively with only thin-liquid diet. Antibiotics are rarely necessary. Recurrence can again be safely treated conservatively.

01.3

### TUMOUR RESPONSE TO NEOADJUVANT CHEMORADIATION IN PRIMARY RECTAL CANCER: CAN POST-CHEMORADIATION MRI SELECT PATIENTS FOR LOCAL EXCISION?

M. Maas, D.M.J. Lambregts, S.M.E. Engelen, M.J. Lahaye, G. Lammering, R. Jansen, R.M. Van Dam, J.W.A. Leijten, J. Konsten, C.J.H. Van de Velde, G.L. Beets, R.G.H. Beets-Tan  
*Maastricht Universitair Medisch Centrum, Maastricht*

**Purpose:** Local excision (LE) could be considered in selected rectal cancer patients that show a good response to chemoradiation (ypT0-2 tumours), provided accurate selection of these patients is possible with MRI. The purpose of this study is to determine the accuracy of MRI for predicting post-chemoradiation T&N-stage and to evaluate whether MRI can select patients for LE after chemoradiation.

**Methods:** 79 locally advanced rectal cancer patients underwent neoadjuvant chemoradiation followed by restaging-MRI after a 6-8 week-interval and subsequent surgery. MRI consisted of axial/coronal/sagittal T2W-FSE, axial 3DT1WGRE & in 62 patients additional Ultrasmall Superparamagnetic Particles of Iron Oxide(USPIO) enhanced

3DT2\*-sequences. The post-chemoradiation T&N-stage was prospectively predicted with confidence level scoring by expert and non-expert radiologists. Histology was the gold standard. Receiver operator characteristics(ROC)-curve analyses were performed and accuracy figures were calculated.

**Results:** The 79 patients had 16 ypT0, 21 ypT1-2 and 42 ypT3-4 tumours. For selection of ypT0-2 area-under-the-ROC-curve(AUC) was 0.84 for the expert and 0.69 for the non-experts. Sensitivity, specificity, positive predictive value(PPV) and negative predictive value(NPV) were 46%,95%,90%,64% for the expert and 41%,88%,76%,60% for the non-experts, respectively. 62 patients (18ypN+, 44 ypN0) were evaluated for N-stage with USPIO-MRI. AUC for N-stage prediction was 0.90 for the expert and 0.72 for the non-experts. The sensitivity, specificity, PPV and NPV were 89%,80%,64%,95% for the expert and 73%,55%,37%,85% for the non-experts, respectively.

**Conclusion:** With a PPV of 80-90% for selection of ypT0-2-tumours and NPV of 85-95% for selection of ypN0-patients, post-chemoradiation-MRI is a useful tool for selection of good responders for LE.

01.4

### CAN RESTAGING-MRI IDENTIFY CHANGES IN NODAL DISTRIBUTION THAT MAY EXPLAIN A BETTER SELECTION OF THE YNO RECTAL CANCER PATIENTS?

M. Maas, D.M.J. Lambregts, U.C. Lalji, M. Berkhof, G.L. Beets, R.G.H. Beets-Tan  
*Maastricht Universitair Medisch Centrum, Maastricht*

**Purpose:** Recent publications show that MRI in rectal cancer is more accurate in selecting yN0-patients after chemoradiation(CRT) than in selecting the cN0-patients at primary-staging. This improved accuracy facilitates selection of patients for local excision after CRT. We aimed to evaluate whether changes in nodal distribution and size after CRT can explain this phenomenon.

**Methods:** We included 46 patients with locally advanced rectal cancer(LARC) who underwent preoperative CRT(group A) and 26 patients with non-LARC who underwent immediate surgery with/without preoperative 5x5Gy(group B). Group A underwent MRI before and 6-8 weeks after CRT, group B underwent pretreatment-MRI only. Nodes were

analysed on 3DT1W-GRE with 1mm<sup>3</sup> isotropic voxels. For each node, short axis diameter was measured. For group A, nodes were measured and matched on pre- and post-CRT MRI.

**Results:** In group A, 882 nodes were identified on pre-CRT-MRI, of which 380 (43%) disappeared after CRT. Mean number of nodes/patient decreased from 21(±9) pre-CRT to 13(±7) post-CRT (p<0.0001). Mean nodal size (mm) decreased from 3.8(±2) pre-CRT to 2.6(±1.8) post-CRT (p<0.0001). Mean size on pre-CRT-MRI of the 380 nodes that disappeared after CRT was smaller than that of the nodes that were still visible after CRT: 2.9(±1.4) vs. 3.8(±2.0)mm (p<0.0001). In group B 558 mesorectal nodes were visualized (mean 22(±11) nodes/patient).

**Conclusion:** Pretreatment number of nodes does not differ between LARC and non-LARC. After CRT, mean number and size of nodes decrease significantly. Most small nodes disappear after CRT. These findings may contribute to the fact that size-criteria work better for restaging-MRI after CRT.

01.5

## IN VIVO ANALYSIS OF HEPATIC LIPID COMPOSITION USING 3.0T MR SPECTROSCOPY IN A STEATOTIC RAT MODEL

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

**Purpose:** The in vivo assessment of hepatic lipid composition using 3.0T H-MRS in a steatotic rat model compared to histopathological and biochemical assessment.

**Methods:** Hepatic steatosis was induced by feeding rats a methionine/choline-deficient diet for 1,2,3,5 or 7 weeks (n=5 per group). At the end of the diet period H-MRS of the liver was performed and rats were sacrificed for histopathological and biochemical assessment of the liver. From the MR spectra ratios were calculated to assess hepatic lipid composition.

**Results:** During diet periods, hepatic steatosis significantly increased on histopathology (p<0.001). The unsaturated fatty acids at H-MRS (5.4/4.65ppm) correlated with biochemical assessed unsaturated fatty acids (r=0.913,p<0.001). Polyunsaturated fatty acid ratio assessed with H-MRS (2.8/4.65ppm) strongly correlated with biochemical polyunsaturated fatty acids (r=0.921,p<0.001). Polyunsaturated fatty acids at H-MRS showed best correlation with omega-6 polyunsaturated fatty acids (r=0.939,p<0.001) and the degree of lobular inflammation (r=0.506,p=0.023). Linoleic acid is the most predominant omega-6 polyunsaturated fatty acid and was strongly correlated to polyunsaturated fatty acids at H-MRS (r=0.929,p<0.001).

**Discussion:** 3.0T H-MRS is able to non-invasively measure (poly)unsaturated fatty acids and this strongly correlates with biochemical assessment. Correlation with polyunsaturated fatty acids could provide a non-invasive predictive parameter in non-alcoholic fatty liver disease.

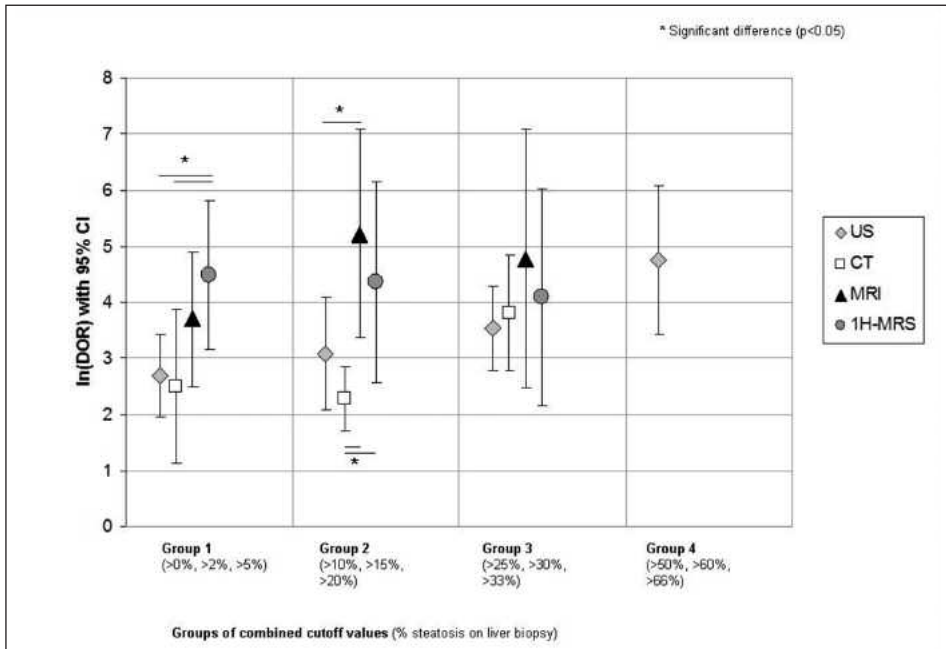
01.6

## THE DIAGNOSTIC ACCURACY OF US, CT, MRI AND 1H-MRS FOR THE EVALUATION OF HEPATIC STEATOSIS COMPARED TO LIVER BIOPSY: A META-ANALYSIS

A.E. Bohte, J.R. van Werven, S. Bipat, J. Stoker  
Academisch Medisch Centrum, Amsterdam

**Objective:** To meta-analyze the diagnostic accuracy of US, CT, MRI and 1H-MRS for the evaluation of hepatic steatosis.

**Methods:** From a comprehensive literature search in MEDLINE, EMBASE, CINAHL and Cochrane (until November 2009), articles were selected that investigated the diagnostic performance of US, CT, MRI and/or 1H-MRS for evaluation of hepatic steatosis.



**Table 1:** Comparison of logarithmic diagnostic odds ratios

ting hepatic steatosis with histopathology as the reference standard. Cutoff values for the amount of steatosis as positive on liver biopsy were subdivided into subgroups (group 1: >0% to >5% steatosis; group 2: >10% to >20%; group 3: >25% to >33%; group 4: >50% to >66%). Per group, summary estimates for sensitivity and specificity were calculated. The natural-logarithm of the diagnostic odds ratio (lnDOR) was used as a single indicator of test performance.

**Results:** 46 articles were included (US [n=28], CT [n=12], MRI [n=10], 1H-MRS [n=5]). Mean sensitivity estimates for

subgroups ranged between 73.3%-90.5% (US), 46.1%-72.0% (CT), 82.0%-97.4% (MRI) and 72.7%-88.5% (1H-MRS). Mean specificity ranges were 69.6%-85.2% (US), 88.1%-94.6% (CT), 76.1%-95.3% (MRI) and 92.0%-95.7% (1H-MRS). Overall performance (lnDOR) of MRI and 1H-MRS was better than US and CT for all subgroups, with significant differences in group 1 and 2.

**Conclusion:** MRI and 1H-MRS can be considered as techniques of choice for accurate evaluation of hepatic steatosis.

01.7

### BLADDER DETRUSOR ENDOMETRIOSIS: MR IMAGING CHARACTERISTICS AND DIAGNOSTIC COMPARISON WITH TRANSVAGINAL SONOGRAPHY

M.P.H. Busard, A.B. Luchinger, V. Mijatovic, M.C.G. Bleeker, R. Schats, I.C. Pieters-van den Bos, C. van Kuijk, P.G.A. Hompes, J.H.T.M. van Waesberghe  
*VU medisch centrum, Amsterdam*

**Purpose:** The aim of this study was to compare magnetic resonance (MR) imaging and transvaginal sonography (TVS) for diagnosis of bladder endometriosis and to correlate MR findings with histopathology in patients that underwent surgery.

**Materials and Methods:** In a single-center, retrospective study (2004-2009), 515 consecutive patients analysed because of suspected or known deep infiltrating endometriosis (DIE) were studied for the presence of bladder endometriosis. Inter-rater agreement was calculated. MR studies revealing bladder endometriosis were analysed by two experienced readers (location, size, signal intensity, uterine involvement and presence of cysts). MR imaging was com-

pared with TVS, performed by an experienced gynecologist (presence, location, size). Histopathology was correlated in 8 patients that underwent partial bladder resection.

**Results:** Bladder endometriosis was diagnosed in 38 patients on MR imaging. Calculated inter-rater agreement was 0.72. Most lesions showed inhomogeneous isointensity compared to muscle with foci of high signal intensity on T2- and T1-weighted imaging. Small (submucosal) cysts were present within 23 lesions, which were confirmed at histopathology in 4 out of 5 lesions of patients that underwent surgery. At TVS, 24% lesions were not detected, with undetected lesions being significantly smaller compared to lesions detected by TVS ( $p=0.015$ ). Uterine involvement was found in 89% lesions. Presence of adenomyosis in continuity was found in only 4 lesions.

**Conclusion:** MR imaging is useful to diagnose bladder endometriosis and provide a roadmap to surgery. Uterine involvement is frequent with no evidence for associated adenomyosis. TVS is a useful primary modality, although smaller lesions may be missed.

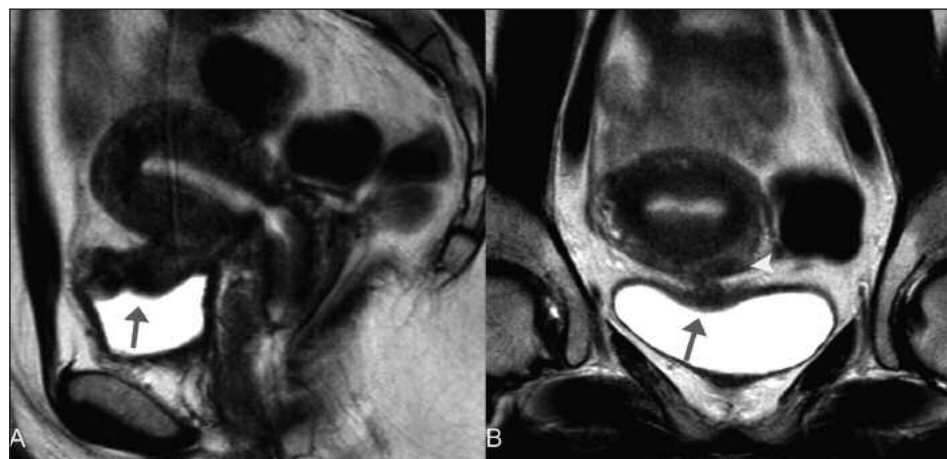


Image 1: Bladder endometriosis with uterine involvement

01.8

## DUAL PHASE CONTRAST IN MDCT: LIVER ENHANCEMENT IN 3 SPLIT-BOLUS PROTOCOLS

I. ten Katen, M.S. van Leeuwen, J. Hendrikse  
Universitair Medisch Centrum Utrecht, Utrecht

**Objective:** To compare vascular and parenchymal enhancement in three split-bolus MDCT protocols used in our institution. The enhancement values were compared with a conventional single-phase CT abdomen and the portovenous phase of a 3-phase liver.

**Subjects and methods:** A retrospective analysis was performed on data obtained by a split-bolus CT intravenous pyelogram, a split-bolus CT Thorax (including liver) and a split-bolus trauma protocol. Enhancement values of the large vessels, liver, spleen and kidneys were compared with values found in a conventional CT abdomen and the portovenous phase of a 3-phase liver CT. The time-line and para-

eters of the injection protocols are shown in figure 1. There were 25 examinations evaluated for all mentioned protocols. All scans were performed on a 64-slice MDCT.

**Results:** Significant lower enhancement values of the liver parenchyma were found for the CT IVP protocol ( $68 \pm 22$  HU) compared to the enhancement of the single-phase CT abdomen ( $108 \pm 20$  HU,  $p < 0.01$ ) and the portovenous phase of a 3F-liver CT ( $111 \pm 28$  HU,  $p < 0.01$ ). No difference was found between liver enhancement of the split-bolus CT thorax-liver ( $98 \pm 16$  HU) and CT trauma protocol ( $92 \pm 16$  HU) compared to the conventional single-phase CT abdomen and the portovenous phase of a 3F-liver CT.

**Conclusion:** The split-bolus CT thorax-liver and the CT trauma protocol provided sufficient enhancement of the liver. In the split-bolus CT IVP protocol (with a 4.5 min delay after start of the first injection) the liver doesn't enhance enough for optimal assessment.

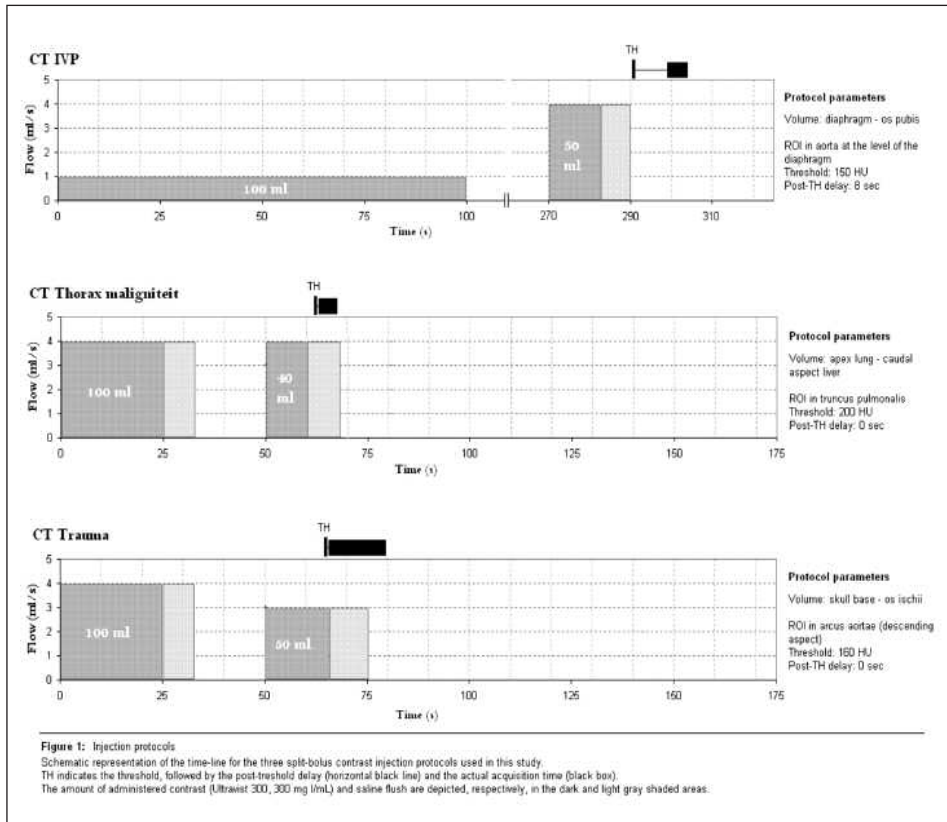


Figure 1: Injection protocols

## Sessie 2

## Cardiovasculaire radiologie

Donderdag 16 september 2010, 11.00 - 12.30 uur

O2.1

**INCREASED EPICARDIAL ADIPOSE TISSUE VOLUME IN IMPAIRED GLUCOSE TOLERANCE AND TYPE 2 DIABETES MELLITUS IS ASSOCIATED WITH SEVERITY OF CORONARY ATHEROSCLEROSIS**T. Leiner<sup>1</sup>, J.H.M. van den Broek<sup>2</sup>, I.A.P.G. Joosen<sup>2</sup>,M. Versteijlen<sup>2</sup>, L. Hofstra<sup>2</sup>, J.E. Wildberger<sup>2</sup><sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht<sup>2</sup>Maastricht Universitair Medisch Centrum, Maastricht

**Purpose:** Patients with impaired glucose tolerance (IGT) and type 2 diabetes mellitus (DM2) suffer from 2-4 fold higher cardiovascular mortality compared to normoglycaemic patients. We examined the hypothesis that in patients with IGT and DM2 increased amounts of epicardial adipose tissue are associated with more severe coronary artery disease (CAD).

**Method and Materials:** Coronary plaque burden was assessed in 174 patients referred for imaging of the coronary arteries to rule out CAD. EAT was estimated by measuring the amount of adipose tissue within the pericardium

using ImageJ software. CAD was classified in each of 16 coronary artery segments as mild (diameter stenosis <50%; 1 point), moderate (50%-70% stenosis; 2 points), or severe (diameter stenosis >70%; 3 points). Total CAD burden per patient was expressed as the sum of all points divided by the number of assessable segments.

**Results:** 61 patients had normal glucose metabolism, 56 IGT and 57 DM2. Mean( $\pm$ SD) fat volumes were 76.9 $\pm$ 30.4 (normoglycaemia group), 85.4 $\pm$ 29.3 (IGT group) and 94.3 $\pm$ 33.6 (DM2 group) mL, respectively ( $p=0.018$ ). Increased EAT was also independently and significantly associated with higher CAD burden (ANOVA;  $p=0.03$ ), although there was no significant difference with regard to the presence of >50% coronary stenosis ( $p>0.05$ ). 34% of patients with normoglycaemia, 25% of patients with IGT and 17.5% DM2 were free of CAD ( $p=0.03$ ).

**Conclusion:** An increased amount of epicardial adipose tissue is a proxy measure for the presence of an increased coronary atheroma burden in patients with impaired glucose tolerance and type 2 diabetes compared to patients with normoglycaemia.

O2.2

**IS THERE A GENDER DIFFERENCE IN THE DIAGNOSTIC ACCURACY OF MULTI SLICE CT CORONARY ANGIOGRAPHY FOR THE DETECTION OF CORONARY ARTERY DISEASE?**

A.S. Dharampal, A.C. Weustink, A. Rossi, L.A.E. Neefjes,

S.L. Papadopolou, C.H. Chen, M.L. Dijkshoorn,

N.R.A. Mollet, H. Boersma, G.P. Krestin, P.J. de Feyter

Erasmus Medisch Centrum, Rotterdam

**Purpose:** The purpose of this study was to examine whether there is a gender difference in diagnostic accuracy of CT coronary angiography (CTCA) for the detection of coronary artery disease (CAD).

**Methods:** We studied 916 symptomatic patients (636 males and 280 females) who underwent 64-slice CTCA with invasive coronary angiography as reference standard. The

patients had no history of CAD. Segments were scored as obstructive in presence of  $\geq 50\%$  lumen diameter narrowing. Sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV) and diagnostic odds ratio (DOR) were calculated on patient level. Adjusted values were calculated for the differences in gender variables. The diagnostic accuracy was compared between the genders with the use of independent Student t-test. P-values < 0.05 were considered significant.

**Results:** Males were significantly younger than females (60.0 vs 62.7 years) and had a higher prevalence of obstructive disease (76% vs 60%). Sensitivity in males was not significantly different from females (99% vs 98%). The specificity in males was also not significantly different from females (82% vs 78%). There was no significant difference in NPV between males and females (98% vs 97%). The PPV was significantly different between males and females

(95% and 87%). The DOR was not significantly different between males and females.

**Conclusion:** CTCA can exclude obstructive CAD with a high

diagnostic accuracy with no significant gender difference. The detection of obstructive disease on patient level is similar in males and females. The PPV is higher in males due to the higher prevalence of disease.

02.3

## MODERATELY IMPAIRED RENAL FUNCTION IS A PREDICTOR OF INCREASED CORONARY PLAQUE BURDEN IN PATIENTS WITH SUSPECTED CORONARY ARTERY DISEASE

T. Leiner<sup>1</sup>, F. Schipho<sup>2</sup>, M. Versteven<sup>2</sup>, I.A.P.G. Joosen<sup>2</sup>,

L. Hofstra<sup>2</sup>, J.E. Wildberger<sup>2</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

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

**Purpose:** We studied the prevalence of coronary artery disease (CAD) in patients with mild and moderately impaired renal function.

**Method and Materials:** We assessed coronary calcium scores (CCS) as well as coronary plaque burden in 1314 patients (mean age: 57 yrs; 719 males) referred for ruling out CAD. CAD was classified as wall irregularities, non-significant (<70%) or significant (≥70%) luminal narrowing. The relative risk of coronary atherosclerosis was assessed for four groups of patients based on their eGFR as determined

by the MDRD equation, namely: 1) eGFR<45, 2) 45≤eGFR<60, 3) 60≤eGFR<90, and 4) eGFR≥90.

**Results:** There were 27, 144, 867 and 276 patients in groups 1-4, respectively. CCS and coronary plaque burden increased with decreasing renal function. The relative risks (95%CI) for CCS>0 were 1.81 (1.45-1.95), 1.40 (1.19-1.61) and 1.13 (0.99-1.29) for patients in groups 1-3, respectively, compared to patients in group 4 (p<0.001 for groups 1-2 versus group 4). Decreasing renal function was also associated with an increased risk for the presence of significant coronary plaques. The relative risks for significant plaque were 3.16 (1.82-4.94), 1.91 (1.27-2.85) and 1.20 (0.86-1.68) for patients in groups 1-3, respectively, compared to patients in group 4 (p<0.001 for groups 1 and 2 versus group 4).

**Conclusion:** The relative risk of CAD as manifested by elevated CCS or presence of significant coronary plaques is significantly higher in patients with moderately impaired renal function (30≤eGFR<60), compared to patients with normal or mildly impaired renal function (eGFR≥60).

02.4

## PROSTHETIC HEART VALVE ASSESSMENT BY MULTISLICE CT: IMAGE QUALITY OF DIFFERENT VALVE TYPES

J. Habets<sup>1</sup>, P. Symersky<sup>2</sup>, L.A. van Herwerden<sup>1</sup>,

B.J.A.M. de Mol<sup>3</sup>, W.P.Th.M. Mali<sup>1</sup>, R.P.J. Budde<sup>1</sup>

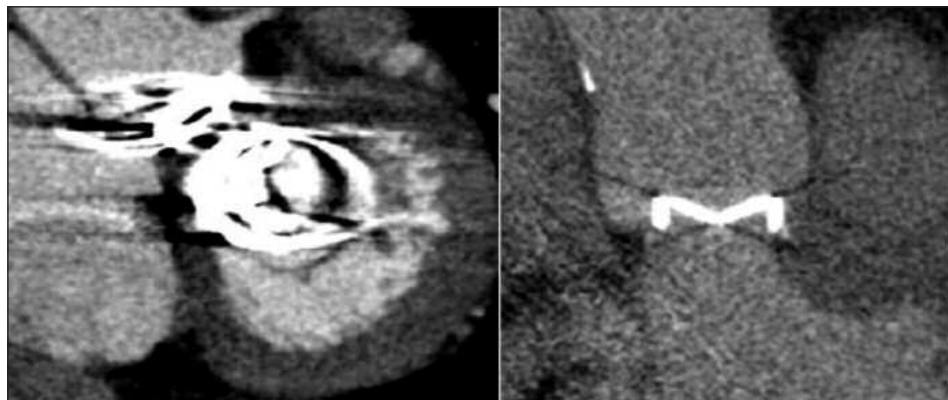
<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

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

<sup>3</sup>Academisch Medisch Centrum Amsterdam, Amsterdam

**Purpose:** CT is a promising technique for prosthetic heart valve (PHV) assessment that may complement echocardiography and replace fluoroscopy. Little is known about the CT appearance of different valve types. We assessed the CT image quality of different PHV types to determine which PHV's are suitable for CT evaluation.

**Method and Materials:** We reviewed all ECG-gated CT's performed in our institution since 2003 for the presence of



**Image 1:** Bjuork Shiley: severe artefacts (left), Carbomedics: limited artefacts (right)

PHV. Images of the closed PHV were reconstructed in 3 perpendicular imaging planes. Image quality of the supra-avalvular, valvular, subvalvular and perivalvular regions was scored on a four-point scale (1=non-diagnostic, 2=moderate, 3=good and 4=excellent) by a single observer.

**Results:** Fifty-two patients with a total of 63 PHV were included: 46 mechanical valves (38 bileaflet valves and 8 tilting discs) of 8 different manufacturers and 17 biological valves. Scans were performed on a 16-slice (n=1), 64-slice (n=8) or 256-slice (n=44) scanner (one patient scanned twice with different valves). Mean heart rate was  $73 \pm 19$

(mean $\pm$ SD). PHV's were positioned in the aortic (n=45), mitral (n=15), pulmonary (n=1) and tricuspid (n=2) position. Mean image quality scores for the supra-, peri-, sub- and valvular regions were (3.7, 3.8, 3.6, 3.8, respectively) for bileaflet valves (n=38); (3.5, 3.8, 3.8, 3.8, respectively) for Medtronic Hall valves (n=4); (1.0, 1.0, 1.0, 1.0, respectively) for Björk Shiley PHV (n=4) and (3.6, 3.9, 3.9, 3.1, respectively) for biological valves.

**Conclusion:** Most common implanted PHV are associated with good or excellent image quality of the supra-, peri-, sub- and valvular anatomy on multislice CT.

02.5

### **DETECTION OF AORTIC AND MITRAL VALVE DISEASE IN PATIENTS WITH AN ABDOMINAL AORTIC ANEURYSM ON ROUTINE PREOPERATIVE CT**

O.A.M. Kessels<sup>1</sup>, R.P.J. Budde<sup>2</sup>, S. Meijer<sup>2</sup>, M.J.M. Cramer<sup>2</sup>, M. Prokop<sup>2</sup>, F.L. Mol<sup>2</sup>, W.P.Th.M. Mali<sup>2</sup>

<sup>1</sup>Ziekenhuisgroep Twente, Almelo

<sup>2</sup>Universitair Medisch Centrum Utrecht, Utrecht

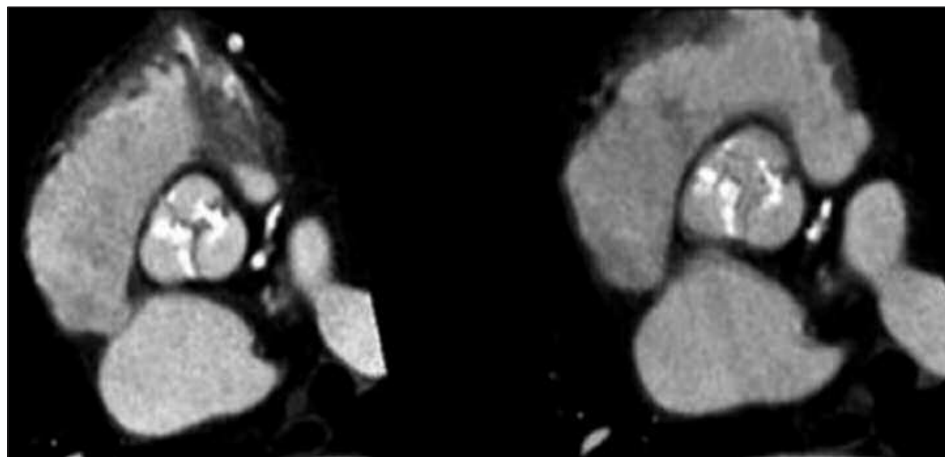
**Introduction:** Patients with abdominal aortic aneurysm (AAA) routinely undergo non  $\beta$ -blocked preoperative thoraco-abdominal ECG-gated multidetector-row computed tomography (MDCT) in our hospital to evaluate the entire aorta. From the same scan we reconstructed and analyzed the aortic and mitral valve (AoV, MV) to determine the feasibility of detecting AoV and MV disease in AAA patients.

**Methods:** Seventy-four consecutive patients that underwent 64- or 256-slice ECG-gated MDCT prior to AAA repair were retrospectively evaluated. Systolic and diastolic reconstructions of the AoV and MV were made in 3 perpendicular

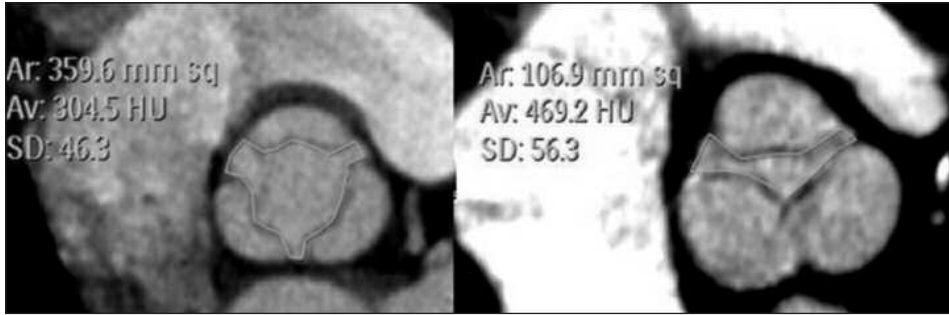
imaging planes. Valvular image quality (non-diagnostic, poor, moderate or good) and the presence of valvular calcifications (none, limited, moderate, severe) were scored. Maximal AoV opening area (AVA) was measured by tracing the lumen in the systolic in plane images. Central leaflet non-coaptation was scored as valve insufficiency.

**Results:** Mean patients age was 72,4 years (range 56-88 years). Mean initial heart rate 70 beats per minute. AoV and MV image quality was moderate or good in all patients. No, limited, moderate or severe calcifications were seen in 35(47%), 25(33%), 13(18%) and 1(1%) of AoV and 61(82%), 6(8%), 7(9%), 0(0%) of MV, respectively. AVA was measurable in 71 patients. Mean AVA was 3,2 cm<sup>2</sup>(range 1.2-5.5), with 11 patients having an AVA 1.5-2.5cm<sup>2</sup>(15%) and 2 having an AVA <1,5cm<sup>2</sup>(3%). AoV insufficiency was seen in 12 patients,.

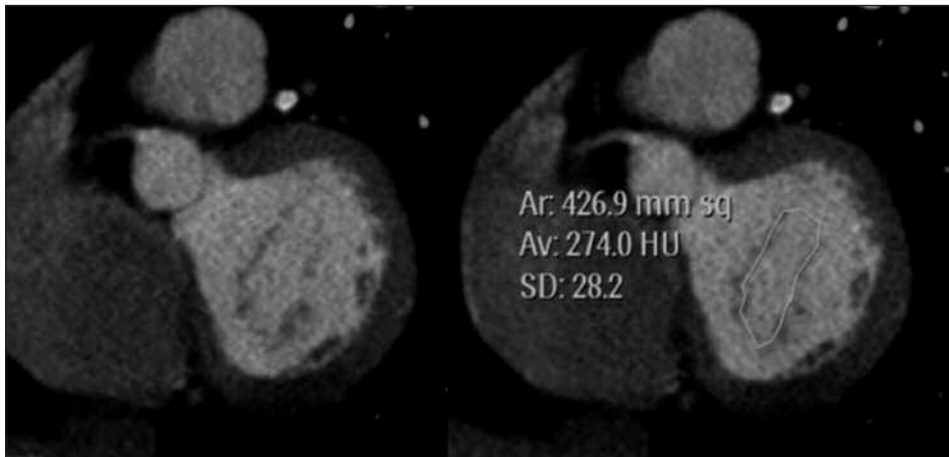
**Conclusion:** Preoperative non  $\beta$ -blocked thoraco-abdominal ECG-gated MDCT allows concomitant assessment of the aortic and mitral valve in AAA patients. Cardiac analysis on routine scans may play a role in preoperative risk assessment.



**Image 1:** Aortic valve in plane calcified and gr 2 stenosis



**Image 2:** Aortic valve in plane normal opening measurement



**Image 3:** Mitral valve in plane normal opening

02.6

## **CARDIOVASCULAR RISK FACTORS ARE NOT ASSOCIATED WITH PROGRESSION OF CALCIFICATIONS IN CAROTID ATHEROSCLEROTIC PLAQUES IN SYMPTOMATIC PATIENTS**

M.J. van Gils, L.G.M. Cremers, P.J. Homburg, D.W.J. Dippel, A. van der Lugt

*Erasmus Medisch Centrum, Rotterdam*

**Purpose:** Calcified plaques in stenotic carotid arteries are less likely to be symptomatic than non-calcified plaques. Determinants of calcium progression are still uncertain. In this study we serially assessed growth of calcifications in carotid plaques on Multi-detector CT Angiography (MDCTA) and evaluated the association between cardiovascular risk factors and calcium progression.

**Methods:** We quantified calcium volumes (threshold >600 HU) in a 6-cm range around the carotid bifurcation in 76 TIA/stroke patients who had undergone two MDCTAs. Changes in calcium volume over time were measured and annual calcium growth rate was correlated with

cardiovascular risk factors.

**Results:** Mean time interval between MDCTAs was  $22.3 \pm 13.8$  months. Median baseline calcium volume in the 76 patients was  $4.4 \text{ mm}^3$  (interquartile range (IQR) 0.0-24.6). Twenty-seven patients had no calcification at baseline. Six patients developed some calcification (median annual growth  $0.44$ , IQR 0.1-1.1  $\text{mm}^3$ ), whereas 21 had no calcification at follow-up. Median annual growth in the 49 patients with calcified plaque at baseline was  $2.9 \text{ mm}^3$  (IQR 0.5-9.3). Calcium volumes in the whole group were significantly higher at follow-up (median  $7.3 \text{ mm}^3$ ) than at baseline ( $p < 0.0001$ ). Age and baseline calcium volume were significantly associated with the upper quartile of annual calcium growth (range 19.5-165.2  $\text{mm}^3$ ) (OR=1.06, 95%-CI=1.01-1.12 and OR=1.02, 95%-CI=1.00-1.26 respectively). No associations with classical cardiovascular risk factors were found.

**Conclusion:** Except for high age and larger baseline calcium volume, no associations were found between cardiovascular risk factors and the upper quartile of annual calcium growth in the carotid atherosclerotic plaque.

02.7

### STIMULANT INDUCED LEFT VENTRICULAR HYPERTROPHY IN STRENGTH ATHLETES ON CARDIAC MRI

T. Luijckx, B.K. Velthuis, M.J.M. Cramer, W.P.Th.M. Mali  
Universitair Medisch Centrum Utrecht, Utrecht

**Purpose:** Cardiac MRI (CMR) is often used to distinguish physiologic cardiac adaptation in athletes from cardiomyopathies when screening remains inconclusive. Earlier research, both with echocardiography and CMR, is ambivalent on the nature of cardiac changes in strength athletes. In an attempt to clarify possible causes of observed ventricular wall thickening in strength athletes we investigated strength athletes either admitting or denying the use of stimulants and compared them with non-athletes.

**Methods:** 91 men aged 18-40 years underwent CMR (mean age 27±5 years): 72 non-athletes (0-3 hrs/wk training) and 20 strength athletes (>6 hrs/wk training, 7 weightlifting, 8 powerlifting, 4 strongman, 1 bodybuilding) of which 4 admitted and 16 denied the use of stimulants. Blinded observers experienced in cardiac MRI used a reproducible contour tracing protocol for the assessment of volumes, function, and wall mass.

**Preliminary results:** Whereas non-using strength athletes show hardly any difference in cardiac dimensions as compared to non-athletes, the stimulant-using strength athletes show an increased LV diameter (although no increased LV ED volume), LV wall mass and ventricular septum thickness.

**Conclusions:** Although the number of subjects is low, there is a marked increase of left ventricular hypertrophy in strength athletes admitting to stimulant-use as compared to those denying stimulant-use and non-athletes.

Subjects (n)	Non-athletes (72)	Strength athletes - stimulants (16)	Strength athletes + stimulants (4)
LV ED volume (ml/m <sup>2</sup> )	102.3 ± 14.3	102.4 ± 15.3	101.5 ± 9.5
LV ED wall mass (g/m <sup>2</sup> )	47.8 ± 8.5	46.8 ± 8.6	56.3 ± 7.1
RV ED volume (ml/m <sup>2</sup> )	112.6 ± 16.7	114.0 ± 14.4	111.3 ± 7.7
RV ED wall mass (g/m <sup>2</sup> )	11.6 ± 2.2	8.6 ± 1.7	8.2 ± 1.3
LV diameter 4CH	55.3 ± 3.8	57.6 ± 3.4	63.9 ± 4.7 *#
RV diameter 4CH	46.1 ± 6.0	49.2 ± 4.7	50.6 ± 9.3
Septal wall thickness (mm) SA	9.6 ± 1.2	9.3 ± 1.5	13.0 ± 1.4 *#
Septal wall thickness (mm) 4CH	9.8 ± 1.2	9.9 ± 1.4	13.7 ± 2.4 *#

ED = end-diastolic, 4CH = 4 chamber view, SA = short axis view, \* = significant difference (p<0.05) from controls, # = significant difference from non-users

Figure 1: Cardiac MRI parameters

02.8

### MRI OF BLOOD FLOW RESERVE CAPACITY OF THE POPLITEAL ARTERY IN INTERMITTENT CLAUDICATION

T. Leiner<sup>1</sup>, B. Versluis<sup>2</sup>, M.H.G. Dregmen<sup>2</sup>, P.J. Nelemans<sup>2</sup>, J.E. Wildberger<sup>2</sup>, W.H. Backes<sup>2</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

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

**Objectives:** The aim of the current study was to develop a MR method capable of determining flow reserve of the popliteal artery in patients with peripheral arterial disease (PAD) and to investigate whether flow reserve is able to discriminate between patients with intermittent claudication and healthy volunteers.

**Material and Methods:** Ten consecutive patients with intermittent claudication, as well as 10 healthy volunteers were included. All subjects underwent ECG-triggered 2D cine phase-contrast MR flow waveform measurements of the popliteal artery at rest and during reactive hyperemia. Resting

flow, maximum hyperemic flow, absolute flow reserve and relative flow reserve, time-to-peak (TTP) and time-to-recovery (TTR) were determined by two independent MRI readers.

**Results:** Resting flow, maximum hyperemic flow and the absolute flow reserve were significantly lower in patients compared to healthy volunteers (p < 0.01 for all measures). Relative flow reserve was unable to discriminate between patients and healthy volunteers (p = 0.81). TTP and TTR showed a clear trend of prolonged in patients, but no significant difference was found (p = 0.15 and p = 0.16 respectively).

**Conclusions:** Using 2D MR cine PCA flow measurements it is possible to determine flow reserve measures in patients with intermittent claudication and healthy volunteers. A strong reduction was found for resting flow, maximum hyperemic flow and absolute flow reserve in patients with intermittent claudication. Therefore, the assessment of flow reserve might be a valuable addition to morphologic MRI to objectively determine the hemodynamic consequences and disease severity in PAD patients.

## Sessie 3

## Interventieradiologie

Donderdag 16 september 2010, 11.00 - 12.30 uur

O3.1

**UTERINE ARTERY EMBOLIZATION IN PATIENTS WITH A LARGE FIBROID BURDEN**

R.J. Nijenhuis, A.J. Smeets, E. Weimar, L. Lampmann, P.F. Boekkooi, H.A.M. Vervest, R.C. Bremer, J.W. van Rooij, P.N.M. Lohle

St. Elisabeth Ziekenhuis, Tilburg

**Purpose:** Uterine artery embolization (UAE) in patients with a large fibroid burden (i.e. dominant fibroid diameter >10 cm and/or uterine volume > 700 ml) is controversial. Purpose of this study was to evaluate the long-term clinical outcome.

**Material and methods:** Seventy-one consecutive women (mean age 42,5 years) with a large fibroid burden underwent UAE between August 2000 and April 2005. Infarction rate of the dominant fibroid and overall fibroid burden as well as volume reduction of the dominant fibroid and uterus were assessed using the baseline and latest follow-up MR images. Patients were clinically followed at fixed time inter-

vals after UAE using standardized questionnaires (Uterine Fibroid Symptom and Quality of Life questionnaire). In addition, in May 2009 an additional questionnaire was sent to all the women inquiring on clinical satisfaction of the UAE and possible additional treatments.

**Results:** Mean follow-up was 48 months. No major complication occurred after UAE. Mean dominant fibroid volume reduction was 44% (from 450 to 248 ml). Mean uterus volume reduction was 43% (from 1125 to 639 ml). Mean dominant fibroid infarction and mean overall fibroid infarction rate were 86% and 87%, respectively. Sixty-one women reported improvement of symptoms. Ten women underwent hysterectomy due to insufficient symptom relieve.

**Conclusion:** Women with a large fibroid burden can be safely embolized with a good clinical outcome in the vast majority of patients.

O3.2

**HOLMIUM-166 RADIOEMBOLIZATION FOR THE TREATMENT OF PATIENTS WITH LIVER METASTASES: DESIGN AND INITIAL RESULTS OF THE PHASE I HEPAR TRIAL**

M.L.J. Smits, J.F.W. Nijssen, M.A.A.J. van den Bosch, M.G.E.H. Lam, M.A.D. Vente, J.E. Huijbregts, A.D. van het Schip, B.A. Zonnenberg  
Universitair Medisch Centrum Utrecht, Utrecht

**Background:** Holmium-166 poly(L-lactic acid) microspheres (<sup>166</sup>Ho-PLLA-MS) have been developed for intra-arterial radioembolization of liver tumours. <sup>166</sup>Ho is ideal for radioembolization because it emits beta- and gamma radiation, and is highly paramagnetic, which allows for scintigraphic imaging and MRI which is useful for biodistribution assessment and dosimetry.

**Purpose:** The aim of this first-in-man trial is to assess the safety and toxicity profile of <sup>166</sup>Ho-RE in patients with liver metastases.

**Methodology:** 15 to 24 patients with chemorefractory, unresectable liver metastases of any origin will be included in the HEPAR trial (Holmium Embolization Particles for Arterial Radiotherapy). Four cohorts of 3-6 patients will be treated with <sup>166</sup>Ho-RE according to a standard dose escalation protocol (20Gy, 40Gy, 60Gy, and 80Gy, respectively). Prior to treatment, in addition to the standard <sup>99m</sup>Tc-Technetium labelled macroaggregated albumin (<sup>99m</sup>Tc-MAA), a low radioactive safety dose of 60 mg <sup>166</sup>Ho-PLLA-MS is administered. The primary objective is to establish the maximum tolerated radiation dose using the Common Terminology Criteria for Adverse Events (CTCAE version 3.0). Secondary objectives are to assess tumour response, biodistribution, performance status, quality of life and to compare the <sup>166</sup>Ho-PLLA-MS safety dose and the <sup>99m</sup>Tc-MAA dose distributions with respect to the ability to accurately predict microsphere distribution.

**Preliminary results:** The first two patients of the 20Gy-cohort have been treated with  $^{166}\text{Ho}$ -RE. The procedures were technically successfully performed. Post-treatment scintigraphy indicated that the  $^{166}\text{Ho}$ -PLLA-MS were predominantly distributed at the tumorous areas in the liver.

**Conclusion:** This study will investigate whether the safety and toxicity profile of  $^{166}\text{Ho}$ -RE is comparable with yttrium-radioembolization.

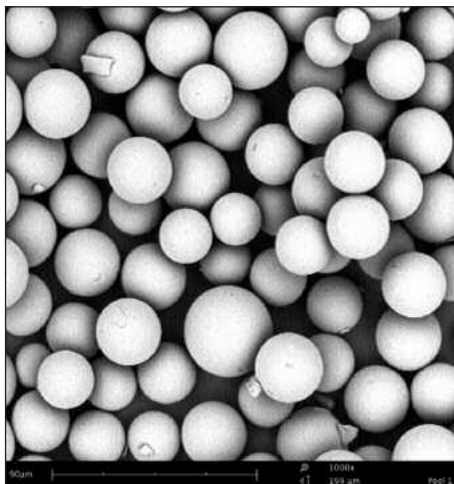


Image 1: Holmium microspheres

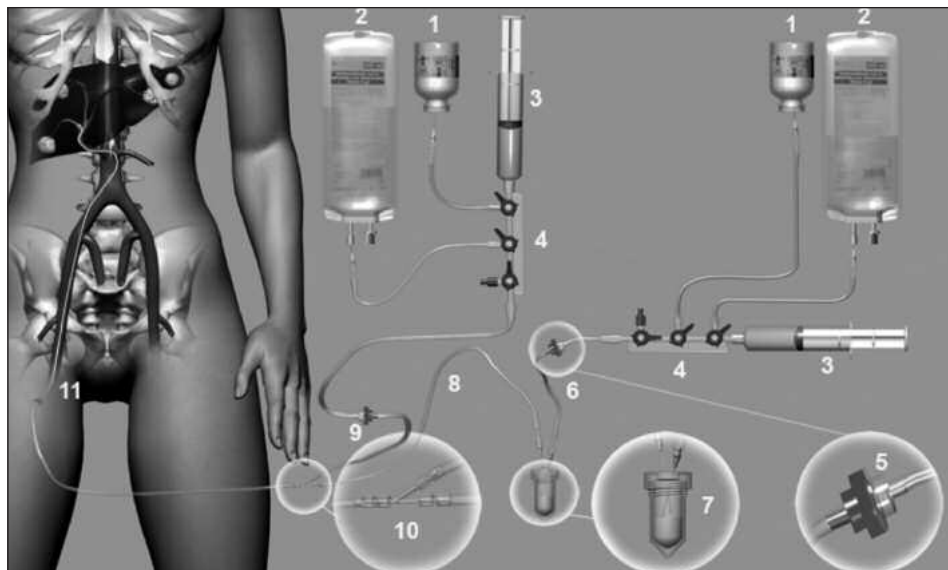


Image 2: Administration system, schematic

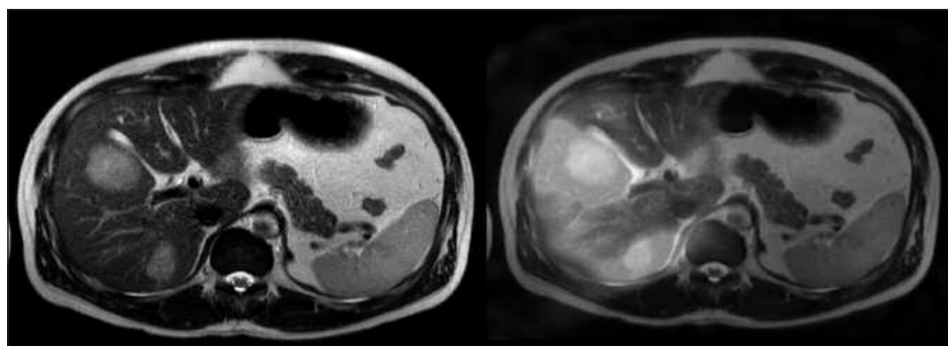


Image 3: Intrahepatic activity distribution post  $^{166}\text{Ho}$ -RE

03.3

### INITIAL EXPERIENCE WITH STENTING OF THE VENOUS ILIOFEMORAL TRACT; SUCCESS RATE AND EARLY PATENCY

M.W. de Haan, R. de Graaf, C.W.K.P. Arnoldussen, C.H.A. Wittens

*Maastricht Universitair Medisch Centrum, Maastricht*

**Objective:** Chronic venous obstruction of the ilio-femoral tract is a serious problem after best medical treatment of deep venous thrombosis (DVT). After five years 44% of patients suffer from venous claudication. The endovascular approach for ilio-femoral obstructive disease is becoming more popular, due to its low invasiveness and promising patency. We report our preliminary results of stenting for ilio-femoral obstructive disease.

**Methods:** Between May 2009 and March 2010, 15 conse-

cutive patients were admitted for non-malignant obstruction of the ilio-femoral venous tract. Routinely, Doppler ultrasound (Duplex) and Magnetic Resonance venography (MRV) were performed to evaluate the extent of the venous obstruction. All patients with significant disease underwent recanalization attempts, after which stent placement was performed under general anaesthesia.

**Results:** No mortality or morbidity was seen. Percutaneous recanalization was successful in 14 of 15 patients (93%). At 3 months 86% patients reported significant pain relief as 57% experienced improvement in leg swelling. At 3 month 13 stents (93%) remained patent without significant flow restriction.

**Conclusion:** Percutaneous recanalization and stenting of the occluded ilio-femoral venous tract appears to be a save procedure with a good short term patency results.

03.4

### RADIATION DOSE FOR INTERVENTIONAL RADIOLOGISTS IN 3D CONE-BEAM CT GUIDANCE

S.J. Braak<sup>1</sup>, M.J.L. van Strijen<sup>1</sup>, J.A. Vos<sup>1</sup>, J.P.M. van Heesewijk<sup>1</sup>, E. Meijer<sup>1</sup>, W.P.Th.M. Mali<sup>2</sup>

<sup>1</sup>St. Antonius Ziekenhuis, Nieuwegein

<sup>2</sup>Universitair Medisch Centrum Utrecht, Utrecht

**Purpose:** Quantitative analysis of radiation dose for the radiologist in cone-beam CT-guidance and the effect of shielding.

**Materials and Methods:** Cone-beam CT-guidance uses 3D-CT reconstruction of the acquired information for needle path planning. The trajectory is, after co-registration, projected on the fluoroscopy image. Using a Rando-phantom® we

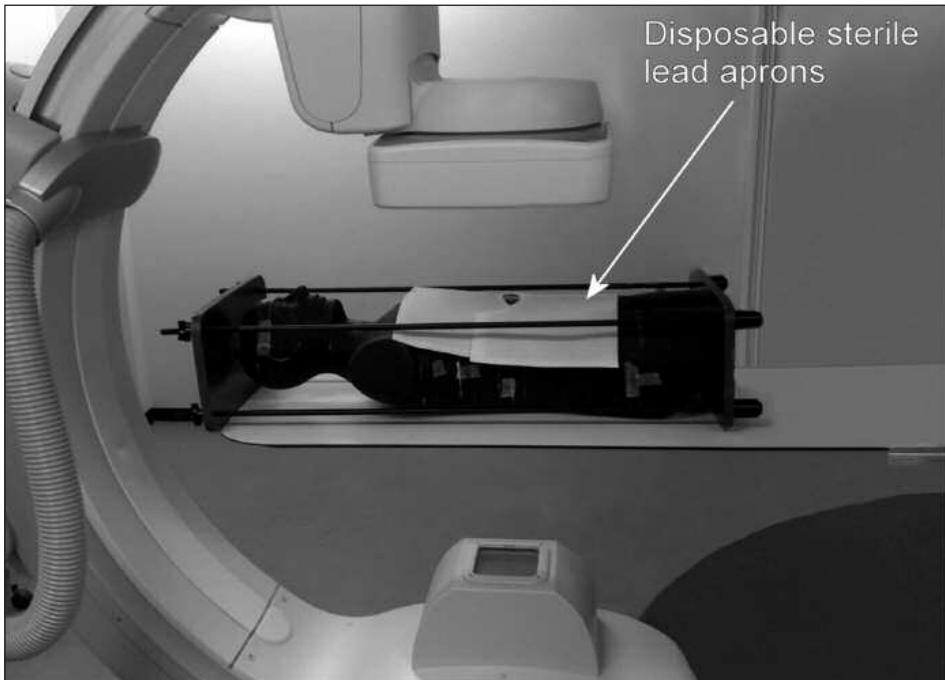


Figure 1

designed a model to measure radiation dose for the hand, collar and gonads. The effect of sterile lead aprons (figure 1) and ceiling/couch shielding was also measured. During the procedures relevant parameters were recorded. Using the radiation model the dose during routine clinical procedures was determined.

**Results:** We performed 186 procedures between December 2007 and August 2009 (77 thorax, 109 abdomen). Mean radiation hand dose was 33.6 (95%CI 28.7-38.5)  $\mu$ Sv for thoracic and 53.9 (95%CI 47.7-60.2)  $\mu$ Sv for abdominal procedures. The collar and gonad doses were 78.5 (95%CI 29.2-127.8)  $\mu$ Sv and 34.7 (95%CI 29.0-40.5)  $\mu$ Sv in the thoracic group; 72.4 (95%CI 42.2-102.6)  $\mu$ Sv and 46.4 (95%CI 40.6-

52.2)  $\mu$ Sv in abdominal procedures. Performing 90 procedures annually, hand dose is 4.8 mSv, collar dose is 7.1 mSv and gonad dose 4.2 mSv without shielding. Using disposable lead aprons dose reduction was 61% (95%CI 54-67%) for the hand, but increased to 121% (95%CI 87-154%) for the collar and 159% (95%CI 146-173%) for the gonads. Ceiling/couch shielding caused a 91.9-97.7% dose reduction.

**Conclusion:** The respective annual dose is 4.8, 7.1 and 4.2 mSv for hand, collar and gonads. Lead aprons reduces hand dose, but increases collar and gonad doses. Large dose reductions can be achieved by ceiling/couch shielding.

O3.5

### DWI-MRI FOR EARLY RESPONSE ASSESSMENT AFTER YTTRIUM-90 RADIOEMBOLISATION IN PATIENTS WITH METASTATIC LIVER TUMORS

C.E.N.M. Rosenbaum, M.G.E.H. Lam, E.J. Vonken, M.L.J. Smits, J.F.W. Nijsen, M.A.D. Vente, B.A. Zonnenberg, M.A.A.J. van den Bosch  
*Universitair Medisch Centrum Utrecht, Utrecht*

**Objective:** Response to local treatment of liver tumors is typically determined by measuring tumor size using RECIST criteria. However, treatment induced molecular and cellular changes may be an earlier predictor of response to therapy. In this study we assessed whether changes in apparent diffusion coefficient (ADC) of target lesions were related to changes in lesion size following treatment.

**Methods:** Six consecutive patients (four women, two men; mean age, 55 years) who received <sup>90</sup>yttrium-radioembolisation (<sup>90</sup>Y-RE) for treatment of unresectable and chemorefractory colorectal cancer liver metastases were included.

Contrast-enhanced and diffusion weighted magnetic resonance images (MRI) of the liver were acquired before treatment and at one, three and six months after treatment. Longest diameter according to RECIST 1.1 and ADC value of target lesions were prospectively scored by an independent radiologist.

**Results:** A total of nine lesions (mean lesion size 48.6 mm, range 30.0-94.2) were evaluated at longest available follow up (n=2 at one month interval, n=2 at three months and n=1 at six months). Six lesions decreased in size (responders) with a mean change of 10% (p=0.010) and corresponding mean ADC value increased by 18% (p=0.041). Three lesions showed an increase in size (non-responders) following <sup>90</sup>Y-RE with mean change of 30% (p=0.020) and corresponding mean ADC value decreased by 9.7% (p=0.607, not statistically significant).

**Discussion:** In this preliminary study we showed that lesions decreasing in size following intra-arterial treatment were associated with a significant increase in ADC value.

O3.6

### MR-GELEIDE HIGH INTENSITY FOCUSED ULTRASOUND ALS BEHANDELING VAN SYMPTOMATISCHE UTERUS MYOMEN: EERSTE RESULTATEN VAN PILOTSTUDIE

M.J. Voogt<sup>1</sup>, R. Deckers<sup>2</sup>, L.W. Bartels<sup>2</sup>, W.P.Th.M. Mali<sup>1</sup>, M.A.A.J. van den Bosch<sup>1</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

<sup>2</sup>Image Sciences Institute / Universitair Medisch Centrum Utrecht, Utrecht

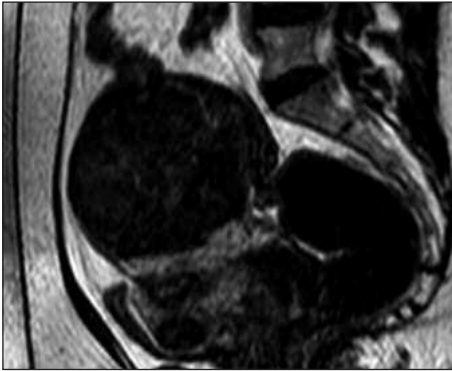
**Achtergrond:** MR-geleide High Intensity Focused Ultrasound (MR-HIFU) is een non-invasieve behandelingsmethode waarbij hoogfrequent ultrageluid voor weefselablatie

gecombineerd wordt met MRI beeldvorming. In deze studie rapporteren we de veiligheid en effectiviteit van MR-HIFU voor behandeling van patiënten met symptomatische uterus myomen.

**Methoden:** Patiënten met myomen werden gescreend voor geschiktheid voor MR-HIFU d.m.v. MRI. Inclusiecriteria waren onder andere laag signaal van het myoom op T2-gewogen beelden, aankleuring van myoom na contrasttoediening, geen interpositie van darm tussen uterus en buikwand, en geen uitgebreide littekens op de buikwand. De behandeling werd poliklinisch uitgevoerd onder lichte sedatie op het commercieel beschikbare Sonalleve HIFU-systeem (Philips Healthcare, Helsinki). Patiënten ondergingen structu-

rele follow-up met behulp van telefonische consulten, vragenlijsten, een gynaecologisch consult, en MRI-scan.

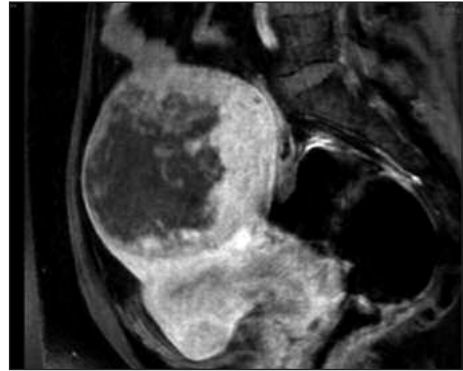
**Resultaten:** Vier vrouwen (leeftijd 37-48 jaar) werden met MR-HIFU behandeld. Drie behandelingen verliepen technisch succesvol, één werd gestaakt omdat er sprake was van een hyper-geperfundeed myoom waardoor de temperatuur lokaal onvoldoende opliep tijdens ablatie. Bij de drie behandelde patiënten bedroeg de totale behandel tijd bedroeg 3-4 uur. Het aantal behandelde myomen varieerde van 1-4 per patiënt. De behandeling werd goed verdragen,



**Figuur 1:** Sagittale T2W MRI van onbehandeld myoom

zonder belangrijke complicaties. Ondanks dat de behandelde volumina in deze patiënten relatief klein is (variërend van 20 tot 200 cc, zie figuur 1 en 2), rapporteerden alle drie de vrouwen verbetering van hun klachtenpatroon.

**Conclusie:** De eerste resultaten laten zien dat MR-HIFU een veilige en weinig belastende behandeling is voor vrouwen met symptomatische uterus myomen. Nader onderzoek naar de klinische effectiviteit is noodzakelijk, om de plaats van MR-HIFU in het klinisch behandel spectrum te bepalen.



**Figuur 2:** Ablatiezone na behandeling na contrasttoediening

03.7

### CT GUIDED TREATMENT OF SPINAL SYNOVIAL CYSTS

V.H. Koen, W. de Monyé  
Kennemer Gasthuis, Haarlem

**Purpose:** To study the results of CT guided treatment of spinal synovial cysts in our hospital.

**Methods:** We retrospectively searched for all patients in our hospital who were diagnosed with spinal synovial cysts using MRI between 1-1-2008 and 1-4-2010. Of these patients we gathered information about age, sex, the level of the synovial cyst and treatment by CT guided rupture of the cyst and/or injection of a mixture of Kenacort, Lidocaine and saline in an outpatient setting. We registered how often operative treatment could be avoided.

**Results:** Between 1-1-2008 and 1-4-2010 41 patients were diagnosed with spinal synovial cysts in our hospital using

MRI. Most patients were female (23 patients; 56%). Most cysts were located at level L4/L5 (19; 46%), followed by level L3/L4 (12; 29%) and L5/S1 (8; 19%). In 12 patients CT guided treatment was performed. Of these 12 patients, 7 underwent operative treatment at a later stage. In 4 patients there was significant reduction in pain after CT guided treatment, and no operative surgery was deemed necessary. In one patient severe pains remained despite the disappearance of the synovial cyst on follow-up MRI. No complications were reported during or after CT guided treatment.

**Discussion:** In a substantial number of patients surgery could be avoided by CT guided treatment. This advantage is consistent with results described in recent literature. Therefore we conclude that CT guided treatment of spinal synovial cysts should be attempted as a first treatment which could prevent patients from having to undergo more invasive surgery.

03.8

**VALIDATIE VAN DE NEDERLANDSE VERSIE  
VAN DE VASCUQOL EN AMC LINEAR  
DISABILITY SCORE IN PATIËNTEN MET  
CLAUDICATIO INTERMITTENS**

F.A. Frans, S. van Wijngaarden, R. Met, M.J.W. Koelemaij  
*Academisch Medisch Centrum, Amsterdam*

**Introductie:** Kwaliteit van leven (QoL) is een belangrijke uitkomstmaat in de behandeling van patiënten met perifeer arterieel vaatlijden. Een veelgebruikt meetinstrument voor bepaling van QoL bij dergelijke patiënten is de ziektespecifieke Vascular Quality of Life Questionnaire (VascuQol). De AMC Linear Disability Score (ALDS) is een gevalideerd instrument om het niveau van fysiek functioneren te meten bij patiënten met een chronische ziekte zoals perifeer vaatlijden. Doel van dit onderzoek was het bepalen van de validiteit en reproduceerbaarheid van de VascuQol en ALDS bij patiënten met stabiele claudicatio intermittens (CI).

**Materiaal en methoden:** Gedurende een periode van 3 maanden werd bij 40 patiënten (gemiddelde leeftijd 67) met stabiele CI de VascuQol en ALDS afgenomen na informed consent. Bij twintig patiënten die conservatief werden behandeld werden de vragenlijsten na 4 weken nogmaals afgenomen.

**Resultaten:** De gemiddelde VascuQol score was 4.6 (SD  $\pm 0.9$ ), en de gemiddelde ALDS score was 79 (SD  $\pm 7.9$ ). De interne consistentie van de VascuQol en ALDS waren uitstekend met een Cronbach's  $\alpha$  van respectievelijk 0.87 en 0.92. De test-retest reproduceerbaarheid van de VascuQol en ALDS waren eveneens voortreffelijk met een intraclass correlatie coëfficiënt van respectievelijk 0.91 (95% BI, 0.78-0.96) en 0.90 (95% BI, 0.76-0.96).

**Conclusie:** De Nederlandse versie van de VascuQol is een valide en reproduceerbaar instrument om de QoL te meten, en de ALDS om het niveau van functioneren te meten van patiënten met CI. Beide instrumenten zijn zeer geschikt om het effect van interventies in deze patiëntengroep te evalueren, zowel in onderzoek als in de dagelijkse praktijk.

## Sessie 4

Interventie- / Thorax- /  
Mammariadiologie

Donderdag 16 september 2010, 11.00 - 12.30 uur

O4.1

**LEVENDE TUMORCELLEN AAN NAALD-  
APPLICATORS DIRECT NA LOKALE TUMOR  
ABLATIE; EEN RISICOFACITOR VOOR LOKAAL  
RECIDIËF**

M.C. Jansen<sup>1</sup>, N. Snoeren<sup>2</sup>, J. Huiskens<sup>3</sup>, A.M. Rijken<sup>4</sup>,  
R. van Hilleberg<sup>5</sup>, A. van Erkel<sup>6</sup>, G. Slooter<sup>6</sup>,  
J.M. Klaase<sup>7</sup>, P. van den Tol<sup>8</sup>, F. ten Kate<sup>2</sup>, T.M. van Gulik<sup>3</sup>

<sup>1</sup>Medisch Centrum Alkmaar, Alkmaar

<sup>2</sup>Universitair Medisch Centrum, Utrecht

<sup>3</sup>Academisch Medisch Centrum, Amsterdam

<sup>4</sup>Amphia Ziekenhuis, Breda

<sup>5</sup>Leids Universitair Medisch Centrum, Leiden

<sup>6</sup>Máxima Medisch Centrum, Veldhoven

<sup>7</sup>Medisch Spectrum Twente, Enschede

<sup>8</sup>VU medisch centrum, Amsterdam

**Inleiding:** Lokaal recidief is een frequente complicatie na lokale tumor ablatie van maligniteiten in de lever en vormt een bedreiging van de lange termijn overleving. Lokaal recidief kan het gevolg zijn van onvolledige ablatie van de te behandelen tumor. In deze studie evalueren we de correlatie tussen vitale tumorcellen aan de applicatiennaald en lokaal recidief en ziekte-vrije overleving.

**Materiaal en methoden:** Na behandeling van 130 levertumoren in 96 patiënten werd de applicatiennaald onderzocht op cellen en/of weefsel.

De verzamelde cellen en het weefsel werd geanalyseerd op vitaliteit met behulp van een vitaliteitskleuring (G6PD) en bepaling van de autofluorescentie intensiteit van H&E coupes. Patiënten werden vervolgd tot het moment van tumor-recidief.

**Resultaten:** Vitale tumor cellen werden gevonden in 26.7% van de patiënten. Het type naald, een open procedure en het nalaten van 'track ablatie' waren significant gecorreleerd aan het vinden van vitale tumorcellen aan de naald. Zowel na uni- als na multi-variate analyse bleek de aanwezigheid van vitale tumorcellen significant gecorreleerd aan het optreden van lokaal recidief. De gemiddelde tijd tot lokaal recidief bedroeg 9 maanden en was significant korter indien vitale tumorcellen werden gevonden. Er was geen verschil in (ziektevrije) overleving.

**Conclusie:** Na maar liefst 26.7 % van de lokale tumorablaties werden vitale tumorcellen gevonden aan de applicatiennaald. De aanwezigheid van deze tumorcellen is een onafhankelijke risicofactor voor lokaal recidief.

O4.2

**COMPARISON OF AUTOMATED 4-CHAMBER  
CARDIAC VIEWS VERSUS AXIAL VIEWS FOR  
MEASURING RIGHT VENTRICULAR  
ENLARGEMENT IN PATIENTS WITH  
SUSPECTED PULMONARY EMBOLISM**

R. Wittenberg<sup>1</sup>, J.W. van Vliet<sup>2</sup>, B. Ghaye<sup>3</sup>, J.F. Peters<sup>4</sup>,  
C.M. Schaefer-Prokop<sup>1</sup>, E. Coche<sup>3</sup>

<sup>1</sup>Meander Medisch Centrum, Amersfoort

<sup>2</sup>Medisch Centrum Alkmaar, Alkmaar

<sup>3</sup>Cliniques Universitaires St Luc, Brussel

<sup>4</sup>Philips Healthcare, Best

**Purpose:** Compare the right ventricle to left ventricle (RV/LV) diameter ratio obtained from axial pulmonary CT angiograms (CTPA) with those derived from automatically generated 4-chamber (4-CH) reformat in patients with

suspected pulmonary embolism (PE).

**Methods:** We included 120 consecutive non-ECG-gated CTPA from 3 institutions (mean age 60±16 years; 71 women). Twenty 64-slice CTPA with PE and 20 without PE were selected per institution. For each patient the RV/LV diameter ratio was obtained from both axial CTPA images and automatically generated 4-CH reformats. Measurements were performed twice in two separated sessions by 2 experienced radiologists and 2 residents. Vascular enhancement was measured in the RV and LV. The differences between the measurements on both views were evaluated.

**Results:** The 4-CH was successfully obtained in 113 patients. The mean axial and 4-CH diameter ratios were comparable for three of the four readers ( $p=0.56$ ,  $p=0.13$ ,

$p=0.08$ ). Although the mean diameters (1.0 and 1.03 respectively) for one resident were significantly different ( $p=0.013$ ), the difference of 0.03 seems negligible in clinical routine.

Three readers achieved equally high intra-reader agreements with both measurements (ICCs of 0.94, 0.95 and 0.96), only one reader showed a different variability with ICCs of 0.96 for the axial view and 0.91 for the 4-CH view.

The interreader agreement was equally high for both measurement types with ICCs of 0.95 and 0.94, respectively.

**Conclusion:** In patients with suspected PE, RV/LV diameters ratio can be measured with the same reproducibility and accuracy using an automatically generated 4-CH view compared to the axial view.

04.3

### THERAPEUTISCHE EFFICIENTIE VAN X-THORAX OP INTENSIVE CARE IS AFHANKELIJK VAN OPNAMEDUUR EN VERANDERING IN KLINISCHE TOESTAND

F. Lalezari, C.A. Hendrikse, W. ten Hove, J.H. Rommes, P.E. Spronk, J.W.C. Gratama

*Genre ziekenhuizen, Apeldoorn*

**Introductie:** In eerder onderzoek is reeds aangetoond dat de therapeutische efficiëntie (TE) van indicatie thoraxfoto's (Xth's) (18%) groter is dan de dagelijkse routine thoraxfoto's (2%) bij IC-patiënten. De vraag is of dit voor alle IC-patienten geldt.

**Methoden:** In een prospectieve, geblindeerde controle studie (1 jaar) werden dagelijkse routine XTh's gemaakt, geblindeerd voor intensivisten. Op indicatie konden intensivisten ook Xth's aanvragen. Alle Xth's werden door onafhankelijke radiologen gescoord op tevoren vastgestelde criteria. Hierop werden de diagnostische efficiëntie (DE: het aantal XTh's met significante afwijkingen/totaal aantal XTh's) en thera-

peutische efficiëntie (aantal XTh's leidend tot een interventie/totaal aantal XTh's) berekend. De patiënten werden opgedeeld in verschillende subgroepen: beademd/niet beademd, type patiënt (acuut chirurgisch, electief chirurgisch en niet-chirurgisch), opnameduur (1-2; 3-14 en >14 dagen) en aanvraag-reden (nieuwe opname, evaluatie beleid en klinische verslechtering). X2-analyse werd als test toegepast.

**Resultaten:** Gedurende 12 maanden zijn 1890 routine XTh's en 926 indicatie Xth's gemaakt bij 587 patiënten. De TE nam significant toe met de opnameduur (1-2 dagen 11,7%, 3-14 dagen 19,5% en >14 dagen 22,4%) en de indicatie (nieuwe opname 14,0%, evaluatie beleid 18,8% en klinische achteruitgang 31,2%). De TE van indicatie Xth's was niet afhankelijk van beademingsstatus of type patiënt. Opsplitsing in subgroepen leverde geen significante verschillen op voor de DE van routine en indicatie Xth's en TE van routine Xth's.

**Conclusion:** De TE is het hoogst bij indicatie Xth's bij IC-patiënten die lang opgenomen liggen en bij IC-patiënten met klinische verslechtering.

04.4

### GROUND GLASS NODULES DETECTED DURING LUNG CANCER SCREENING: A DIAGNOSTIC AND THERAPEUTIC DILEMMA

B.J. de Hoop<sup>1,2</sup>, H.A. Gietema<sup>1,2</sup>, R. van Klaveren<sup>3</sup>, S. van der Vorst<sup>1</sup>, J.W. Lammers<sup>1</sup>, A. Vink<sup>1</sup>, R.C.A. Meijer<sup>1</sup>, B. Ginneken<sup>4</sup>, M. Prokop<sup>4</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

<sup>2</sup>Alysis Zorggroep, Arnhem

<sup>3</sup>Erasmus MC, Rotterdam

<sup>4</sup>UMC St Radboud, Nijmegen

**Purpose:** No consensus exists on treatment of pulmonary ground glass nodules (GGNs). We describe our experience with GGNs in a CT lung cancer screening study.

**Method and Materials:** All participants received regular CT-screening. All persistent GGNs, i.e. GGNs that were visible on two consecutive CT scans, were included in this analysis. Retrospectively, all GGNs were manually segmented. Volume doubling time (VDT) and mass doubling time (MDT) were calculated.

**Results:** In total 2.994 volunteers received CT-screening. Fourty-one GGNs were detected in 36 (1,2%) patients. Median follow-up covered 1760 days. Twenty-two patients (25 GGNs) were referred to a pulmonologist, and 15 patients (17 GGNs) underwent resection. Histology demonstrated adenocarcinoma (n=9), bronchioloalveolar carcinoma (n=7) and chronic inflammatory infiltration (n=1). All malignancies were staged IA or IB. One patient in which GGN resection was delayed, developed metastatic disease 22 months after resection. For resected GGNs, VDT and MDT 385-1733 days and 565-1386 days respectively. For nonresected GGNs, VDT and MDT were 770 days- >5000 and 630 days- >5000, respectively. In the total follow-up period, none of the GGNs showed a sudden increase in growth rate; the shortest VDT and MDT at any point during follow-up being 336 and 349 days respectively.

**Conclusion:** Growing GGNs have a very high malignancy rate but tend to grow slowly and predictably. Our data suggest that long-term follow-up with CT may be a valid option to monitor changes in persistent GGNs. Resection should be considered in any GGN that shows discernable growth.

O4.5

### FREQUENCY OF MICRONODULES IN SILICA-EXPOSED HEAVY SMOKERS VERSUS NON-EXPOSED HEAVY SMOKERS

O.M. Mets<sup>1</sup>, J. Rooijackers<sup>2</sup>, P.A. de Jong<sup>1</sup>, W.P.Th.M. Mali<sup>1</sup>, S. van Amelsvoort-van der Vorst<sup>1</sup>, W.M. Prokop<sup>3</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

<sup>2</sup>Nederlands Kenniscentrum Arbeid en Longaandoeningen (NKAL), Universiteit Utrecht, Utrecht

<sup>3</sup>Universitair Medisch Centrum St Radboud, Nijmegen

**Purpose:** To determine the number of micronodules (<3 mm) in heavy smokers on chest computed tomography (CT) to aid in the CT diagnosis of early silicosis in silica-exposed heavy smokers.

**Methods:** Fifty-four male silica-exposed heavy smokers (mean age 55.7 years; range 50.1-63.3) were compared to 54 age, sex and smoking history matched silica-unexposed subjects participating in a lung cancer screening trial. All 108 subjects underwent low-dose chest CT and lung

function testing. CT scans were scored for absolute numbers of solid micronodules. Difference in presence and number of micronodules between silica-exposed and unexposed groups was assessed and the 95th percentile of micronodule count in the unexposed was calculated.

**Results:** Micronodules were present in the majority of both silica-exposed (94%) and unexposed subjects (87%). The 95th percentile of nodule count in unexposed smokers was 13. Twelve (22%) silica-exposed subjects had more than 13 nodules (up to 144).

Lung function of these twelve individuals was not different from the other exposed subjects with 'normal' numbers of micronodules. FEV1 and FEV1/FVC of the exposed subjects was slightly but significantly lower compared to controls.

**Conclusion:** In heavy smokers up to 13 micronodules can be expected on chest CT. In silica-exposed smokers there is a subgroup with a significantly increased nodule count that may represent early stages of silica-related disease.

O4.6

### GEbruik VAN VERSCHILLENDE ADEMHALINGSTECHNIKEN BIJ METEN VAN DIAFRAGMAFUNCTIE MIDDELS M-MODE ULTRASONOGRAFIE

M.N.F. Poulsen, M. Logtenberg, L. Jongen, P.E. Spronk, J.W.C. Gratama

Gezondheidszorg, Apeldoorn

Meten van diafragma-bewegingen middels M-mode ultrasonografie is een valide meetinstrument met een goede inter- en intraobserver-variabiliteit, aangetoond in eerdere studies. De variabiliteit in meetwaarden binnen proefpersonen is echter niet bekend, wat belangrijk is bij de interpretatie van sequentiële metingen. Deze studie heeft als doel te bepalen welke ademhalingsstechniek het minst beïnvloed wordt door de patiënt zelf.

Drie onderzoekers gebruikten M-mode ultrasonografie om bij 30 gezonde vrijwilligers, op gestandaardiseerde wijze, rechtszijdig de diafragma-amplitude (cm) te meten tijdens drie verschillende ademhalingsstechnieken, namelijk het rustig ademen, maximaal in- en uitademen en de snelle geforceerde inspiratie. Per ademstechniek werden drie metingen per proefpersoon verricht door elke onderzoeker.

Als spreidingsmaat berekenen we de spreiding in uitkomsten ten opzichte van het gemiddelde ((max-min)/gem), binnen de proefpersoon, per ademhalingsstechniek. Ook werd de interobserver-variabiliteit berekend (Pearson correlatiecoëfficiënt).

De relatieve spreiding in metingen binnen de proefpersonen bedroeg bij rustig ademen 30.7% (SD 19,4%), bij maximaal in- en uitademen 17.8% (SD 13,1%) en bij de snelle geforceerde inspiratie 30.3% (SD31,5%) (n=90 metingen per ademstechniek). De correlatie tussen metingen van de 3 onderzoekers was bij rustig ademen R=0.571 (p = 0.008), bij maximaal in- en uitademen R=0.629 (p= 0.002) en bij de snelle geforceerde inspiratie R=0.858 (p<0,0001).

De verschillende ademhalingsstechnieken tonen een goede tot zeer goede inter-observer variabiliteit, conform de literatuur. Een significant lagere spreiding in meetwaarden binnen de proefpersonen wordt gevonden bij het maximaal in- en uitademen. Deze ademhalingsstechniek is hierdoor het best bruikbaar voor nauwkeurige sequentiële meting van de diafragmafunctie. Deze bevindingen moeten nog gevalideerd worden in een patiënten populatie.

04.7

**EFFECT OF PREVIOUS BENIGN BREAST SURGERY ON BREAST CANCER DETECTION AT SCREENING MAMMOGRAPHY**

V. van Breest Smallegenburg<sup>1</sup>, L.E.M. Duijm<sup>1</sup>, A.C. Voogd<sup>2</sup>, J.H. Groenewoud<sup>3</sup>, F.H. Jansen<sup>1</sup>, M. van Beek<sup>4</sup>, M.W.J. Louwman<sup>5</sup>

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

<sup>2</sup>Universiteit Maastricht, Maastricht

<sup>3</sup>Centre of Expertise Transitions in Care, University of Applied Sciences, Rotterdam

<sup>4</sup>PAMM, Eindhoven

<sup>5</sup>Integraal Kankercentrum Zuid (IKZ), Eindhoven

**Purpose:** To determine whether tumor detection at screening mammography and tumor characteristics are different in women with and without previous benign breast surgery.

**Materials and methods:** All 317398 women who were screened at one of two screening units in our region between January 1, 1997 and January 1, 2008 were included. During a two year follow-up period, clinical data, breast imaging reports, biopsy and surgery reports were collected of all women with screen detected and interval cancers.

**Results:** 1604 women with screen detected breast cancer and 603 interval cancers were included. Significantly more cancers presented as interval cancers in women with previous benign surgery than in women without surgery (35.7% vs 26.6%,  $p=0,01$ ). This increased interval cancer risk remained after logistic regression adjustment for age and breast density (OR= 1,5, 95% CI: 1,1-2,1). Tumor biology characteristics in terms of distribution of cancer histology, estrogen-receptor status and mitotic activity were similar for women with and without previous surgery. There were no significant differences in proportions of advanced (T2+) tumors (screen detected 17.6% vs 22.1%,  $p= 0,6$  and interval 51,7% vs 47,6%,  $p= 0,9$ ) or lymph node positive tumors (screen detected 21.2% vs 27.0%,  $p= 0,4$  and interval 43.1% vs 46.1%,  $p= 0,5$ ) in women with previous benign surgery compared to women without previous surgery.

**Conclusion:** Previous breast surgery for benign disease decreases the sensitivity of screening mammography and increases the risk of interval cancer. However tumor characteristics and tumor size are comparable for women with and without previous benign breast surgery.

04.8

**SYNCHRONOUS BILATERAL BREAST CANCER: INCIDENCE AND DETECTION AT SCREENING MAMMOGRAPHY**

W. Setz-Pels<sup>1</sup>, J. Nederend<sup>1</sup>, F.H. Janssen<sup>1</sup>, M.J.H.H. Hooijen<sup>2</sup>, L.E.M. Duijm<sup>1</sup>

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

<sup>2</sup>St. Anna Ziekenhuis, Geldrop

**Purpose:** To determine the incidence of bilateral synchronous breast cancer at biennial screening mammography and to assess the sensitivity of screening for the detection of these cancers.

**Materials and methods:** We included all screens of women obtained at a southern breast screening region in the Netherlands between May 1, 1998 and June 1, 2008. Follow-up of screened women was about two years. Two screening radiologists reviewed the screens of bilateral breast cancers (either screen detected cancers (SDC) or interval cancers (IC)) and determined whether the bilateral cancer

was visible at the latest screen. They were initially blinded to information from each other and discrepant assessments were followed by consensus reading. Synchronous bilateral SDC were defined as cancers where the contralateral malignancy was diagnosed within 3 months from the first cancer or bilateral cancers that were visible at the latest screen but diagnosed more than 3 months after this screen.

**Results:** Within two years following referral, bilateral breast cancer was diagnosed in 41 of 1543 SDC (2.7%). Of these 41 bilateral cancers, 31 (75.6%) appeared to be synchronous. Twenty of the 31 (64.5%) contralateral breast cancers were either missed at screening or showed a minimal sign. A total of 571 IC were found, of which 12 (2.1%) were bilateral. Eight of the 12 (66.7%) bilateral IC were either missed at the latest screen or showed a minimal sign.

**Conclusion:** About 2.5% of breast cancers in screened women are bilateral and synchronous. Screening shows a disappointing accuracy for detection of these cancers.

## Sessie 5

Musculoskeletale radiologie /  
Neuro- en Hoofdhals radiologie

Donderdag 16 september 2010, 11.00 - 12.30 uur

05.1

**THE PREVALENCE OF RADIOGRAPHIC FEMORO ACETABULAR IMPINGEMENT PARAMETERS IN THE GENERAL POPULATION**

M. Reijnierse, F. De Bruin, J.L. Bloem

*Leids Universitair Medisch Centrum, Leiden*

**Purpose:** To determine the prevalence of the radiographic femoro acetabular impingement (FAI) parameters in the general population. In addition frequency distribution of cam, pincer and mixed type impingement was compared and we assessed whether pain, age or gender is associated with a higher prevalence of radiographic parameters described before to be associated with FAI.

**Materials and Methods:** A total of 1503 patients (572 men) with hip radiography were eligible for this retrospective study. For each gender the population was divided into four age groups. Based on a power analysis for a confidence interval of 95% a total amount of 310 patients were included in this study. 603 hips could be evaluated.

All radiographic parameters and their definitions were extracted from the literature. Pearson's chi-square test was used and a p-value of <0,05 was considered statistically significant.

**Results:** In only 50 hips (8.29%) radiographic signs of FAI were absent.

In the 70 hips (11.61%) with cam impingement characteristics, there was no significant difference in gender. In the 130 hips (21.56%) with pincer type impingement, males were significantly more often affected ( $p < 0,001$ ). In the 367 hips (60.86%) with signs of mixed type impingement, female hips were significantly ( $p < 0,001$ ) more often affected. 553 hips (91.71%) were categorized as cam or pincer impingement. No correlation with age was found. Coxa profunda was significantly more seen in patients complaining of pain (122/168, 72.19%) ( $p = 0,002$ ).

**Conclusion:** Radiographic parameters attributed to FAI are non-specific. Their contribution to the diagnosis of FAI is at best very limited.

05.2

**DOUBLE BUNDLE ACL ANATOMY AT 3 TESLA**M.E.A.P.M. Adriaensen<sup>1</sup>, R.A.P. Borghans<sup>1</sup>, B.A. Hogan<sup>2</sup>, H.I.J. Al Bulushi<sup>3</sup>, E.C. Kavanagh<sup>4</sup><sup>1</sup>Atrium Medisch Centrum Parkstad, Heerlen<sup>2</sup>Sports Surgery Clinic, Dublin, Ireland<sup>3</sup>Armed Forces Hospital, Muscat, Oman<sup>4</sup>Mater Misericordiae Hospital, Dublin, Ireland

**Introduction:** Before surgical reconstruction of the anterior cruciate ligament (ACL), physical examination and MRI are the most important preoperative parameters. The double-bundle-ACL-reconstruction-technique uses the anatomic double bundle approach of the ACL in order to improve functionality. Magnetic resonance imaging on 3 Tesla (3T-MRI) with arthroscopic correlation has proven to adequately identify the anteromedial bundle (AMB) and posterolateral bundle (PLB) in cadaver knees. Purpose of this study was to describe the depiction of ACL bundle anatomy on 3T-MRI in daily practice.

**Methods:** In a retrospective cohort study, we included 50

consecutive patients who underwent standard 3T-MRI of the knee and had an intact ACL. Two musculoskeletal radiologists independently reviewed all scans for depiction of ACL bundle anatomy using standardized forms. Descriptive statistics were used.

**Results:** 23 right knees (46%) and 27 left knees (54%) were included. Mean age of patients was 35 years (range 12 to 68 years); 37 patients were male (74%). ACL bundle anatomy was best depicted in the axial plane in 44 knees (88%) and in the coronal plane in 6 knees (12%). Two bundles were seen in 47 knees (94%). The AMB was completely seen in 45 knees (90%). The PLB was completely seen in 40 knees (80%). Both bundles were completely seen in 37 knees (76%).

**Conclusion:** The double bundle anatomy of the ACL is visualized in 94% of patients on 3T-MRI. Because of associated clinical consequences we advocate to report separately on the anteromedial bundle and posterolateral bundle in case of anterior cruciate ligament injury.

05.3

**IMAGING THE HUMAN VERTEBRAL COLUMN AT 7 TESLA**

M.H.E. Vossen, W.M. Teeuwisse, M. Reijnierse, N.B.S. Smith, A.G. Webb  
*Leids Universitair Medisch Centrum, Leiden*

**Purpose:** To develop a radiofrequency (RF) coil for imaging of the human vertebral column at 7 Tesla (T) and to present the first images in healthy volunteers.

**Materials and Methods:** We describe the design of a quadrature transmit, eight-channel receive array RF coil configuration for acquisition of images of the human spinal column at 7T (Philips Achieva, Philips Healthcare, Best, The Netherlands). Imaging parameters were selected for fast data acquisition. In three healthy volunteers, large field of view (FOV) scanning enabled sagittal imaging in two stations.

**Results:** A RF coil arrangement is presented, enabling high spatial resolution images of the entire vertebral column at 7T in a scan time of 10 to 15 minutes. Several techniques were explored in terms of sensitivity to motion artifacts, signal-to-noise efficiency per unit time, image contrast and SAR.

The final sequence is a multiple two-dimensional gradient echo sequence without respiratory triggering: TR/TE 15/2 ms (partial echo acquisition), FOV 450x240 mm, data matrix 600x320, in-plane resolution 0.75x0.75 mm, 3 mm slice thickness, 8 signal averages, 7 slices, no interslice gap, total data acquisition time ~4 minutes.

7T images resemble short time inversion recovery (STIR) images acquired at 1.5T. In particular, contrast between vertebral endplates and vertebral discs is very high, which

might benefit distinguishing endplate changes associated with several spinal diseases.

**Conclusion:** Perfectly useable images of the vertebral column can be acquired using this RF setup. Issues of whether added clinical value can be provided by high field imaging can begin to be addressed.



**Image 1:** Cervicothoracic spine in a healthy male volunteer

05.4

**REVIEW OF MR SCORING METHODS CORRELATED TO CONVENTIONAL IMAGING AND CLINICAL FEATURES FOR THE PRESENCE OF KNEE OSTEO-ARTHRITIS**

R. Steens, D. Schiphof, J.H. Hensen, R.A. Niezen, M.G. Hunink, D. Vroegindewij, S.M.A. Bierma-Zeinstra  
*Maasstad Ziekenhuis, Rotterdam*

**Purpose:** The aim of this study was to discuss MR scoring systems and methods for describing severity and presence of osteo-arthritis.

**Methods and Materials:** We performed a systematic review study including the following keywords: MR and Kellgren/Lawrence, Ahlback, KOSS, clinical ACR, Mankin, knee pain and osteoarthritis. We used the year 2000 as a

starting point. Inclusion criteria were: isolated single or multicentre OA studies presenting own study populations, and at least a semi-quantitative scoring of cartilage or osteophyte on MR. We excluded studies with (post)traumatic knees.

**Results:** We detected 29 publications out of 441 in Pubmed which included all mentioned criteria. Scoring methods can be divided in three groups: WORMS (multi-feature Whole Organ MR Scoring system), KOSS (Knee Osteoarthritis Scoring System), BLOKS and miscellaneous methods. Out of 29 articles, WORMS was described 10 times, KOSS 3 and BLOKS 1 time. A relation ship with conventional radiograph was reported in 10 studies. The articles in which a correlation with Kellgren and Lawrence score was done reported in all studies a significant relationship. Only 1 study compared two different MR scoring methods. Reproducibility of all

scores was good to excellent. Features of OA were scored separately, but none of the MR scores, circumscribed an overall cut-off for presence of severity of OA.

05.5

### **PARTIALLY THROMBOSED INTRACRANIAL ANEURYSMS PRESENTING WITH MASS EFFECT: LONG-TERM CLINICAL AND IMAGING FOLLOW-UP AFTER ENDOVASCULAR TREATMENT**

S.P. Ferns<sup>1</sup>, W.J.J. van Rooij<sup>2</sup>, M. Sluzewski<sup>2</sup>,

R. van den Berg<sup>1</sup>, C.B.L.M. Majoie<sup>1</sup>

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

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

**Background:** Partially thrombosed aneurysms as a distinct entity form a diverse collection of complex aneurysms characterized by organized intraluminal thrombus and solid mass. Endovascular treatment options are PVO or selective coil occlusion of the remaining lumen. We present long-term clinical and angiographic results of endovascular treatment of unruptured partially thrombosed aneurysms that presented with symptoms of mass effect.

**Methods:** Between 1994 and 2008, 30 partially thrombosed aneurysms were treated by selective coiling and 26 by PVO. Of 56 aneurysms, 53 (95%) were large or giant. Neurologic

**Conclusion:** There are still no unambiguous criteria for grading OA using MR to be used in clinical practice or epidemiological research.

recovery during a mean clinical follow-up of 42.7 months was established. Evolution of aneurysm size during a mean follow-up of 26.6 months in 46 patients was assessed with MR imaging.

**Results:** Seventeen of 56 patients (30%) fully recovered, 22 patients (39%) partially recovered, 11 patients (20%) were unchanged, and 6 patients (11%) died. Complete recovery more often occurred after PVO than after coiling (12 of 26 versus 5 of 30,  $P = .02$ ). Aneurysm size reduction occurred more often after PVO (17 of 18 versus 2 of 28,  $P < .001$ ). Five aneurysms continued to grow after coiling, resulting in death in 3. During follow-up, 27 additional treatments were performed in 19 patients, all treated with coiling.

**Conclusions:** In partially thrombosed aneurysms presenting with mass effect, results of PVO are much better than selective coiling. After coiling, additional treatments are often needed, and some aneurysms keep growing. When PVO is not tolerated or not possible, surgical options should be considered before proceeding with coiling.

05.6

### **PREVALENCE AND CLINICAL CONSEQUENCES OF CAROTID ARTERY RESIDUAL DEFECTS FOLLOWING ENDARTERECTOMY: A PROSPECTIVE CT ANGIOGRAPHY EVALUATION STUDY**

A.G. van der Kolk, G.J. de Borst, L.M. Jongen,

A.G. den Hartog, F.L. Moll, W.P.Th.M. Mali, J. Hendrikse

Universitair Medisch Centrum Utrecht, Utrecht

**Background and Purpose:** It is still unclear whether residual defects seen after carotid endarterectomy (CEA) have clinical consequences. In the present study we investigated the incidence of residual defects in the carotid artery and their impact on both clinical and Duplex ultrasound (DUS) follow-up.

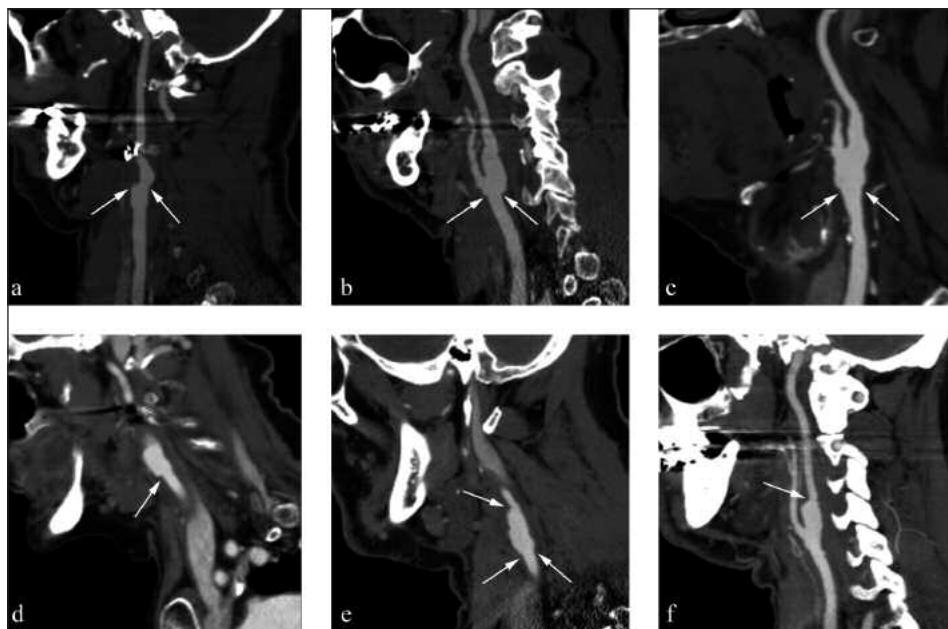
**Methods:** Sixty-five patients undergoing CEA were prospectively examined with 1-3 month postoperative Computed Tomographic Angiography (CTA), and further clinical and DUS follow-up. Defects in common (CCA) and internal (ICA) carotid artery were scored as either positive or negative clamp mark, intimal step or flap, mural thrombus, kink, microdehiscence suture or residual stenosis (any residual

plaque at CEA site). Associations between residual defects and follow-up results were analyzed.

**Results:** Fifty-five patients (85%) had a residual defect in CCA or ICA (118 defects). Intimal steps ( $n = 39$ , Figure) and residual stenosis ( $n = 17$ ) were most noted defects. Residual CCA defects were not associated with clinical events or recurrent stenosis during short- or long-term follow-up, irrespective of stenosis grade caused by defect. Residual stenosis and intimal flaps in ICA were significantly associated with more ipsilateral ischemic stroke and TIA during long-term follow-up, but without strong statistical power.

**Conclusion:** Residual defects in CCA following endarterectomy are not associated with significant recurrent stenosis assessed by DUS, and have no clinical relevance. In the present series, a definite conclusion regarding clinical relevance of ICA defects could not be drawn. We found no clear indication for performing intensified follow-up imaging of the CEA site in case of residual defects following CEA.

(see image on next page)



**Image 1:** Examples of intimal steps on postoperative CTA

05.7

### INTRACRANIAL VESSEL WALL IMAGING AT 7.0 TESLA MRI

A.G. van der Kolk<sup>1</sup>, J.J.M. Zwanenburg<sup>1</sup>, F. Visser<sup>2</sup>, J. Hendrikse<sup>1</sup>, P.R. Luijten<sup>1</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

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

**Background and Purpose:** Although current research regarding ischemic stroke and TIA primarily focuses on carotid artery atherosclerosis, little is known about the role of intracranial atheroma in this regard. A reason for this might be absence of imaging methods to depict intracranial vessel wall. We have developed a volumetric (3D) turbo spin echo (TSE) sequence for intracranial vessel wall imaging at 7 Tesla, and have tested this sequence in healthy volunteers as well as stroke- and TIA patients.

**Methods:** Three healthy volunteers and eighteen ischemic stroke or TIA patients were imaged with a 7 Tesla scanner. A 3D TSE sequence was used with inversion recovery (IR) to null CSF for contrast with the vessel wall. A time-of-flight angiography sequence was added to identify observed vessels on black blood images. T2 preparation was applied to improve signal-to-noise ratio (SNR). In patients, contrast agent was added for the possible depiction of atherosclerotic plaque.

**Results:** Vessel wall could be clearly visualized in all volunteers and patients with good contrast between wall, blood and cerebrospinal fluid. The quality of the vessel wall depiction was independent of the vessel orientation. In several patients atherosclerotic vessel wall lesions could be identified, some enhancing after contrast administration.

**Conclusion:** Intracranial vessel wall and its pathology can clearly be depicted with 3D IR-TSE imaging on 7 Tesla MRI, both in healthy volunteers and in ischemic stroke and TIA patients. This sequence makes it possible to study the role of intracranial atherosclerosis in stroke and TIA in more detail.



**Image 1:** Middle cerebral artery vessel wall in TIA patient

05.8

**LENTICULOSTRIATE ARTERIAL LUMINA ARE  
NORMAL IN CADASIL - A HIGH FIELD IN  
VIVO MRI STUDY**

M.K. Liem<sup>1</sup>, J. van der Grond<sup>1</sup>, M.J. Versluis<sup>1</sup>, J. Haan<sup>2</sup>,  
A.G. Webb<sup>1</sup>, M.D. Ferrari<sup>1</sup>, M.A. van Buchem<sup>1</sup>,  
S.A.J. Lesnik Oberstein<sup>1</sup>

<sup>1</sup>Leids Universitair Medisch Centrum, Leiden

<sup>2</sup>Rijnland Ziekenhuis, Leiderdorp

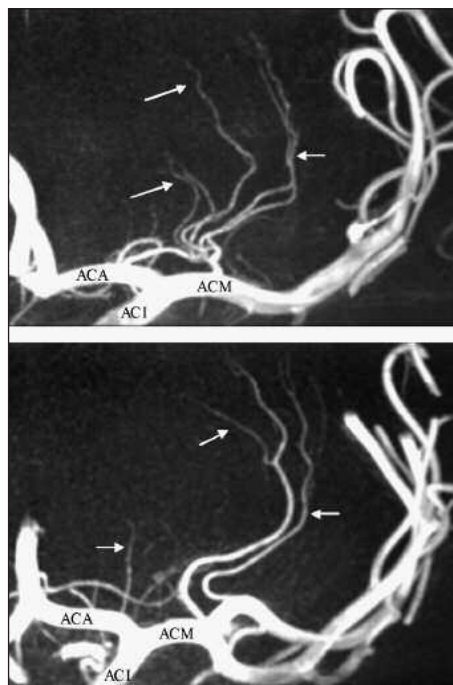
**Background and Purpose:** Cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) is a hereditary small vessel disease. Although postmortem studies have demonstrated mural thickening in leptomenigeal and lenticulostriate perforating arteries, it is unclear whether this also leads to luminal narrowing. High-field MRI scanners enable in vivo imaging of the lumen of the lenticulostriate arteries. The aim of this study is to examine the luminal diameters of lenticulostriate arteries in living CADASIL patients and to investigate whether luminal narrowing is correlated with the number of lacunar infarcts in the basal ganglia.

**Methods:** 22 NOTCH3 mutation carriers (MCs) and 11 healthy controls were examined using high resolution 3D-time-of-flight magnetic resonance angiography (TOF MRA) imaging on a 7-Tesla MRI scanner. Scans were analyzed for the presence of focal stenotic segments. The total number, length and total cross-sectional area of lenticulostriate arteries were measured and compared between mutation carriers and controls. These measurements were correlated with age, disease duration and number of lacunar infarcts in the basal ganglia.

**Results:** No stenotic segments were observed. No differences between MCs and controls were found in length, total

number or total cross-sectional area of lenticulostriate artery lumina ( $p > 0.05$ ). Measurements of lenticulostriate artery lumina were not associated with lacunar infarct load in the basal ganglia area ( $p > 0.05$ ).

**Conclusions:** 3D TOF MRA on 7-Tesla shows that CADASIL patients have normal luminal diameters of lenticulostriate arteries, suggesting that lacunar infarcts in the basal ganglia in CADASIL patients do not result from luminal narrowing of these vessels.



**Image 1:** 3D-TOF MRA: Top: CADASIL; Bottom: Control

## Sessie 6

## Neuro- en Hoofdhals radiologie

Vrijdag 17 september 2010, 11.15 - 12.45 uur

O6.1

**PROGRESSION AND CONSEQUENCES OF BRAIN LESIONS IN MIGRAINE: THE POPULATION-BASED CAMERA-2 NINE YEAR FOLLOW-UP MRI STUDY**

I.H. Palm-Meinders, H. Koppen, L.J. Launer, G.T. Terwindt, J. Konishi, M.A. van Buchem, M.D. Ferrari, M.C. Kruit  
*Leids Universitair Medisch Centrum, Leiden*

**Purpose:** We previously reported that migraine is an independent risk factor for cerebellar infarcts and, among women, for high deep white matter lesion (DWML) load. As the risks increased with increasing attack frequency, we re-investigated the same population-based cohort (295 migraineurs; 140 controls) nine years later, to test for migraine-related progression of these brain lesions and to evaluate potential cognitive consequences.

**Materials and methods:** Baseline and 9 yr follow-up brain MR images were acquired (same protocols/scanners) in 203/295 (69%) migraineurs and 83/140 (60%) controls, and analyzed for progression of volume and prevalence of WML (deep / periventricular) and cerebellar infarcts, blinded for

diagnosis. MR results were controlled for age, hypertension, diabetes, low education, and correlated with findings from the cognitive test battery conducted in both time points.

**Results:** We found > 1 new cerebellar infarct in n=10 (5%) migraineurs vs. none in controls (p=0.039) and, in female migraineurs, a greater progression of DWML load (OR 2.1[1.1-4.2]) was found. After adjustment for age and level of education, no association of cognitive functioning with migraine diagnosis and/or lesion load was found.

**Conclusion:** After 9 years, significantly more migraineurs than controls have developed new cerebellar infarcts. Among women, having migraine is an independent risk factor for the progression of DWML. Consequences for cognitive functioning of having these lesions could not be demonstrated.

**Clinical relevance:** Migraineurs are at risk of brain lesion progression and should be evaluated and treated for cardiovascular risk factors. More preventive / aggressive migraine treatment needs to be considered.

O6.2

**7T MRI REVEALS DIFFUSE IRON DEPOSITION IN THE PUTAMEN AND CAUDATE NUCLEUS IN CADASIL**

M.K. Liem<sup>1</sup>, S.A.J. Lesnik Oberstein<sup>1</sup>, M.J. Versluis<sup>1</sup>, M.L.C. Maat-Schieman<sup>1</sup>, J. Haan<sup>2</sup>, A.G. Webb<sup>1</sup>, M.D. Ferrari<sup>1</sup>, M.A. van Buchem<sup>1</sup>, J. van der Grond<sup>1</sup>

<sup>1</sup>Leids Universitair Medisch Centrum, Leiden

<sup>2</sup>Rijnland Ziekenhuis, Leiderdorp

**Purpose:** To quantify focal and diffuse iron deposition in CADASIL, using in-vivo and ex-vivo 7 Tesla MRI.

**Materials and Methods:** The local ethics committee approved the study and informed consent was obtained from all participants. Twenty-five NOTCH3 mutation carriers and 15 healthy controls were examined using high resolution susceptibility-weighted imaging on a 7 Tesla whole body

MRI scanner. MRI scans were analyzed for focal and diffuse areas of decreased signal intensity. Mean signal intensity measurements in affected brain regions were compared between mutation carriers and controls using ANCOVA. Ex-vivo brain specimens of another 3 CADASIL patients were scanned at very high resolution imaging to detect highly localized cortical areas of decreased signal intensity.

**Results:** Diffuse areas of decreased signal intensity were found in mutation carriers. Compared to healthy controls, mutation carriers had significantly lower signal intensity in the putamen (p=0.005) and caudate nucleus (p=0.0007). Focal areas of decreased signal intensity were found in 9 out of 25 mutation carriers (36%) and not in healthy controls. These areas were predominantly located in the thalamus. Other locations included the subcortical and deep white matter. There were no highly localized cortical areas of hypointensity on either the in-vivo scans, or on the postmortem scans.

**Conclusions:** 7 Tesla MRI reveals increased areas of diffuse hypointensity in the putamen and caudate nucleus of CADASIL patients, which is likely caused by increased diffuse iron accumulation. Areas of focal decreased signal intensity were found in 36% of CADASIL patients, in a pattern consistent with microbleeds.



**Image 1:** T2\*GE scan. Top: CADASIL patient; bottom: Control

06.3

### 5-YEAR INCIDENCE OF DEVELOPMENT OF DE NOVO ANEURYSMS AND GROWTH OF UNTREATED ANEURYSMS ON MR ANGIOGRAPHY

S.P. Ferns<sup>1</sup>, M.E.S. Sprengers<sup>1</sup>, W.J.J. van Rooij<sup>2</sup>, R. van den Berg<sup>1</sup>, B.K. Velthuis<sup>3</sup>, G.A.P. de Kort<sup>3</sup>, M. Sluzewski<sup>2</sup>, W.H. van Zwam<sup>4</sup>, G.J.E. Rinkel<sup>3</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>Universitair Medisch Centrum, Utrecht

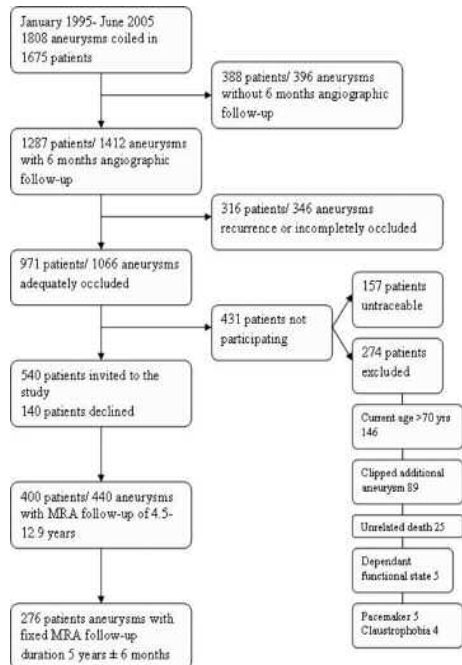
<sup>4</sup>Maastricht Universitair Medisch Centrum, Maastricht

**Background and Purpose:** Frequency of de novo intracranial aneurysm formation and rate of growth of untreated additional aneurysms is largely unknown. We assessed 5-year incidence of de novo aneurysm formation and pace of growth of additional untreated aneurysms.

**Methods:** From 7 medical centers, 400 patients with coiled intracranial aneurysms and adequate aneurysm occlusion on 6 months follow-up angiography underwent long-term follow-up 3 Tesla MRA, to assess long-term stability of coiled aneurysms. In 276 patients with fixed follow-up duration of 5 years $\pm$ 6 months, additional aneurysms were classified as unchanged/grown/de novo/incomparable with previous imaging. Frequency of treatment and supplementary follow-up imaging was assessed.

**Results:** In 50 of 276 patients (18%), 75 additional aneurysms were found. In 7 patients, 10 additional aneurysms were incomparable with previous imaging. Of the 65 addi-

tional aneurysms that could be compared, 58 (87%) in 41 patients were unchanged, 5 (7%) in 4 patients had grown and 2 (3%) in 2 patients were classified as de novo. Grown aneurysms were present in 5 of 276 patients (1.8%, 95%CI:0.2-3.4%) and de novo aneurysms in 2 of 276 patients (0.7%, 95%CI:0.2-2.6%). Five-year incidence of a



**Figure 1:** patient and aneurysm selection

de novo aneurysm was 150 per 100.000 patient-years. Three patients were treated for two grown and two incomparable additional aneurysms (1.1%, 95%CI:0.4-3.1%) and extra follow-up imaging was scheduled for 8 patients.

O6.4

### DETECTION OF CEREBRAL MICROBLEEDS WITH DUAL ECHO T2\*-WEIGHTED MR IMAGING AT 7T

M.M.A. Conijn, M.I. Geerlings, P.R. Luijten, J.J.M. Zwaneburg, F. Visser, G.J. Biessels, J. Hendrikse  
*Universitair Medisch Centrum Utrecht, Utrecht*

**Introduction:** Increasing interest in microbleeds had led to an increasing number of studies addressing the prevalence and clinical relevance of these lesions. Prevalence estimates differ substantially between studies, due to differences in image protocols and field strengths. This study assessed the visualization of cerebral microbleeds with dual echo T2\*-weighted imaging at 7T MRI.

**Methods:** Ten consecutive participants (8 men, 2 women, mean age 54±12 years) with atherosclerotic disease from the SMART study were included. Dual echo T2\*-weighted scans (echo time: 2.5/15.0ms) were made for all participants

**Conclusions:** We have found a low yield of MRA 5 years after coiling to detect de novo aneurysms and growth of additional untreated aneurysms in terms of detecting additional aneurysms that need treatment.

at 7T MRI. The number of visible microbleeds and the diameter of the microbleeds were recorded for both echo times. Microbleeds were evaluated on minimal intensity projection (minIP) images of both echoes.

**Results:** The first echo image shows dark microbleeds against a homogeneous, more hyperintense signal of the brain tissue including veins and basal ganglia (figure 1). In 8 patients microbleeds were observed, with a total of 104 microbleeds. Of these, 88 (84.6%) were visible on the first and 102 (98.0%) on the second echo image. The mean diameter of the microbleeds was 1.24 mm for the first echo and 2.34 mm for the second echo (figure 2).

**Conclusion:** T2\*-weighted imaging at two echo times combines the large contrast between the microbleeds and the surrounding tissue at the first echo time and the larger size of the microbleeds at the second echo time for the visualization of microbleeds at 7T MRI.

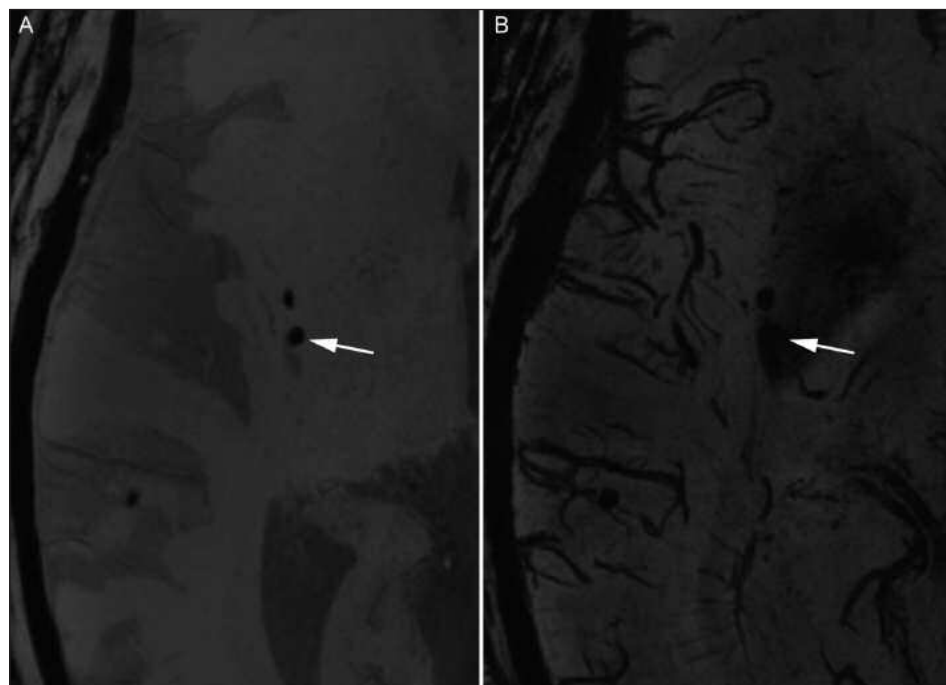


Figure 1: A) first echo B) second echo image

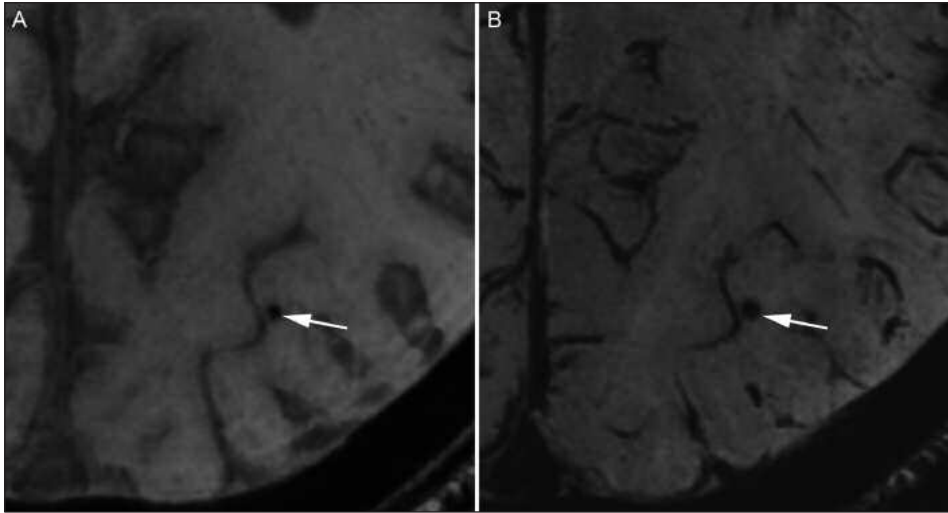


Figure 2: A) first echo B) second echo image

O6.5

### ROLE OF MDCTA IN LOCALIZATION OF PARATHYROID ADENOMA IN PRIMARY HYPERPARATHYROIDISM

B. Elias, C.H. Eijck, W.W. de Herder, R. Valkema, M. Smits, A. van der Lugt  
Erasmus Medisch Centrum, Rotterdam

**Purpose:** To evaluate the role of multidetector computed tomography angiography (MDCTA) in preoperative localization of hyperfunctioning parathyroid adenoma.

**Method and materials:** Records of 77 patients with primary hyperparathyroidism between 2007- 2009 were retrospectively reviewed. MDCTA was performed if there was discrepancy in the findings between ultrasound and Tc-99m-sestamibi scintigraphy. Patients with an MDCTA were selected for analysis. Ultrasound, sestamibi scintigraphy and MDCTA were reviewed and the results were compared with surgical and histopathologic findings. The operations were declared successful if the calcium- and PTH levels were normalised after surgery.

**Results:** MDCTA was performed in 18 patients. Scan range included the neck and upper mediastinum. In 9 of 18 (50%) patients ultrasound and sestamibi scintigraphy were positive, but there was discrepancy in accurate localising of adenoma (n=7) or sestamibi scintigraphy revealed an adenoma in the upper mediastinum (n=2). MDCTA identified and localized an adenoma in all cases. Surgical resection, which was performed in 7 patients, confirmed the imaging findings. In 7 of 18 patients (39%) adenoma were revealed by either ultrasound or sestamibi scintigraphy. MDCTA confirmed the presence of an adenoma in all patients, which was surgically confirmed. In 2 patients (11%) both ultrasound and sestamibi scintigraphy were negative. MDCTA revealed an adenoma in one patient, which was surgically confirmed.

**Conclusion:** MDCTA is a useful imaging technique in identifying and accurate localising parathyroid adenoma in patients with primary hyperparathyroidism in which ultrasound and sestamibi scintigraphy are discrepant or negative.

O6.6

### INITIAL EXPERIENCE WITH FETAL BRAIN MRI

M.M.A.C. van Santen - van Doorn, E. Newsum, L. Reneman, C.B.L.M. Majoie  
Academisch Medisch Centrum, Amsterdam

**Purpose:** To give an overview of the cerebral abnormalities we encountered over the past 4 years with fetal brain MRI

and to correlate these findings with clinical outcome and postnatal MRI scans, when available.

**Materials and method:** 50 fetuses with a gestational age range of 21-35 weeks were scanned prenatally, 12 of these patients were also scanned postnatally (age range: 1 day-3 months postpartum). Coronal, sagittal and axial T2-HASTE MRI-sequences were performed on a 1.5T MRI. MRI scans were evaluated by 2 experienced neuroradiologists.

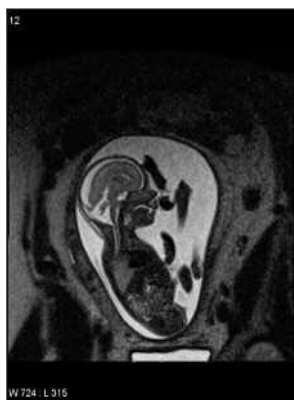
**Results:** Prenatal MRI scans (n=50): Normal findings in 10 cases. The three most frequently found abnormalities were ventriculomegaly (n=22), corpus callosum abnormalities (n=7), interhemispheric cyst (n=6).

Postnatal MRI scans (n=12): In all postnatal brain MRI scans additional abnormalities were detected when compared to prenatal MRI scan; microcephaly (n=2), corpus callosum agenesis (n=1), aquaduct stenosis (n=1), diffuse white matter abnormalities (n=1), cortical atrophy (n=1), vascular anomaly (n=1).

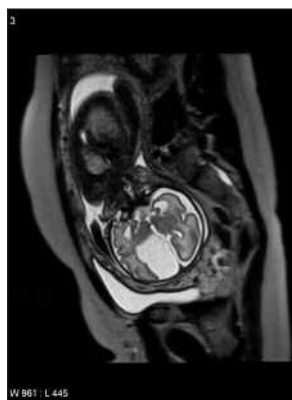
In 5 cases the pregnancy was terminated, 9 cases died

ante-, durante- or postpartum. The most frequent abnormalities on the prenatal MRI scan in this group includes: ventriculomegaly (n=8), corpus callosum agenesis (n=4), cerebellar and/or vermis hypoplasia (n=3).

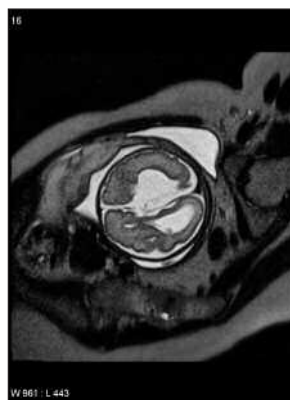
**Conclusion:** Fetal brain MRI is a new and important diagnostic tool, showing a very high incidence of relevant brain abnormalities (75%) in a very vulnerable patient population (death or termination of pregnancy in 35%). Still, all postnatal scans revealed additional findings, pointing out the technical limitations of fetal brain MRI.



**Image 1:** Fetal MR image: Dandy Walker variant



**Image 2:** Interhemispheric cyst and corpus callosum agenesis



**Image 3:** Interhemispheric cyst and corpus callosum agenesis

O6.7

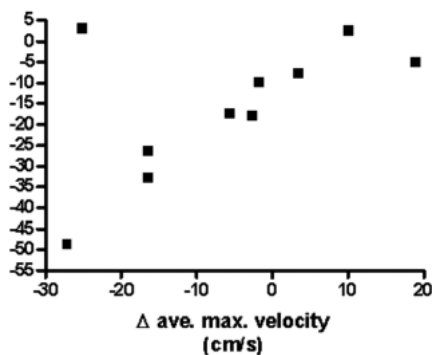
### COMPARISON OF 3T PHASE CONTRAST MR BLOOD FLOW VELOCITY MEASUREMENTS WITH DIRECT INTRA-ARTERIAL MEASUREMENTS

J.J. Schneiders, S.P. Ferns, P. van Ooij, R. van den Berg, M. Siebes, A.J. Nederveen, E. van Bavel, C.B.L.M. Majolie  
*Academisch Medisch Centrum, Amsterdam*

**Introduction:** Hemodynamic stress is thought to play an important role rupture of intracranial aneurysms, limited information is available about patient specific boundary conditions such as actual arterial pressure and blood flow velocity (BFV) in intracranial vessels. We used both phase contrast MRI (PC-MR) and an intra-arterial (IA) dual sensor wire to obtain patient-specific BFV measurements of the intracranial arteries close to an intracranial aneurysm.<sup>1</sup>

**Methods:** Ten patients were included who were scheduled for elective endovascular treatment of an intracranial aneurysm. Every patient underwent PC-MR BFV measurements before treatment as well as IA-BFV measurements during treatment.

The neurointerventional procedures were performed under general anesthesia, following institutional protocol. During the catheterization the standard guidewire was replaced by an intra-arterial dual-sensor flow and pressure wire. During the procedure the SBP was recorded from an arterial pressure catheter used for the anesthesia. Because BFV and SBP are closely linked, we analysed whether differences in BFV were correlated to the differences in SBP.



**Figure 1**

**Results:** Both modalities show BFV measurements of normal cardiac cycles. The averaged maximal velocity in the measurement envelope is clearly lower in in the ComboWire® measurements compared to PC-MR. This difference correlated well with the difference in systemic Mean Arterial Pressure for 9 out of the 10 subjects; Pearson's correlation coefficient for 10 subjects is 0.581,

$p=0.078$ , without the one outlier the correlation is 0.930,  $p<0.01$

**Conclusions:** Per patient, PC MR BFV measurements correlated very well with IA measurements, after correction for differences in SBP.

06.8

### **DETECTION OF RESIDUAL AND RECURRENT CHOLESTEATOMA WITH NON-EPI DIFFUSION WEIGHTED IMAGING: THE DUTCH EXPERIENCE**

M.H.G. Dremmen, P.A.M. Hofman, J.R. Hof, R.J. Stokroos, A.A. Postma  
Maastricht Universitair Medisch Centrum, Maastricht

**Objective:** The aim of this study was to evaluate the role of non-epi DWI MRI as an alternative for second-look surgery in detecting residual or recurrent cholesteatoma in our hospital.

**Patients and methods:** The study design is retrospective. The study group consisted of 56 consecutive non-epi DW MR imaging studies between 2005-2010, in 51 patients previously operated for cholesteatoma. Conventional imaging techniques were followed by single-shot turbo-spin echo DWI in the transverse and coronal plane. The imaging findings were correlated with intraoperative findings at second-look surgery in 24 patients and with close clinical follow-up in 6 patients. Four patients are

planned for surgery. Twenty-two patients without evidence of recurrent cholesteatoma by imaging or clinical investigation are under follow-up.

**Results:** SS TSE DW sequences detected 22 cholesteatomas confirmed by second-look surgery. 2/24 cases were false-positive: one case was diagnosed with an empyema, in the second patient no evidence of cholesteatoma was found at surgery. Two patients showed restrictive diffusion, however hyperintens signal on the T1-weighted images was suggestive of fat.

The sensitivity and specificity were respectively 100 and 92%. The positive predictive value was 92% and the negative predicted value 100%.

**Conclusion:** Residual or recurrent cholesteatomas after primary cholesteatoma surgery are very accurately detected by restrictive diffusion on SS TSE DW imaging with a sensitivity of 100% and specificity of 92%.

DWI imaging without conventional sequences will increase the number of false-positive findings in our patient setting, because transplanted fat within the cavity may show restrictive diffusion.

## Sessie 7

# Cardiovasculaire radiologie / Nucleaire geneeskunde

Vrijdag 17 september 2010, 11.15 - 12.45 uur

07.1

## HYPERTENSION ADDS TO AORTIC STIFFNESS IN TYPE1 DIABETES MELLITUS PATIENTS

A. Brandts, S.G.C. van Elderen, J.J.M. Westenberg,  
L.J.M. Kroft, R.W. van der Meer, J.T. Tamsma, A. de Roos  
*Leids Universitair Medisch Centrum, Leiden*

**Purpose:** To investigate the independent effect of diabetes mellitus type1 (DM1) and hypertension on aortic stiffness using MRI.

**Materials and Methods:** Approval from the local medical ethics committee was obtained and subjects gave informed consent. A total of 111 subjects (61 men, 50 women; mean age±standard deviation: 52.1±7.0 years), including 32 healthy control subjects, 20 DM1 patients without hypertension, 31 hypertensive patients and 28 DM1 patients with hypertension were included in our study. Aortic stiffness was measured by means of pulse wave velocity (PWV) using velocity-encoded MRI. Analysis of variance (ANOVA) was used to calculate the differences between groups. Covariate analyses were performed to adjust for potential confounding factors. The Bonferroni-test was used to correct for multiple testing.

**Results:** Mean aortic PWV was: 5.8±1.2 m/s in healthy subjects, 6.0±1.2 m/s in DM1 patients without hypertension, 7.4±1.8 m/s in hypertensive patients and 7.5±2.4 m/s in DM1 patients with hypertension (ANOVA  $p < 0.001$ ). Figure 1 demonstrates the differences in aortic PWV between groups. Compared to healthy control subjects, aortic PWV was significantly higher in patients with hypertension ( $p < 0.001$ ) and in DM1 patients with hypertension ( $p < 0.001$ ), whereas PWV was not increased in DM1 patients without

hypertension. Furthermore, aortic PWV was significantly different between DM1 patients without hypertension and DM1 patients with hypertension ( $p = 0.021$ ). These findings remained significant after adjustment for confounding factors (i.e. age, gender, systolic blood pressure, hypertension and diabetes duration, BMI, smoking and cholesterol/HDL-ratio).

**Conclusion:** Hypertension determines aortic stiffness in DM1 patients, whereas DM1 on itself does not.

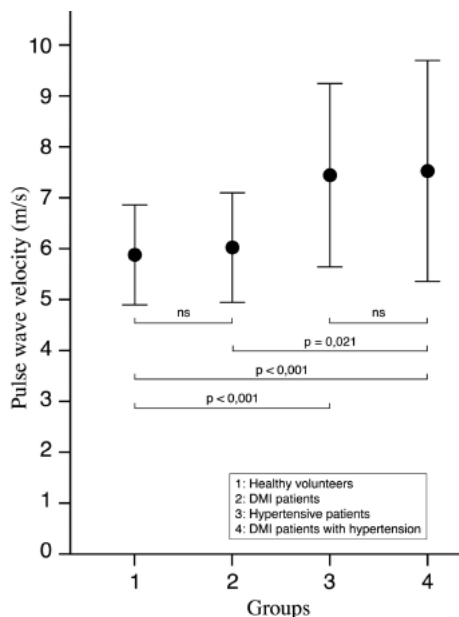


Figure 1: Differences in aortic pulse wave velocity

07.2

## DISTINGUISHING ARVC PATIENTS FROM ATHLETES: A CMR STUDY EVALUATING DIA- GNOSTIC REVISED TASK FORCE CRITERIA

T. Luijckx, N.H.J. Prakken, B.K. Velthuis, M.G.P.J. Cox,  
R.N. Hauer, M.J.M. Cramer

*Universitair Medisch Centrum Utrecht, Utrecht*

**Purpose:** Differentiating arrhythmogenic right ventricular cardiomyopathy (ARVC) from cardiac adaptation in athletes on cardiac MRI (CMR) is complicated by overlapping features of RV dilatation, especially in males. The recently revised Task Force Criteria (TFC) for diagnosing ARVC include new CMR RV end-diastolic volume (RV-EDV) and ejection fraction (RV-EF) cut-off values. We compared cardiac dimen-

sions and revised TFC cut-off values on CMR in male ARVC patients, healthy non-athletes and athletes.

**Methods:** 162 male subjects aged 18-60 years underwent CMR (mean age 32±10 years): 20 definite ARVC patients (V 4 TFC points), 87 non-athletes (0-3 hrs/wk training) and 50 strength-endurance athletes (>9 hrs/wk training). Blinded observers experienced in CMR used a reproducible contour tracing protocol for volume and function assessment.

**Results:** RV-EF is lower and RV-EDV higher in ARVC

patients as compared to athletes and non-athletes. Although the absolute cut-off value for EF works well, the cut-off value for end-diastolic volume performs poorly. Ratios of LV and RV EF and EDV perform as well (EF) or much better (EDV).

**Conclusions:** RV-EDV cut-off values cannot differentiate athletes from ARVC patients. Cut-off values based on LV-RV ratios combined with RV-EF seem to work better than absolute RV-EDV cut-off values.

Subjects (n)	Non-athletes (87)	Athletes (50)	ARVC (20)
LV EF (%)	58.0 ± 6.1 #	55.3 ± 5.2 #	48.4 ± 8.8 *
LV EDV index (ml/m <sup>2</sup> )	99.7 ± 13.9	128.4 ± 16.0 *#	97.8 ± 17.1
RV EF (%)	52.9 ± 5.5 #	49.6 ± 4.5 *#	34.3 ± 10.2 *
RV EDV index (ml/m <sup>2</sup> )	109.3 ± 16.7 #	144.0 ± 18.9 *	145.9 ± 39.7 *
RV end-diastolic diameter (mm)	45.5 ± 5.5 #	50.6 ± 4.3 *	53.9 ± 2.9 *
Ratio EF LV/RV	1.10 ± 0.09 #	1.12 ± 0.07 #	1.51 ± 0.43 *
Ratio EDV LV/RV	0.92 ± 0.08 #	0.89 ± 0.06 #	0.70 ± 0.16 *
<b>Revised TFC minor criteria</b>			
RV EF <45% (%)	8	16	85
RV EDV index > 100 ml/m <sup>2</sup> (%)	71	98	90
<b>Revised TFC major criteria</b>			
RV EF <40% (%)	0	2	65
RV EDV index > 110 ml/m <sup>2</sup> (%)	54	96	90
<b>Adapted to ratio cut-off values</b>			
Ratio EF LV/RV > 1.20 (%)	14	12	80
Ratio EDV LV/RV < 0.85 (%)	15	22	85

significant difference from \* non-athletes, # ARVC-patients

**Figure 1:** Significant difference from \* non-athletes, # ARVC

07.3

## CARDIOVASCULAR RISK FACTORS FOR CAROTID INTRAPLAQUE HEMORRHAGE IN ASYMPTOMATIC PATIENTS AS DETECTED BY MRI

Q.J.A. van den Bouwhuisen, A. Hofman, G.P. Krestin, J.C.M. Witteman, A. van der Lugt  
*Erasmus Medisch Centrum, Rotterdam*

**Purpose:** High-resolution MR-Imaging is capable of detecting plaque constituents in carotid atherosclerosis. Plaque vulnerability to rupture is not only predicted by the degree of arterial stenosis, but also to the composition of the plaque. Plaques with intraplaque hemorrhage (IPH) are considered more vulnerable. IPH can be identified with T1W-GRE

scanning. The purpose of this study was to assess prevalence of IPH in asymptomatic carotid atherosclerosis. Subsequently, to explore the associations of cardiovascular risk factors with presence of carotid IPH.

**Methods and Materials:** This study was embedded in The Rotterdam Study; a population based cohort study. Participants with asymptomatic carotid atherosclerosis defined by ultrasound were studied. We acquired MRI scans with multiple contrast weightings (PDW-FSE, PDW-EPI, T2W-EPI, 3D-T1W-GRE, 3D-PC-MRA) using a 1.5Tesla MRI scanner and surface coil. Images were assessed for presence of IPH. This study describes the first 500 scans.

**Results:** Nine participants were excluded due to the absence

ce of carotid wall thickening. Thirty four participants were excluded due to low image quality (6.8%). The mean age of the remaining study population (n=457) was 68.2 years and 43.6% were male. In 28.9% of the participants an IPH was present (19.3% of all plaques). Presence of IPH was significantly associated with carotid wall thickness OR1.6(95%CI(1.3-1.9), stenosis of >30% OR2.1(95%CI(1.2-

3.7) and smoking ((current OR3.43(1.7-7.0); past OR1.78(1.0-3.2)), not with other cardiovascular risk factors.

**Conclusions:** There is a high prevalence of IPH in asymptomatic carotid atherosclerosis, this increases with enlargement of the plaque and is associated with smoking but not with other risk factors.

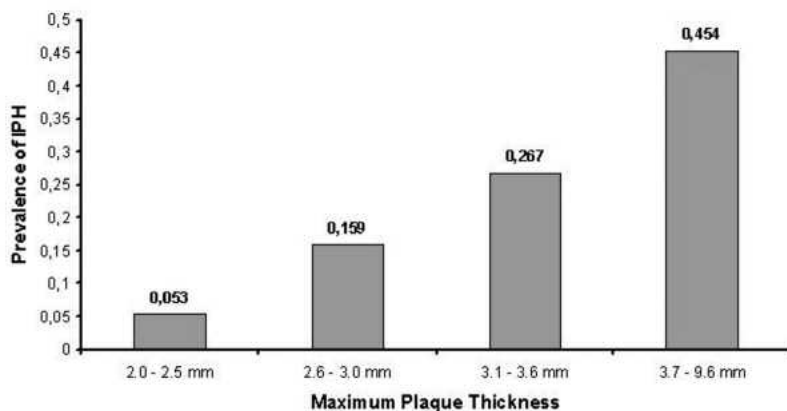


Figure 1: Maximum Plaque Thickness versus Prevalence of IPH

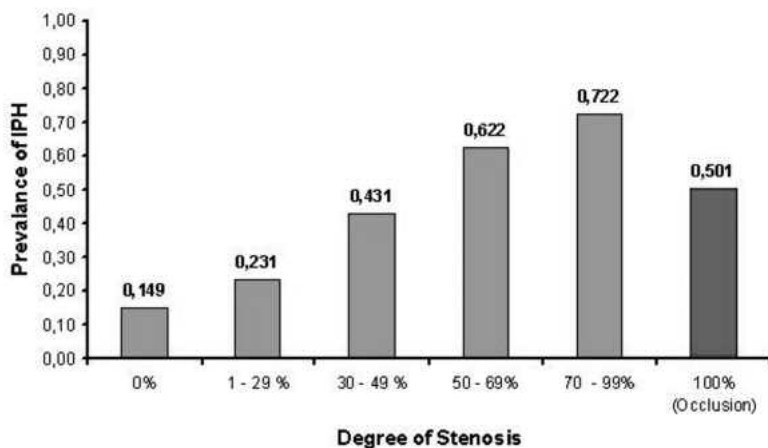


Figure 2: Degree of Stenosis versus Prevalence of IPH

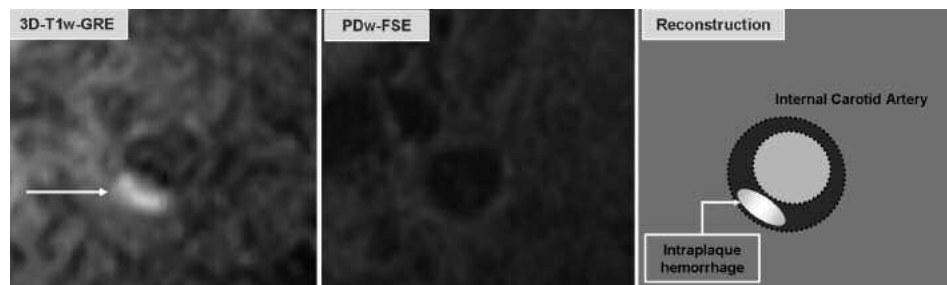


Image 1: Example of IPH on T1w-GRE and PDw-FSE images

07.4

## LONG-TERM EFFECTS OF THERAPEUTIC CALORIC RESTRICTION: SUSTAINED CARDIAC REMODELING IN OVERWEIGHT PATIENTS WITH TYPE 2 DIABETES MELLITUS

S. Hammer, J.T. Jonker, M. Snel, J.A. Romijn, J.W.A. Smit, I.M. Jazet, A. de Roos, H.J. Lamb  
*Leids Universitair Medisch Centrum, Leiden*

**Purpose:** To assess the long-term effects of initial weight loss achieved by therapeutic caloric restriction in patients with type 2 diabetes mellitus (T2DM) using cardiovascular magnetic resonance imaging (MRI).

**Materials and Methods:** Cardiovascular MRI was performed in 15 patients with T2DM before and after 16 weeks of intensive therapeutic caloric restriction and at 18 months follow up (regular diet). Left ventricular mass (g) and heart function was assessed by quantifying basic functional para-

eters, such as rate-pressure-product, ratio between early (E) and atrial (A) filling phase (E/A ratio) etc.

**Results:** Initial (16 weeks) caloric restriction induced a decrease in body mass (BMI) index from  $35 \pm 1$  to  $27 \pm 1$  kg/m<sup>2</sup>. At 18 months of follow up, BMI increased to  $32 \pm 1$  kg/m<sup>2</sup> (all  $P < 0.01$  compared for both occasions compared to baseline). Rate pressure product decreased from  $13033 \pm 620$  to  $9411 \pm 513$ , and subsequently increased to  $10634 \pm 538$  (sustainably improved compared to baseline,  $P < 0.05$ ). Left ventricular mass decreased from  $122 \pm 8$  to  $104 \pm 8$  g and increased moderately to  $116 \pm 10$  g at 18 months of follow-up ( $P < 0.05$  for all occasions). Diastolic E/A peak ratio increased from  $0.94 \pm 0.08$  to  $1.13 \pm 0.06$  and subsequently moderately decreased to  $1.07 \pm 0.08$  (all  $P < 0.05$ ).

**Conclusion:** Therapeutic caloric restriction in patients with T2DM leads to sustained improvements in systolic and diastolic cardiac function, despite weight gain during a regular diet.

07.5

## LONG-TERM EFFECTS OF THERAPEUTIC CALORIC RESTRICTION: TISSUE-SPECIFIC RESPONSE IN TRIGLYCERIDE CONTENT OF DIFFERENT FAT COMPARTMENTS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

S. Hammer, J.T. Jonker, M. Snel, J.A. Romijn, J.W.A. Smit, I.M. Jazet, A. de Roos, H.J. Lamb  
*Leids Universitair Medisch Centrum, Leiden*

**Purpose:** To assess the long-term effects of therapeutic caloric restriction in overweight patients with type 2 diabetes mellitus (T2DM) on triglyceride (TG) content of different fat compartments assessed with magnetic resonance imaging (MRI) combined with proton MR spectroscopy (MRS).

**Materials and Methods:** Measures were performed in 15 patients with T2DM before and after 16 weeks of therapeutic caloric restriction. Measures were repeated after a period of 18 months with a normal dietary pattern. Myocardial and hepatic TG content were measured with optimized

navigator gated MRS. Pericardial fat was quantified on a 4-chamber view acquired with a turbo-field echo sequence. Abdominal fat was quantified on 3 slices (using the fifth lumbar vertebrae as landmark).

**Results:** During caloric restriction, total body weight, myocardial triglyceride (TG) content, hepatic TG content visceral, subcutaneous abdominal fat and pericardial fat volumes decreased to resp. 88, 82, 16, 38, 53 and 84% of basal values (all  $P < 0.05$ ). After an additional 14 months of follow-up on regular diet, weight, myocardial and hepatic TG content increased to 90, 126 and 73% of basal values ( $P < 0.05$ ). The initial preferential loss of visceral fat compared to subcutaneous fat content, disappeared at 14 months of follow up, as they increased to 81 and 83 % of baseline values ( $P < 0.05$ ). In contrast, pericardial fat volume did not increase during this period.

**Conclusion:** Therapeutic Caloric Restriction induces tissue-specific dynamics in TG content of different fat compartments in patients with T2DM.

07.6

## ASSOCIATION BETWEEN AORTIC STIFFNESS AND WHITE MATTER BRAIN ATROPHY IN TYPE 1 DIABETES MELLITUS PATIENTS, ASSESSED WITH MAGNETIC RESONANCE IMAGING

S.G.C. van Elderen, A. Brandts, J.J.M. Westenberg, J. van der Grond, J.W.A. Smit, A. de Roos  
*Leids Universitair Medisch Centrum, Leiden*

**Purpose:** To assess the possible association between aortic

stiffness, an independent predictor of cardiovascular outcome, and brain atrophy in type1 diabetes mellitus(DM) patients by using magnetic resonance imaging(MRI).

**Methods:** Approval from the local institutional review board was obtained, and patients gave informed consent. Fifty-two type1 DM patients (30men; mean age $\pm$ SD, 44 $\pm$ 12 years) and thirty-four age and gender matched healthy controls, were prospectively enrolled for MR examination of the aorta (1.5T) and brain (3T) using standard pulse sequences.

Exclusion criteria comprised diagnosed hypertension, stroke, aortic valve disease and standard MRI contra-indications. Aortic arch pulse wave velocity (PWV), a marker of aortic stiffness, grey matter, white matter and total brain volumes normalized for skull size were automatically assessed. Multiple linear regression analyses were used for statistical analyses.

**Results:** Mean aortic arch PWV was  $5.7 \pm 1.5$  m/s in type 1 DM patient and  $6.1 \pm 2.1$  m/s in healthy controls (non-significant difference). Aortic arch PWV was associated with white matter brain volume independent of age, gender, body

mass index, smoking, heart rate, pulse pressure, DM duration and glucose regulation in type 1 DM patients ( $p=0.028$ ,  $\text{Beta}=-0.432$ ), and no independent association between aortic arch PWV and grey matter or total brain volume was found. There was no independent association between aortic arch PWV and grey, white or total brain volume in the healthy control group.

**Conclusion:** Stiffness of the aortic arch in normal range is inversely associated with white matter brain atrophy and not with grey matter brain atrophy in type 1 DM patients without hypertension, independent of glucose regulation.

07.7

### WHOLE-BODY IMAGING FOR THE DETECTION AND EVALUATION OF METASTATIC DISEASE IN PRIMARY STAGING OR FOLLOW-UP OF COLORECTAL CANCER

M. Maas, I.J.G. Rutten, D.M.J. Lambregts, P.J. Nelemans, V.C. Cappendijk, G.L. Beets, R.G.H. Beets-Tan  
Maastricht Universitair Medisch Centrum, Maastricht

**Aim:** Up to 40% of patients with colorectal cancer (CRC) develops metastases. Early and accurate identification of metastases is important because survival is improved when metastases are curatively resected. The aim is to determine which is the most accurate whole-body imaging modality for detection of metastatic disease in primary staging and during follow-up of patients with CRC.

**Methods:** Medline&Embase were searched. Studies evaluating the accuracy of whole-body imaging with CT, PET-CT, MRI or PET for metastasis detection in CRC at primary staging or follow-up were included. Studies evaluating liver only or response to therapy were excluded. 2x2 contingency tables were extracted and summary receiver operator characteristics (sROC)-curves with area-under-the-curves (AUC) were constructed by a regression model.

**Results:** 20 studies (published between 1997&2009) were included. Grouping the articles according to modality, 16 investigated PET, 10 CT, 7 PET/CT and one MRI. All studies used histopathology and/or clinical and radiological follow-up and/or conventional diagnostic modalities and/or surgical exploration as reference method. PET-CT and PET had the highest diagnostic performance: AUC 0.986 and 0.972, res-

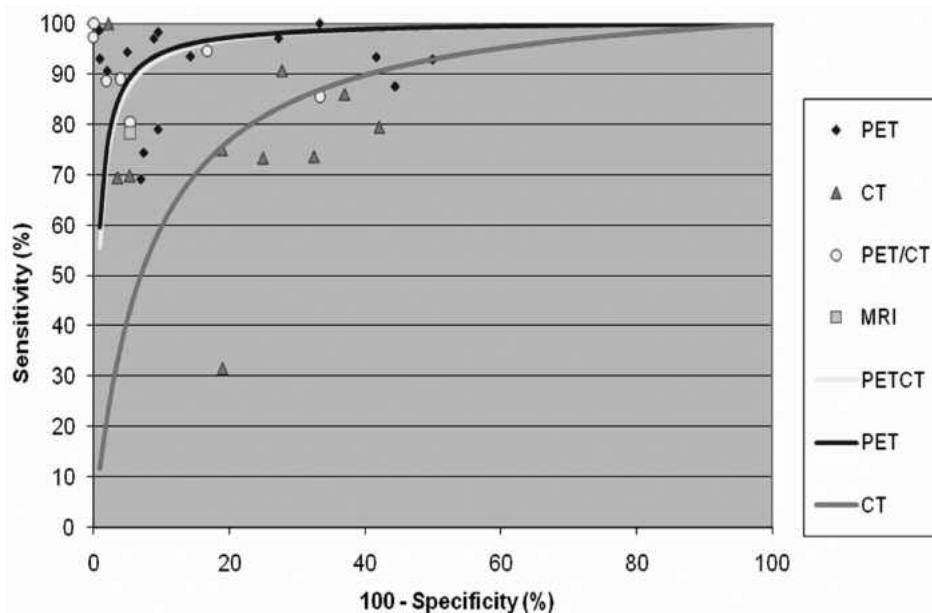


Figure 1: Summary ROC curves for all modalities.

pectively, followed by CT: AUC of 0.853,  $p=0.01$  (ROC-curves are shown in figure 1). Interestingly, in a subgroup of studies which evaluated distant recurrence detection only and did not include local recurrence detection, the AUC for CT was 0.894.

07.8

## THE DIAGNOSTIC VALUE OF FDG-PET-CT IN FEVER OF UNKNOWN ORIGIN

P.L. van der Plas, R.A. Niezen, D. Vroegindewij, J.H. Hensen, H. van der Lely  
*Maasstad Ziekenhuis, Rotterdam*

**Aim:** Revealing the underlying cause of fever of unknown origin (FUO) is often challenging. The most common causes of FUO are infections, malignancy and autoimmune or collagen vascular disease. However, in up to 40% of patients the underlying disease remains unclear. During recent years FDG-PET-CT has emerged as a promising imaging modality in the evaluation of patients with FUO. The aim of the present study was to evaluate the diagnostic value of FDG-PET-CT in patients with FUO.

**Methods:** A retrospective analysis was performed on data of all patients with FUO referred for FDG-PET-CT between

**Conclusion:** PET-CT and PET have the highest diagnostic performance for the detection of metastases in primary staging or follow-up of CRC. CT has significantly lower diagnostic performance, most likely because CT was inferior to PET(-CT) for detection of extrahepatic metastases.

January 2007 and March 2010. Patients underwent the FDG-PET-CT on a Siemens Biograph 2 slice scanner after administration of, depending on weight, 233-333 MBq  $^{18}\text{F}$ -fluorodesoxyglucose, 1 hour prior to the scan. Clinical parameters and definitive diagnosis were compared with reports from the FDG-PET-CT.

**Results:** 37 Patients were included of which 16 were male. 25 out of 37 patients (67,6%) had positive FDG-PET-CT findings. FDG-PET-CT essentially contributed to a final diagnosis in 76,0% of the 25 patients with positive FDG-PET-CT findings and in 51,4% of all evaluated patients with FUO. Definite cause of FUO was infection in 73,7% and autoimmune or connective tissue disease in 26,3%.

**Conclusion:** FDG-PET-CT contributed to the definite diagnosis in more than half the patients analysed and can therefore be regarded as a valuable diagnostic modality that may play an important role in finding the cause of FUO.

## Sessie 8

## Mammariadiologie

Vrijdag 17 september 2010, 11.15 - 12.45 uur

08.1

**PROSPECTIEVE PILOT STUDIE NAAR DE AANVULLENDE WAARDE VAN ELASTOSONOGRAFIE BIJ HET ECHOGRAFISCH BEOORDELEN VAN SOLIDE MAMMALAESIES**

K.M. Duvivier, G. Stapper, M.A. Fernandez

*Universitair Medisch Centrum Utrecht, Utrecht*

**Doel:** Prospectieve pilot studie naar de aanvullende waarde van elastosonografie bij het echografisch beoordelen van solide mammalaesies.

**Materiaal en methode:** Elastosonografie werd aanvullend gebruikt bij de echografische beoordeling van 10 solide laesies in de maand maart 2010. Het onderzoek is uitgevoerd op een Philips IU 22 met een 12Mhz lineaire transducer uitgerust met de elastosonografie software, waarbij het elastobeeld gevormd wordt zonder dat radioloog zelf hoeft te wisselen met de gegeven compressie. Dit laatste heeft als potentieel voordeel dat het onderzoek minder operator dependant is en er een grotere uniformiteit in de beoordeling van het elastobeeld is. De solide tumoren zijn initieel

beoordeeld op alleen het echobeeld in de mammografie waarna een BIRADS classificatie gegeven is. Hierna werden de elastografie bevindingen (graad 1 t/m5) meegenomen in de beoordeling alsmede de grootte-ratio (grootte op elastosonografiebeeld/initiële grootte), hetgeen potentieel iets zegt over de neovascularisatie. De laesies zijn beoordeeld door zowel een ervaren mammariadioloog als een opleidingsassistent.

**Resultaten:** Van de laesies berusten er 4, PA bewezen, op een fibroadenoom. Het elastosonografiebeeld van 1 van deze patiënten liet een overwegend harde laesie zien. De grootte-ratio van alle vier van deze laesies is 1, of minder. De grootte-ratio van de PA-bewezen maligniteiten is allen groter dan 1,08.

Conform de bevindingen in de literatuur lijkt de specificiteit toe te nemen bij het combineren van echo en elastosonografie.

**Conclusie:** Elastosonografie lijkt een effectief hulpmiddel in het echografisch beoordelen van solide mammatumoren. Met name het beoordelen van de grootte-ratio lijkt een veelbelovend hulpmiddel.

08.2

**A NEW QUANTITATIVE MULTIVOXEL MAGNETIC RESONANCE SPECTROSCOPY IN 16 BREAST LESIONS, A PILOT STUDY**M.D. Dorrius<sup>1</sup>, R.M. Pijnappel<sup>2</sup>, M.C. Jansen-van der Weide<sup>1</sup>, L. Jansen<sup>1</sup>, M. Oudkerk<sup>1</sup>, P.E. Sijens<sup>1</sup><sup>1</sup>*Universitair Medisch Centrum Groningen, Groningen*<sup>2</sup>*Martini Ziekenhuis, Groningen*

**Purpose:** The purpose of this study is to determine whether a new quantitative multivoxel Magnetic Resonance Spectroscopy (MRS) can differentiate benign from malignant breast lesions by using the highest choline concentration.

**Materials and Methods:** Fifteen patients with 16 breast lesions underwent an MRS at 1.5 Tesla MRI scanner (Avanto, Siemens, Erlangen). The multivoxel MRS technique used was 2D-CSI with point resolved spectroscopy (PRESS),

first without suppression of the water and fat signals (TR 1500ms; TE 30ms) to serve as a reference measurement, and subsequently with suppression of the water and fat signals (TR 1500ms; TE 135ms) to be able to detect choline. The mean and the highest choline concentration were measured.

**Results:** Mean choline concentration for 7 breast lesions varied between 0.2 and 1.3 mM in up to 4 voxels, while maximum choline level varied between 0.5 and 1.5 mM. No malignancy was found in these lesions. The mean and highest choline concentrations in up to 10 voxels for 9 breast lesions were 1.4-7.4 and 2.2-11.5 mM, respectively. Pathology confirmed malignancy in all 9 breast lesions.

**Conclusion:** The new quantitative multivoxel MRS method can differentiate benign from malignant lesions by indicating that a breast lesion with a highest choline concentration exceeding 2.00 mM is malignant.

08.3

### BIENNIAL BREAST CANCER SCREENING IN THE NETHERLANDS: TRENDS IN THE USE OF EXCISIONAL BIOPSY IN WOMEN WITH BENIGN FOLLOW-UP AT RECALL

J. Nederend, V. van Breest Smalenburg, W. Setz-Pels, L.E.M. Duijm

Catharina-ziekenhuis, Eindhoven

**Purpose:** Previous benign breast surgery decreases screening accuracy for breast cancer detection. Following referral, pathological examination of suspicious lesions should therefore initially consist of percutaneous biopsy, whereas excisional biopsy should be reserved for breast cancer treatment. We determined trends in the use of excisional biopsy in women with benign follow-up after referral.

**Methods:** We included all 293244 screens obtained at a southern breast screening region of the Netherlands between January 1998 and January 2008. During two year follow-up, we collected clinical data, breast imaging reports, biopsy

results and surgery reports of all referred women. We determined the percentage of women who experienced a more than 3 months delay in breast cancer diagnosis after referral.

**Results:** Excisional biopsy had been performed in 9.4% (n=201) of 2149 women with benign follow-up after referral; this percentage decreased from 28.7% (37/129) for women referred in 1998 to 2.3% (7/305) for women referred in 2007. Per 1000 screens, the number of benign excisional biopsies decreased from 1.5 for women screened in 1998 to 0.2 for women screened in 2007. A delay in breast cancer diagnosis was observed in 4.8% of referred women with screen detected cancer (73/1508); this delay decreased from 6.1% (7/115) for women referred in 1998 tot 1.5% (3/197) for women referred in 2007.

**Conclusion:** Currently, women with benign follow-up after referral are rarely confronted with excisional biopsy. The dramatic decrease in use of excisional biopsy was not correlated with an increased proportion of women experiencing a delay in cancer diagnosis after referral.

08.4

### DE BIRADS-CLASSIFICATIE IN VERGELIJKING MET DE HISTOLOGIE VAN STEREOTACTISCHE PUNCTIES VAN AFWIJINGEN IN DE MAMMAE

J.M. Niesten, H.J. Baarslag  
Meander MC, Amersfoort

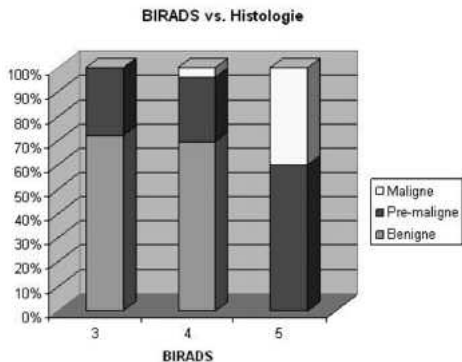
**Doel:** Vergelijken van de histologie van stereotactische puncties van afwijkingen in de mammae met de gegeven BIRADS-classificatie.

**Methoden:** Van patiënten die in 2009 stereotactische punctie(s) van afwijking(en) in de mamma(e) ondergingen, bekeken wij de voorafgegangene mammografie en echografie. Vervolgens vergeleken we retrospectief de door de afzonderlijke radiologen gegeven BIRADS-classificatie met het PA-rapport van deze gebiopteerde afwijkingen, waarbij we een verdeling maakten in benigne en (pre)maligne afwijkingen. Hiernaast bekeken wij complicaties en/of technische fouten die optraden tijdens puncties en naar het gepositioneerd blijven van ingebrachte markers.

**Resultaten:** In totaal werden 135 stereotactische puncties onderzocht. In 131 puncties kon de BIRADS-classificatie met de histologie worden vergeleken. Slechts eenmaal werden een BIRADS-0 en een BIRADS-2 als classificatie gegeven voorafgaand aan de punctie, 18 keer werden de onderzochte afwijkingen als BIRADS-3 geclassificeerd, 107 keer als BIRADS-4 en 5 keer als BIRADS-5. Als BIRADS-3 geclassificeerde mammae vertoonden histologisch in 13 gevallen

(72.0%) een benigne afwijking, en vijfmaal (28.0%) een (pre)maligne afwijking. Bij de BIRADS-4-lesies waren deze aantallen respectievelijk 74 (69.8%) en 32 (30.2%). Als BIRADS-5 afgegeven mammae bleken in alle gevallen histologisch (pre)maligne. Complicaties traden 5 keer op en technische problemen 12 keer. Markers werden 99 keer ingebracht, in 8 gevallen (8.1%) zagen we een duidelijke "migratie" van deze markers, waarbij de minimale gemeten afstand 1.5 centimeter en de maximale migratie 5 centimeter bedroeg.

**Conclusie:** Een BIRADS-4 classificatie wordt in vergelijking met BIRADS-3 en -5 vaak gegeven. Er vindt structureel een te lage BIRADS classificatie plaats. Soms komt migratie van markers voor, maar meestal beperkt.



**Figuur 1:** BIRADS vs. Histologie

08.5

**UNDERESTIMATION OF A DCIS COMPONENT IN PATIENTS WITH LARGE-CORE NEEDLE BIOPSY PROVEN PURE INVASIVE BREAST CARCINOMA**A.C. Schmitz<sup>1</sup>, M.A.A.J. van den Bosch<sup>1</sup>, L.E. Hoorntje<sup>1</sup>, M.E. Schipper<sup>1</sup>, P.J. van Diest<sup>1</sup>, I.H.M. Borel Rinkes<sup>1</sup>, P.H.M. Peeters<sup>1</sup>, W.P.Th.M. Mali<sup>1</sup>, H.M. Verkooijen<sup>2</sup><sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht<sup>2</sup>National University of Singapore, Singapore

**Purpose:** Invasive breast cancers with a ductal carcinoma in situ (DCIS) component have been shown to extent further from the index tumor than those without DCIS.

Consequently, invasive tumors with a DCIS component may be less suitable for minimally invasive therapy and partial breast irradiation. The purpose of this study was to assess the probability of the presence of a DCIS component in patients with large-core needle biopsy (LCNB) proven pure invasive breast cancer.

**Materials and methods:** Patients were retrieved from the

COBRA2000 study, which was conducted from 2000 to 2003. Biopsies were taken using a 14-gauge core needle. We selected patients with invasive carcinoma as only finding on LCNB and with surgical confirmation (n=254). The outcome measure was presence of a DCIS component. We compared patient characteristics as well as findings at mammography and ultrasound between invasive cancers with and without a DCIS component at final histopathology.

**Results:** An additional DCIS component was found in 68 (27%, 95% CI 22-33%) out of 254 cases. None of the patient characteristics, e.g., age (p=0.289), or imaging features, e.g., presence of microcalcifications (p=0.158) or mass (p=0.674) on mammography, were associated with DCIS component at final histopathology.

**Conclusions:** LCNB underestimates the presence of a DCIS component in approximately 1/4th of the patients diagnosed with LCNB proven pure invasive carcinoma. The accuracy to estimate a DCIS component in patients with invasive carcinoma might be improved, e.g., with the use of vacuum assisted biopsy.

08.6

**CONCORDANCE IN QUANTITY OF DCIS AND HORMONE RECEPTOR STATUS BETWEEN VACUUM ASSISTED BIOPSY AND SURGICAL EXCISION SPECIMEN IN EARLY BREAST CANCER PATIENTS**A.C. Schmitz<sup>1</sup>, K.M. Duvivier van Hoof<sup>1</sup>, P.J. Van Diest<sup>1</sup>, A.M. Fernandez Gallardo<sup>1</sup>, K.G. Gilhuijs<sup>2</sup>, A.J. Witkamp<sup>1</sup>, W.P.Th.M. Mali<sup>1</sup>, M.A.A.J. van den Bosch<sup>1</sup><sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht<sup>2</sup>NKI-AvL, Amsterdam

**Purpose:** The purpose of this study was to establish the accuracy of vacuum assisted biopsy (VAB) to predict HR status and the quantity of DCIS outside the invasive index tumor in the excision specimen.

**Materials and methods:** Patients with a BI-RADS 4 or 5 lesion on mammography and/or ultrasound were prospectively included. VAB was conducted using a 9-gauge Vocora needle. Histopathologic examination included tumor type and the quantity of DCIS. Quantity of DCIS was scored by counting every affected duct, followed by categorization into

4 groups; none, minimal, moderate and extensive. Estrogen (ER), Progesterone (PR) and HER2 status were determined in both VAB and excision specimen.

**Results:** Until April 2010, 33 patients were included. A mean  $\pm$ SD of 4.6  $\pm$ 1.4 VAB were taken per lesion. Histopathologic examination of the VAB showed 12 benign cases, 5 cases with DCIS only and 16 invasive carcinomas. For the invasive carcinomas the quantity of DCIS was none in 9 (56%) cases, minimal in 4 (25%), moderate in 3 (19%) and extensive in none (0%). In the excision specimen, this was 63%, 19%, 6% and 12%, respectively (Fisher's exact for none-minimal versus moderate-extensive: p=0.071). ER, PR and HER2 status on VAB showed a 94% (15/16), 94% (15/16) and 100% (16/16) concordance with the excision specimen.

**Conclusions:** These preliminary results show that there is an association between the quantity of DCIS in the VAB and the quantity of DCIS outside the invasive index tumor. VAB seems to be suitable for determination of ER, PR and HER2 status.

08.7

### RESULTS OF A RETROSPECTIVE STUDY OF MRI-GUIDED BIOPSIES BY USING EITHER A LARGE NEEDLE CORE BIOPSY OR A VACUUM ASSISTED BIOPSY (VAB).

K.M. Duvivier, M.A.A.J. van den Bosch, M.A. Fernandez  
Universitair Medisch Centrum Utrecht, Utrecht

**Purpose:** In this study we report the results of MRI-guided biopsies of suspicious breast lesions by using either a large needle core biopsy or a vacuum assisted Biopsy (VAB).

**Materials and methods:** MRI guided biopsy was performed in 75 patients at our hospital between February 2006 and March 2010. MRI findings were correlated with pathology and follow-up. VAB was conducted using a 9-gauge Vocora needle.

**Results:** MRI-guided biopsy was successful in 66 patients, in 2 patients de lesion wasn't visible at time of intervention. In 7 patients de lesion was either 'to medial' or 'to cranial'

situated for the biopsy to be performed.

Of the 33 patients biopsied with a large core needle, 4 patients returned for a second MRI-guided biopsy. In 10 patients using the large core needle approach there wasn't a conclusive pathology report, for which another diagnostic approach or a surgical intervention was planned. None of the 33 patients (35 lesions) using the VAB returned for a second approach. The only problems encountered were the lesions situated to medial, in which the lesion was marked for a needle localization. There were no complications other than 2 minor bleedings. Retrospectively by using VAB instead of the large core needle approach there would have been a more conclusive result (less positioning problems and a more reliable biopsy) in 14 patients.

**Conclusions:** For mammographically occult breast lesions MRI guided biopsies should preferable be performed using a VAB. In our study we encountered less positioning problems and none inconclusive pathology reports.

08.8

### MR-GUIDED BREAST BIOPSY AT 3T; DIAGNOSTIC YIELD OF LARGE CORE BIOPSY COMPARED TO VACUUM ASSISTED BIOPSY

R.M. Mann<sup>1</sup>, C. Meeuwis<sup>2</sup>, R.D.M. Mus<sup>1</sup>, C. Boetes<sup>3</sup>,  
J. Veltman<sup>1</sup>, J.O. Barentsz<sup>1</sup>

<sup>1</sup>UMC St Radboud, Nijmegen

<sup>2</sup>Rijnstate Ziekenhuis, Arnhem

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

**Introduction:** "MR-only" breast lesions need to be biopsied under MR guidance. At 3T only MR-guided large core breast biopsy (LCB) has been evaluated. Moreover, no studies directly compare diagnostic yield of LCB with vacuum assisted breast biopsy (VAB) at any field strength. We evaluated both methods at 3T and compared the diagnostic yield and rate of complications.

**Methods:** We performed MR guided breast biopsy at 3T in a consecutive series of patients with MR-only detected breast lesions between July 2007 and February 2010. Until September 2008 14G LCB were performed, thereafter 9G

VAB was the biopsy technique of choice. We performed 71 LCB and 72 VAB. Histopathology was compared to the MRI. Results were classified as representative, doubtful representative or non-representative of the lesion. Statistical analysis was performed using the chi-square test.

**Results:** 39 LCB were judged representative (56% 12 malignant and 27 benign lesions), 22 were doubtful representative (30%, all benign) and 9 were not representative (13%). 63 VAB were judged representative (87%, 22 malignant and 41 benign lesions), 6 were doubtful representative (8%, all benign) and 3 were not representative (4%). Distribution was significantly different ( $p < 0.001$ ), favoring VAB over LCB. Using VAB 2 small arterial hemorrhages that required prolonged compression were recorded. Using LCB no complications were recorded.

**Conclusion:** Because of the substantial higher diagnostic yield and certainty of a benign diagnosis, VAB is the preferred biopsy technique at 3T. LCB should only be considered when VAB is unavailable.

## Sessie 9

Onderwijs & Diversen /  
Kinderradiologie

Vrijdag 17 september 2010, 11.15 - 12.45 uur

09.1

**MULTIDETECTOR CT UROGRAPHY: A NEW SCANNING PROTOCOL FOR IMPROVED VISUALIZATION OF THE URINARY TRACT**H.M. Suliman, M. Hepkema, Y. Buijs, E.P. van Haarst  
*St. Lucas Andreas Ziekenhuis, Amsterdam*

**Purpose:** To evaluate and describe the degree of opacification of the renal collecting system and ureters on excretory-phase[1]contrast-enhanced CT using 750-1,000 mL oral ingestion of water without abdominal compression, saline infusion, furosemide administration or prone positioning [2]. We evaluated a different CT scanning protocol on the depiction of the urinary tract by multi-detector row CT urography

**Methods and Materials:** 2977 collecting systems and ureters of 1490 consecutive patients (age range, 25-92 years; mean age, 54 years) who had dedicated urinary tract CT examinations were evaluated. The indications for the examination included hematurie(n=1322), history of bladder

cancer (n=36) and suspected urinary obstruction (n=132). All examinations were clinically requested, and approval for retrospective review of the medical records and CT studies was obtained from our institutional review board.

**Results:** Among 2977 renal collecting systems and ureters, the opacification scores of the calyx and infundibulum by each of two reviewers were 3 (complete opacification) in 82% ; (near complete opacification) in 15%, and 1 (poor opacification) in 3%. Twelve patients had mild dilatation of the renal collecting system and ureter on one side. The affected side of the renal collecting system and ureter was completely or nearly completely opacified in these twelve patients

**Conclusion:** Excretory-phase CT after ingestion of 1,000 mL water opacified the ureters completely in 82%, and nearly completely in 15% of the cases. Findings at excretory-phase imaging allow excellent evaluation of the collecting systems and ureters.

09.2

**MRI GERELATEERDE BRANDWONDEN**R.R. Highet, W.H. Backes, M.W. de Haan, J.E. Wildberger  
*Maastricht Universitair Medisch Centrum, Maastricht*

**Introductie:** Binnen enkele maanden werd onze afdeling opgeschrikt door een viertal incidenten, waarbij patiënten tijdens hun MRI onderzoek 2e graads brandwonden hadden opgelopen. De korte tijdsperiode maar ook de impact van deze incidenten op deze patiënten vormden aanleiding tot uitvoerige analyse en het formuleren van verbeterpunten.

**Methoden:** Analyse van de incidenten bestond uit het identificeren van risico factoren. Deze gegevens werden gerelateerd aan de fysieke mechanismen die ten grondslag kunnen liggen aan het ontstaan van opwarming tijdens MRI onderzoeken. Op basis van deze analyse zijn verschillende punten ter preventie en verbetering geformuleerd.

**Resultaten:** De 4 incidenten deden zich voor op één MRI systeem, vonden plaats in de zomer en tijdens langdurige

hoge SAR scans. Van de algemene risicofactoren voor MRI gerelateerde brandwonden was er bij twee onderzoeken sprake van huid-huid contact, bij één onderzoek was er huid-kabel contact en bij één onderzoek toonde de patiënt transpiratie. In een geval was er mogelijk ook sprake van verminderde thermoregulatie.

**Discussie:** Hoewel wereldwijd meer dan 150 brandwondeneincidenten zijn gerapporteerd, zijn er weinig gedetailleerde studies over de oorzaken van MRI brandwonden. Algemeen wordt aangenomen dat directe elektromagnetische inductie vanuit kabelloops verantwoordelijk is voor het ontstaan van brandwonden. Echter vele factoren spelen waarschijnlijk een rol waardoor het ontstaan van brandwonden onvoorspelbaar is. Het risico kan worden beperkt door het nemen van de juiste voorzorgsmaatregelen (cable spacers).

**Conclusie:** Hoewel MRI gerelateerde brandwonden relatief weinig voorkomen, is de impact ervan voor de betrokken patiënt groot. Adequate patiënt instructie voorafgaande aan specifieke scan protocollen kan veel problemen voorkomen.

09.3

**KWALITEITSINDICATOR 'ACUTE BUIK' IN DE PRAKTIJK**

J.J. Hof, M. Kraai  
Ziekenhuisgroep Twente, Almelo

Er bestaat een toenemende tendens voor kwaliteitsinzage. Kwaliteitsvisitaties zijn wettelijk verankerd in de wet BIG en sinds 2005 verplicht. Dit moet leiden tot zelfevaluatie, inzicht in geleverde kwaliteit en transparantie. Prestatie-indicatoren zijn meetbare aanwijzingen voor de mate van kwaliteit en hebben een signaalfunctie; het is geen directe maat voor kwaliteit.

Bij de (test)indicator acute buik van de NVVR draait het om de diagnostische accuratesse van preoperatieve beeldvorming ten opzichte van de postoperatieve bevindingen. Het uitzoeken van deze indicator kan een lastige klus zijn. Wij tonen een voorbeeld hoe deze gegevens te achterhalen zijn ter bepaling van de accuratesse.

Vanaf november 2009 werden alle operaties met een COTG

code passend bij mogelijke acute presentatie van een buikprobleem nagezocht. Acute presentatie werd getoetst, als ook de aanwezigheid van preoperatieve beeldvorming. Onderverdeling geschiedde naar het bij de kwaliteitsvisitatie gehanteerde systeem: correcte OK-indicatie/correcte diagnose (CICD), correcte OK-indicatie, incorrecte diagnose (CIID), incorrecte diagnose en indicatie(IIID).

145 patiënten werden geïncludeerd. Bij 122 patiënten was er een CICD, bij 7 CIID, bij 5 IIID; 10 mensen hadden een inconclusief onderzoek. Hiermee komt de accuratesse voor de OK-indicatie op 96%, de accuratesse voor de diagnose op 90%. Van de incorrecte diagnoses betrof het 3 maal peroperatief en PA bewezen cholecystitis, waar de specifieke radiologische kenmerken onvoldoende benoemd waren. Voorts werden een mogelijk naadlekkage afgegeven en een gedekte dunnedamperforatie gemist.

Uitkomstindicatoren geven een duidelijk beeld van de geleverde diagnostische kwaliteit en door monitoring van de COTG codes is een grotere kwaliteitsslag te maken dan door deze slechts periodiek te bepalen.

09.4

**FINDING THE ORIGIN OF PULMONARY EMBOLISM WITH A TOTAL-BODY MR DIRECT THROMBUS IMAGING TECHNIQUE**

K. van Langevelde, S. C. Cannegieter, F.R. Rosendaal, A. Šrámek  
Leids Universitair Medisch Centrum, Leiden

**Introduction:** Pulmonary embolism (PE) is thought to originate from embolisation of a deep-vein thrombosis (DVT), resulting in two clinical manifestations of one disease: venous thromboembolism. However, in 30% of patients with PE, no DVT is found with ultrasound. A new technique in diagnosing DVT is 'MR Direct Thrombus Imaging' (MRDTI), using endogenous contrast in the thrombus. We performed total body MRIs to visualize thrombi from calf veins to subclavian veins, to assess the origin of PE.

**Methods:** Our study will include 100 patients with PE diagnosed by Multi Detector CT scan. All patients will

undergo a 1.5 T MRDTI scan. In addition a questionnaire on risk factors for DVT and PE will be filled out. Blood sampling for determination of genetic risk factors will take place.

**Results:** At present, 46 patients have been enrolled in the study. In 22/46 (48%) a thrombus could be identified on MR images. Most thrombi originated from the left side of the body (16/22). The popliteal vein was involved most often (10/22), five of these DVTs extended into the femoral vein. Other thrombi were present in the pelvic veins (2/22), femoral vein alone (1/22) and deep calf veins alone (7/22). Two patients had thrombophlebitis.

**Conclusion:** Preliminary results show that in only half of PE patients a thrombus can be found with MRI. Thrombi originated mainly from popliteal and calf veins. In PE patients with no thrombus on MRI, a local origin of PE, a thrombus from cardiac origin or complete embolisation need to be considered.

09.5

**WWW.RADIOLOGINOPLEIDING.NL**

M.S.C. Haag

*Rijnstate Ziekenhuis, Arnhem*

Radioloogopleiding.nl is een educatieve website voor assistenten in opleiding tot radioloog aan de hand van oude voortgangstoetsen. Er zit veel kennis in oude toetsen. In de opleidingsklinieken wordt hier op velerlei manieren gebruik

van gemaakt, als naslagwerk of om te oefenen voor de halfjaarlijkse toetsing, echter vaak op een omslachtige manier. Met behulp van deze site is het mogelijk om doelgericht zelftoetsing toe te passen en efficiënt selectieve onderwerpen terug te zoeken. Vragen kunnen worden teruggezocht per jaar en per aandachtsgebied, maar ook op trefwoord en als random selectie. Wellicht kan het t.z.t. ook als platform voor AIOS worden benut. Presentatie en demonstratie.



09.6

**RADIATIE DOSIS BIJ PEDIATRISCHE FLUOROSCOPIE: EEN KLINISCHE AUDIT**

M.M.A.C. van Santen - van Doorn, R.R. van Rijn  
*Academisch Medisch Centrum, Amsterdam*

**Inleiding:** Klinische audits (KA) zijn in Nederland binnen de radiologie nog geen gemeengoed. Het doel van een KA is middels een formele review radiologisch handelen te vergelijken met geldende standaarden.

**Methoden:** De doorlichtingsdosis (DAP waarden) van de periode 1-1-2007 - 15-3-2009 in het Emma Kinderziekenhuis/AMC zijn geëvalueerd. Van het doorlichting onderzoek is het geslacht en de leeftijd van de patient, het type onderzoek en de onderzoeker (stafid versus assistent) geregistreerd. De patiënten zijn voor analyse gestratificeerd in leeftijdsgroepen ( $\leq 1$  jaar,  $> 1$  jaar). Als standaard is gebruik gemaakt van de waarden van de kinderradiologie van Great Ormond Street Hospital, UK.

**Resultaat:** Van in totaal 817 studies waren alle relevante gegevens beschikbaar voor 707 (87%) studies. Geïnccludeerd zijn de vijf meest voorkomende onderzoeken. Het aantal, gemiddelde, mediaan en 75ste percentiel DAP waarden onder 1 jaar: slik-onderzoek (N= 65 - 3,8 - 1,1 - 3,4), maag duodenum studie (N= 52 - 2,9 - 0,9 - 3,1), colon inloop (N= 65 - 3,1 - 0,8 - 2,2), mictiecystogram (N= 67 - 2,3 - 0,5 - 1,2) en repositie invaginatie (N= 13 - 5,5 - 0,7 - 8,4). Boven 1 jaar: slik-onderzoek (N= 111 - 5,1 - 2,2 - 5,0), maag duodenum studie (N= 75 - 4,4 - 2,4 - 4,5), colon inloop (N= 29 - 6,3 - 3,5 - 7,0), mictiecystogram (N= 118 - 5,6 - 2,0 - 3,4) en repositie invaginatie (N= 11 - 10,0 - 1,4 - 4,9). Er was geen significant verschil tussen stafleden en arts-assistenten.

**Discussie:** Gebaseerd op de gemeten DAP waarden kan een referentie dosisniveau per onderzoek worden bepaald. Streefwaarde is onder de 75ste percentiel. De aangetoonde waarden liggen onder de gepubliceerde standaard.

09.7

**WHOLE-BODY MRI, INCLUDING DIFFUSION-WEIGHTED IMAGING, COMPARED TO FDG-PET FOR STAGING HODGKIN LYMPHOMA - INITIAL EXPERIENCES**

M.A. Vermoolen<sup>1</sup>, T.C. Kwee<sup>1</sup>, E.M. Akkerman<sup>2</sup>, H.M.E. Quarles van Ufford<sup>1</sup>, F.J.A. Beek<sup>1</sup>, M.B. Bierings<sup>1</sup>, J. Zsiros<sup>2</sup>, W.P.Th.M. Mali<sup>1</sup>, R.A.J. Nievelstein<sup>1</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

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

**Purpose:** Whole-body magnetic resonance imaging (MRI), including diffusion-weighted imaging (DWI), is emerging as a new, radiation-free method for oncological staging. This study aimed to compare whole-body MRI, including DWI, to 18F-fluorodeoxyglucose positron emission tomography (FDG-PET) for staging newly diagnosed Hodgkin lymphoma (HL).

**Materials and methods:** 9 children (5 males and 4 females; mean age, 14.9 years; age range, 12-16 years) with newly diagnosed HL prospectively underwent whole-body

MRI (T1-weighted and T2-STIR [n=9], and DWI [n=8]) and FDG-PET. Whole-body MRI and FDG-PET were evaluated by different observers who were blinded to the findings of the other imaging modality. Ann Arbor stages according to whole-body MRI (without and with DWI) were compared to those of FDG-PET.

**Results:** Staging results of whole-body MRI without DWI were equal/higher/lower to those of FDG-PET in 6, 1, and 2 of 9 patients, respectively. Staging results of whole-body MRI with DWI were equal/higher/lower to those of FDG-PET in 6, 1 and 1 of 8 patients, respectively.

**Conclusion:** Our initial results indicate that staging using whole-body MRI (without and with DWI) is equal to staging using FDG-PET in the majority of patients. However, whole-body MRI under- and overstaging relative to FDG-PET occurred in some patients. This study is continuing as an international multicenter trial in collaboration with the European Excellence Network on Pediatric Radiology (EENPR).

## Sessie 10

Abdominale radiologie /  
Acute radiologie

Vrijdag 17 september 2010, 11.15 - 12.45 uur

O10.1

**DE INVLOED VAN MRI OP DE DIAGNOSE-  
ZEKERHEID VAN DE CHIRURG OVER APPEN-  
DICITIS BIJ DE PREMENOPAUAZALE PATIËNT***C.M.P. Ziedses des Plantes<sup>1</sup>, M.J.F. van Veen<sup>2</sup>,  
H.A.J. Gielkens<sup>1</sup>, J. van der Palen<sup>1</sup>, J.M. Klaase<sup>1</sup>,  
R.H. Geelkerken<sup>1</sup>*<sup>1</sup>Medisch Spectrum Twente, Enschede<sup>2</sup>Isala klinieken, Zwolle

**Doel:** Het onderzoeken in welke mate de diagnosezekerheid van de chirurg over appendicitis bij premenopauzale vrouwen wordt beïnvloed door MRI.

**Methode:** Premenopauzale patiënten met de klinische verdenking op appendicitis ondergingen een blanco MRI abdomen. De behandelend chirurg gaf diens waarschijnlijkheid over de diagnose appendicitis in een vijfpuntenschaal (1%, 25%, 50%, 75% of 99%) op drie beslismenten.

1. Na de eerste klinische evaluatie.
2. Na de tweede klinische evaluatie, direct na het ondergaan van de MRI
3. Na het lezen van de MRI uitslag

De waarschijnlijkheid van 1% en 99% werd geduid als 'zeker', terwijl de waarschijnlijkheid van 25%, 50% en 75% beschouwd werd als 'onzeker'.

Gescand werd met een 1.5-Tesla MRI (Philips Medical Systems): coronaal en sagittaal T2 turbo spin echo en transversaal T1 gradiënt echo. De verzegelde MRI uitslag werd geopend na beslismoment 2.

**Resultaten:** 112 patiënten (12-55 jaar) werden geïncludeerd. Op beslismoment 1 en 2, was in respectievelijk 86% en 79% van de gevallen de chirurg 'onzeker' over de diagnose appendicitis. Op beslismoment 3 was de chirurg 'onzeker' in slechts 45% van de gevallen. Het verschil tussen beslismoment 1 en 2 was statistisch significant ( $p=0.021$ ), evenals het verschil tussen beslismoment 1 en 3 ( $p<0.001$ ) en tussen beslismoment 2 en 3 ( $p<0.001$ ) (binomiale test).

**Conclusie:** Deze studie toont aan dat de diagnosezekerheid van de chirurg over appendicitis bij premenopauzale patiënten meer toeneemt door de MRI uitslag te betrekken bij de besluitvorming, dan een eerste of tweede klinische evaluatie alleen.

O10.2

**MINDER ONTERECHE APPENDECTOMIE  
DOOR ECHOGRAFIE EN CT***M.M.N. Leeuwenburgh, O.J. Bakker, M.P. Gorzeman,  
T.L. Bollen, C.A. Seldenrijk, P.M.N.Y.H Go  
St. Antonius Ziekenhuis, Nieuwegein /  
Academisch Medisch Centrum, Amsterdam*

**Doel:** Het onderzoeken van de invloed van de implementatie van echografie met optionele CT en diagnostische laparoscopie op het percentage negatieve appendectomieën bij patiënten met verdenking op appendicitis acuta.

**Opzet:** Prospectief en vergelijkend met een historische controlegroep.

**Methode:** Na introductie van beeldvorming met echografie als eerste stap werd de uitkomst van alle patiënten met

verdenking op appendicitis die zich presenteerden op de Spoedeisende Hulp (SEH) prospectief geregistreerd gedurende een periode van 18 maanden (juli 2006-december 2007). Resultaten werden vergeleken met retrospectief verzamelde data van alle patiënten bij wie in 2001 een appendectomie werd verricht vanwege appendicitis acuta vóór de implementatie van dit beeldvormend onderzoek.

**Resultaten:** Van 312 opeenvolgende patiënten op de SEH met verdenking op appendicitis acuta werd bij 51 appendicitis uitgesloten na klinisch en laboratoriumonderzoek. Het diagnostisch traject werd bij 239 van de 261 patiënten (92%) toegepast. Bij 75 patiënten (31%) volgde na echografie CT en bij 12 patiënten (5%) een diagnostische laparoscopie. 130 patiënten ondergingen een appendectomie, bij wie 8 appendices (6%) bij pathologisch onderzoek sanae waren. Vóór de implementatie van deze preoperatieve beeldvorming waren 36 van de 170 appendices (21%) sanae. Na

introductie van beeldvormende diagnostiek volgens de richtlijn daalde het percentage negatieve appendectomieën significant (21% versus 6%;  $p < 0,001$ ). Het totale aanvullende diagnostisch traject had een positief- en negatief- voorspellende waarde van respectievelijk 90% en 98% voor acute appendicitis.

**Conclusie:** Structurele toepassing van echografie met optionele CT en diagnostische laparoscopie bij patiënten met verdenking op appendicitis acuta resulteerde in een lager percentage negatieve appendectomieën.

O10.3

### **RADIOLOGISCHE BEELDFORMING BIJ ACUTE BUIK: ERVARINGEN MET DE PRESTATIE-INDICATOR BUIKDIAGNOSTIEK**

B. Zwart, L. Sibinga Mulder, P.L. Houweling, T. Weits  
*Diakonessenhuis, Utrecht*

**Doel:** Inzicht te geven in de diagnostische accuratesse van radiologisch onderzoek bij geopereerde patiënten met acute buik, in het kader van de prestatie-indicator buikdiagnostiek.

**Opzet:** Retrospectief, consecutief cohort onderzoek

**Method:** Patiënten geopereerd met acute buik in het Diakonessenhuis Utrecht in de periode 1 januari 2008 tot 1 januari 2009 werden middels het anesthesie informatie management systeem geïnccludeerd. Operatieverslagen en radiologieverslagen van conventionele buikoverzichtfoto's, CT-scans van het abdomen, echo's van het abdomen en röntgenfoto's van de thorax met vraagstelling 'vrij lucht subfrenisch' werden geregistreerd. De radiologische

bevindingen werden gecorreleerd aan de peroperatieve diagnoses conform de prestatie-indicator buikdiagnostiek.

**Resultaten:** Er werden 341 patiënten geïnccludeerd, van wie in 338 gevallen (99,1% ) een operatieverslag beschikbaar was. Bij 181 patiënten (53,6 %) was pre-operatief beeldvormend onderzoek verricht. Appendicitis acuta en cholecystitis acuta vormden tezamen ruim 50% van alle diagnoses. De radioloog stelde in 64,6% een geheel juiste pathologisch-anatomische diagnose. In 23,2 % was de specifieke radiologische diagnose niet juist maar was een terechte operatie-indicatie gesteld. In 12,2% was zowel de pathologisch-anatomische diagnose als de gestelde operatie-indicatie onjuist.

**Conclusie:** Bij bijna vijftig procent van alle geopereerde patiënten met acute buik was vooraf geen beeldvormend onderzoek verricht. Bij patiënten met pre-operatieve beeldvorming was de radioloog in staat om in bijna 90% een juiste operatie-indicatie te stellen.

O10.4

### **MRI EVALUATION OF PATIENTS WITH ANAL AND PERIANAL PAIN REFERRED TO A TERTIARY COLORECTAL SURGICAL DEPARTMENT**

T.E.A. Geeraedts, R.S. Dworkasing, W. Hop, R. Schouten, G.P. Krestin  
*Erasmus Medisch Centrum, Rotterdam*

To assess diagnostic performance of dedicated MRI in patients with persistent anal or perianal pain.

Retrospective analysis was performed on patients referred for dedicated MRI of the anorectum. Inclusion criteria were complaints of anal or perianal pain persisting for at least three months and in which no cause could be found on clinical workup, including examination under general anaesthesia and anorectoscopy. In case of history of anorectal disease the disease free period should be at least one year. MRI was performed with pelvic phased array and an endoanal coil. MRI protocol included T2 weighted sequences of the

pelvis in 3 planes. Examinations were read by 2 experienced abdominal radiologists.

99 patients met the criteria. 61 patients had no history of anorectal diseases, 38 were previously treated for anorectal diseases. MRI indicated the final diagnoses in 35 % of patients (95% C.I.: 26%- 46%), including perianal fistulae (n=16), fistulae with abscess (n=2), perianal abscess (n=5), recurrent perianal abscess (n=1), painful scarring of the sphincter complex (n=9), metastasis to the sacrococcygeus of unknown primary tumor (n=1) and presacral abscess (n=1). All diagnoses assessed with MRI were surgically or biopsy proven. In the remaining patients no abnormalities were found on MRI. The final diagnoses here were painful pelvic syndrome (n=38) and chronic pain of unknown origin (n=26).

In patients with persistent anal and perianal pain in which clinical workup cannot find a cause MRI will demonstrate a pathological substrate in about a third of cases. Mostly this concerns perianal fistula disease.

010.5

## **DYNAMIC CONTRAST-ENHANCED MRI (DCE-MRI) AS AN INDICATOR OF DISEASE ACTIVITY IN PATIENTS WITH LUMINAL CROHN'S DISEASE.**

M.L.W. Ziech, C. Lavini, A.J. Nederveen, C.I.J. Ponsioen, P.F.C. Stokkers, J. Stoker

*Academisch Medisch Centrum, Amsterdam*

**Purpose:** To assess if DCE-MRI parameters are correlated with disease activity in patients with luminal Crohn's disease (CD).

**Methods:** Ethical permission and informed consent was obtained. Luminal CD patients undergoing MRI and ileocolonoscopy were recruited. Patients drank 1600 ml of mannitol 2.5%. Coronal DCE-MRI was performed at 3T during intravenous contrast injection of Gadolinium (TE/TR= 1.8/2.9ms, FA 6°, 14 slices, dynamic scan duration 6.11 min, 450 dynamics, temporal resolution 0.81 sec). ME images were calculated. A region of interest (ROI) was drawn around the most abnormal region assessed on MRI and, if not present, a normal bowel loop and ME was averaged over these ROI.

C-reactive protein and Crohn's disease activity index (CDAI) was determined. Also Crohn's disease endoscopic index of severity (CDEIS) was determined which evaluates bowel involvement. CDEIS evaluation included also a partial CDEIS per segment to assess different bowel segments. Correlations were measured with Spearman's test.

**Results:** Sixteen patients were included (mean age 39 years range 24-72, 7 males). Mean time between MRI and ileocolonoscopy was 15 days (range 2-32). Median CDAI was 329 (range 112-735). Median CDEIS was 5.5 (range 0.4 - 39.0). Median C-reactive protein was 22 (range <1.1-95). ME had a significant positive correlation with CDEIS per segment ( $r=0.601$ ,  $p=0.014$ ). All other per-patient indices (CDAI, CRP and CDEIS) had no significant correlation with ME, although for CDEIS there was a trend towards a positive correlation ( $r=0.487$ ,  $p=0.056$ ).

**Conclusion:** ME measured with DCE-MRI is an objective non-invasive parameter to assess segmental disease activity in CD patients.

010.6

## **BLAND AND TUMOR THROMBI IN ABDOMINAL MALIGNANCIES: MAGNETIC RESONANCE IMAGING ASSESSMENT IN A LARGE ONCOLOGIC PATIENT POPULATION**

M.R.W. Engelbrecht<sup>1</sup>, O. Akin<sup>2</sup>, D. Dixit<sup>2</sup>, L.H. Schwartz<sup>2</sup>

<sup>1</sup>*Academisch Medisch Centrum, Amsterdam*

<sup>2</sup>*Memorial Sloan Kettering Cancer Center, New York, USA*

The purpose of this study was to examine the distribution of venous thrombi associated with primary or secondary abdominal malignancies on magnetic resonance (MR) imaging with respect to thrombus type (bland vs. tumor), tumor sites, tumor types, and veins involved in a large oncologic patient population. In a retrospective review of 10,908 oncologic

patients, MR imaging studies identified 142 (1.3%) showing venous thrombi, of which 55 (0.5%) were bland and 87 (0.79%) were tumor thrombus. Bland thrombi were most commonly seen in liver (35%; 19/55) and retroperitoneal malignancies (24%; 13/55) and were most often located in the inferior vena cava (45%; 25/55) and the portal vein (22%; 12/55). Tumor thrombi were most commonly seen in renal (55%; 48/87) and liver (32%; 28/87) malignancies. The prevalence of tumor thrombi was 8.8% (48/545) in primary renal, 4.7% (6/126) in primary retroperitoneal, 2.9% (19/634) in primary liver, and 1.8% (9/479) in secondary liver malignancies. Tumor thrombi were most commonly located in the inferior vena cava (57%; 50/87), the renal vein (48%; 42/87), and the portal vein (29%; 25/87).

010.7

## **PROSPECTIVE STUDY OF MRI IN PEDIATRIC PATIENTS SUSPECTED OF ACUTE APPENDICITIS**

M.E. Thieme<sup>1</sup>, D.E. Bouman<sup>1</sup>, I.G.J.M. De Bruin<sup>1</sup>, A.P.J. Houdijk<sup>1</sup>, W.H. Schreurs<sup>1</sup>, J. Stoker<sup>2</sup>, B.M. Wiarda<sup>1</sup>

<sup>1</sup>*Medisch Centrum Alkmaar, Alkmaar*

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

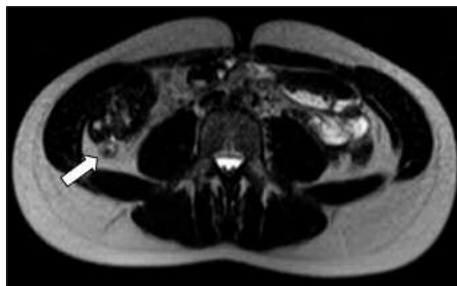
**Purpose:** The primary goal was to assess the value of MRI in pediatric patients for the detection of acute appendicitis (AA).

**Methods:** We conducted a prospective observational cohort study in 105 pediatric patients (47 male, 58 female, mean age 12.1, range 4.1-17.8) clinically suspected of AA. All patients underwent abdominal ultrasound as well as MRI within a maximum of 2 hrs (mean 39 min). MRI was performed using a 1.5T scanner. Clinical and laboratory data as well as imaging findings were collected and analyzed. Follow-up included all available data for a period of at least 3 months. An expert panel (two surgeons and one radiologist) established definitive diagnosis.

**Results:** AA was present in 58 patients (58/105; 55.2%).

MRI was true positive (TP) in 58, false positive (FP) in 6, true negative (TN) in 41 and false negative (FN) in none; sensitivity 100%, specificity 87.2%, PPV 90.6% and NPV 100%.

Four out of the 6 FP patients were operated on: two normal appendix at histopathology, one appendiceal carcinoid; one ovulation bleeding (the appendix was not excised). The two remaining FP patients were admitted and observed, and as



**Image 1:** Axial HASTE shows retrocecal appendicitis

symptoms disappeared, were diagnosed NSAP. US was inconclusive in 45 cases (42.9%), of which MRI correctly diagnosed 43 (95.6%), 11 TP and 32 TN.

**Conclusion:** MRI has high accuracy in diagnosing appendicitis in pediatric patients. NPV and PPV of MRI are comparable to those of CT as described in literature.



**Image 2:** Axial DWI shows restricted appendiceal diffusion

O10.8

### AVOID CT IN HEMODYNAMIC STABLE CHILDREN WITH ABDOMINAL INJURY

J.O. Oldenziel, D.R.N. Nellenstein, J. Groen, T.H. van Zwieten, H.J.D. ten Duis, J.B.F.H. Hulscher  
*Universitair Medisch Centrum Groningen, Groningen*

**Introduction:** Treatment of hemodynamically stable children with splenic or hepatic injury has shifted to non operative treatment (NOT). CT-scans are often used to assess injury. Previous studies show poor correlation between grade of injury and the outcome of NOT. Radiation dosage is substantial, especially in children. We set out to determine the therapeutic yield of CT-scans in relation to the radiation dose and calculated tumour incidence and tumour mortality.

**Patients and methods:** All hemodynamically stable patients undergoing abdominal CT-scans for trauma in the emergency setting between 2005-2009 in our hospital were reviewed. The notes were analysed for: injury, (non)operative therapy, radiological interventions and hemodynamic parameters on admission. From the scans we calculated the radiation risks.

**Results:** 72 patients were scanned, 9 were hemodynamically unstable and excluded.

In 2 cases a CT-scan brought forward an indication for intervention.

One was suspected of a duodenal perforation which was not found by laparotomy.

The second patient underwent an angiogram for a splenic arterial blush on CT which disappeared during the angiogram. She did receive treatment by Selective Arterial Embolisation (SAE).

In 61(97%) patients a CT-scan was performed that didn't influence treatment.

Patients received (median/range) 11,43/1,185-23,76 mSv adding up to 0,17%/0,05-0,67% accumulated tumour incidence and 0,08%/0,02-0,28% mortality.

**Conclusion:** 2(3%) of 63 hemodynamically stable patients who received an abdominal CT underwent, debatably unnecessary, intervention. In 97% CT-scans did not change management. Cumulative cancer risk and cancer mortality in these patients was 0,17% and 0,08% resp. Therefore CT-scans should be avoided in the hemodynamically stable patient.

# Samenvattingen Posterpresentaties

P01

## RENAL AND VASCULAR ENHANCEMENT IN SPLIT-DOSE MDCT UROGRAPHY

I. ten Katen, M.S. van Leeuwen, J. Hendrikse  
*Universitair Medisch Centrum Utrecht, Utrecht*

**Objective:** To compare arterial and renal enhancement in a split-dose CT intravenous pyelogram compared with the arterial and nephrographic phase of a renal CT. The split-dose CT-IVP protocol is designed to combine scanning in the corticomedullary and excretion phase.

**Subjects and Methods:** A retrospective analysis was performed on data obtained by a split-bolus CT-IVP, the arterial and nephrographic phase of a renal CT. 25 examinations were evaluated for each protocol. Enhancement values of the aorta, IVC, renal arteries and veins, renal cortex and medulla were compared. The CT-IVP protocol consisted of 100ml of contrast material (1ml/s), 270 seconds later followed by 50ml at 3ml/s, acquisition started 8 seconds after

reaching a 150HU threshold in the aorta. The renal CT consisted of a single-bolus of 150ml (4.5ml/s), the arterial and nephrographic phase were scanned respectively 20 and 90 seconds after a 100HU threshold.

**Results:** Significant lower mean enhancement values of the renal medulla were found in the CT-IVP (109±21HU) compared to the nephrographic phase of the renal CT (145±36 HU,  $p<0.01$ ). No significant differences were found between enhancement values of the renal cortex. There was no significant difference found in enhancement of the renal artery in the CT-IVP protocol (170±54HU) compared to the arterial phase of the renal CT (200±62HU). However, this difference was significant for the renal vein (CT-IVP: 102±29HU, arterial phase:140±41HU,  $p<0.01$ ).

**Conclusion:** The split-bolus CT-IVP provides sufficient opacification of the renal artery. The renal medulla shows significant lower enhancement compared to the nephrographic phase of a renal CT.

P02

## THE ARGUS® MALE SLING; RADIOGRAPHIC EVALUATION USING CT

N.M. Minderhoud, E.R. Ranschaert, G.P. Serafino,  
D.M. Bochove-Overgaauw, B. Schrier  
*Jeroen Bosch Ziekenhuis, 's-Hertogenbosch*

**Purpose:** To assess the usefulness of CT-scan of the lower abdomen after placement of the adjustable male urethral sling (Argus®) used for the treatment of post-prostatectomy urinary incontinence.

**Introduction:** The Argus® device is a suburethral silicone foam pad with two attached retropubic cone columns. The amount of urethral compression it provides can be regulated by adjustment of two silicone washers that rest on the rectus fascia.

**Methods:** We evaluated 30 patients who were treated with the Argus® male sling between April 2005 and May 2010 and underwent at least one CT-scan of the lower abdomen

after surgery. All scans were analysed to assess proper placement of the device and to detect possible complications of the surgical procedure.

**Results:** A group of 30 patients underwent a total of 37 CT-scans. On 30 scans no abnormalities were seen with proper placement of the sling. Malposition of sling and/or components was seen on 8 CT-scans. In 5 patients an abscess, infection or haemorrhage lead to intervention. Urethral erosion was seen on one CT-scan. Most surgical revisions (14 patients) were done based upon clinically measured parameters, mostly voiding dysfunction. In those cases CT had little clinical value.

**Conclusion:** A CT-scan provides an objective and adequate assessment of the position of the Argus® male sling and its components. Migration and other complications can be easily evaluated. We think postoperative CT evaluation can be a helpful tool in this decision-making process. Decision-making for revision should be based upon proper integration of both radiological and clinical findings.

P03

## EVALUATIE VAN HET POSTTHROMBOTISCH SYNDROOM MET BLOOD POOL MRA: REVIEW VAN IMAGING PROTOCOL EN KARAKTERISTIEKE BEVINDINGEN

T. Leiner<sup>1</sup>, C. Arnoldussen<sup>2</sup>, J.E. Wildberger<sup>2</sup>, C.H.A. Wittens<sup>2</sup>, M.W. de Haan<sup>2</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

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

Het postthrombotisch syndroom (PTS) is een complex van symptomen dat kan optreden als lange termijn complicatie na een doorgemaakte diepe veneuze thrombose.

Doel van deze presentatie is 1) beschrijving van een MR angiografisch protocol waarmee de diepe veneuze structuren in de gehele onderste extremiteit zichtbaar gemaakt kunnen worden en 2) review van de afwijkingen in patiënten

met klinische verdenking op PTS.

Het MRA protocol bestaat uit een combinatie van first-pass imaging van de aorta abdominalis tot en met de voeten met aanvullend ultra-hoge resolutieopnamen in de equilibrium- of blood pool fase met voxels van 0.7x0.7x0.7 mm<sup>3</sup> of kleiner. De acquisitieduur bedraagt ongeveer 20 minuten.

Kenmerkende bevindingen bij patiënten met PTS klachten zijn strengen postthrombotisch materiaal in de venen, diepe veneuze thrombose, veneuze ectasieën en veneuze insufficiëntie.

In de posterpresentatie zal ingegaan worden op onze ervaringen met het MRI protocol alsmede karakteristieke bevindingen in meer dan 50 patiënten die voor PTS klachten zijn geëvalueerd.

P04

## SCHILDWACHTKLIERPROCEDURE BIJ BORSTKANKER: LOGISTIEK EN EFFICIËNTIE

B.L. Stehouwer, W.P.Th.M. Mali, M.G.G. Hobbelink, A.J. Witkamp, M.A. Korteweg, W.B. Veldhuis, P.J. van Diest, M.A.A.J. van den Bosch

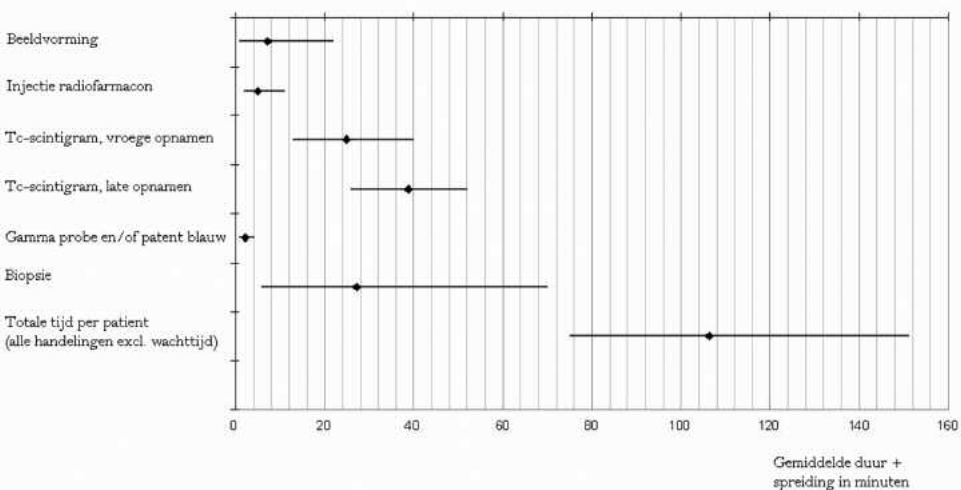
Universitair Medisch Centrum Utrecht, Utrecht

De schildwachtklieprocedure bij borstkankerpatiënten is een standaard onderzoek in de stadiëring van T1 en T2 mammacarcinomen. Bij deze procedure worden verschillen

de stappen doorlopen en zijn meerdere disciplines betrokken. Het doel van deze studie was om de logistiek en tijdsinvestering van de schildwachtklieprocedure per patiënt bij het huidige 1-dags protocol inzichtelijk te maken.

In totaal zijn 10 patiënten geïnccludeerd waarvan 1 met een bilateraal mammacarcinoom. Dit leverde in totaal 11 mammacarcinomen op waarvan 5 palpabel. De gemiddelde leeftijd van de patiënten was 62 jaar (spreiding 46-79 jaar). De gemiddelde maximale diameter van de mammacarcinomen op beeldvormend onderzoek (mammografie of echografie)

Resultaten van de tijdmetingen verricht per stap bij de schildwachtklieprocedure



**Figuur 1:** De figuur toont de resultaten verricht bij de 11 schildwachtklieprocedures. De gemiddelde duur per procedure en de spreiding is weergegeven in minuten. De totale tijd die een patiënt in het ziekenhuis doorbrengt is in dit figuur niet weergegeven. Deze bedraagt gemiddeld 400 minuten (spreiding 302 - 481 min.).

was 14mm (spreiding 5-26mm). In totaal werden 11 schildwachtklierprocedures verricht. Dit resulteerde in 10 biopsieën en 1 non-visualisatie. Het gemiddelde aantal geëxcideerde schildwachtklieren per procedure was 2,4 (spreiding 1-6).

Analyse van de schildwachtklierprocedure bij borstkankerpatiënten resulteerde in een subverdeling van zes verschillende te doorlopen stappen (ten eerste de tumorlokalisatie, gevolgd door toediening van Tc-99m nanocolloid en de scintigrafie met vroege en late statische opnamen, als 5e stap het toedienen van patent blauw en als laatste de biopsie),

een intensieve multidisciplinaire samenwerking (radiologie, nucleaire geneeskunde en chirurgie) en een gemiddelde tijdsinvestering van 106 minuten per patiënt (spreiding 75-151 min.). De tijd die een patiënt in het ziekenhuis doorbrengt, inclusief wachttijd en operatietijd, vanaf de tumorlokalisatie en tracertoediening tot en met de biopsie, is 400 minuten per patiënt (spreiding 302-481 min.).

Concluderend, de schildwachtklierprocedure een bewezen succesvolle procedure, maar deze vereist een multidisciplinaire samenwerking en is arbeidsintensief.

P05

### HET EFFECT VAN MRI IN DE WORK-UP BIJ MAMMACARCINOOM

*M.M.G. van der Leest, R.L.J.H. Bourez, J.M. Huttenhuis  
Ziekenhuisgroep Twente, Almelo*

**Doel:** Het bepalen van de toegevoegde waarde van MRI op het chirurgisch beleid bij mammacarcinoom.

**Opzet:** Descriptief

**Method:** Bij 168 nieuwe patiënten met mammacarcinoom werd preoperatief een MRI-mamma verricht naast de reguliere beeldvorming. Gevonden additionele foci werden met echografie en eventueel biopsie verder onderzocht. Retrospectief werd onderzocht of MRI nieuwe laesies had aangetoond, tevens werd de tumorgrootte bepaald. Het chirurgisch beleid werd retrospectief bepaald met blinding voor de met MRI verkregen informatie. Vervolgens werd informatie over ingestelde therapie en histologie verkregen. Uiteindelijk werd vastgesteld of MRI aan een wijziging van het beleid had bijgedragen. Tevens werd onderzocht of de

histologie overeenkwam met de verwachte tumorgrootte en focaliteit bij MRI na veranderd beleid.

**Resultaten:** MRI vond bij 45 vrouwen (27%) additionele laesies. 26 keer werd geen aanvullend onderzoek verricht omdat het ging om een satellietlaesie of was reeds gekozen voor een ablatie. Met gerichte echografie waren 5 laesies niet reproduceerbaar en imponeerden er 4 benigne. Aanvullende biopsie toonde 2 maligne laesies. Bij 28 patiënten werd het beleid veranderd na verrichte MRI op basis van een aanvullende focus of op basis van de grootte. Bij 19 patiënten werden de bevindingen van de MRI histologisch bevestigd. Bij 3 patiënten werd een ablatie verricht en bij 6 een ruimere lumpectomie, welke histologisch gezien niet nodig leken.

**Conclusie:** MRI leid bij een aanzienlijk aantal patiënten (11%) tot een klinisch relevante verandering van beleid. Valspositieve bevindingen zijn echter dermate frequent (5%), dat het gebruik van de MRI-bevindingen in de praktijk niet zonder meer kan worden toegepast.

P06

### PHARMACOKINETIC EVALUATION OF DCIS

*H.G. Toonen, R.M. Mann, H.J. Huisman, J. Veltman,  
C. Boetes  
UMC St Radboud, Nijmegen*

**Purpose:** Pharmacokinetic quantification of contrast enhancement in dynamic breast MRI can be used for color-coding of enhancement characteristics in breast lesions. In this study we compared the pharmacokinetic parameters of pure DCIS to benign and malignant breast lesions.

**Materials and methods:** All patients were scanned at 1.5 Tesla using a combined dynamic scanning protocol that consisted of fast dynamic imaging during initial enhancement and high spatial resolution T1 weighted imaging. The phar-

macokinetic quantification was performed using an in house developed dynamic MRI software platform. The parameters Ktrans (min<sup>-1</sup>), V (%) and Kep (min<sup>-1</sup>) of 14 cases of pure DCIS were compared to a group of 42 cases of IDC, a group of 11 fibroadenomas and a group of 12 non-mass-like enhancing benign lesions (NML-B). An independent samples T-test was used to compare the parameters.

**Results:** Ktrans (mean value of 1,4 vs 2,5) and V (47,5 vs 71,1) were significantly lower in DCIS when compared to IDC (P<0.01). The difference in kep (3,2 vs 3,8) was not significant. Comparing DCIS to fibroadenomas or NML-B revealed no significant differences for any of the parameters (p>>0.05).

**Conclusion:** The pharmacokinetic parameters calculated in DCIS are significantly lower than in IDC and are within the same range as values found in benign lesions. Color coding

dynamic data based on these parameters will therefore code DCIS as probably benign. This may result in the false negative assessment of DCIS.

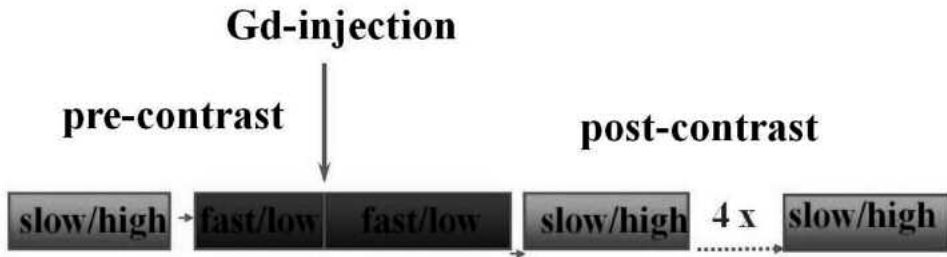


Figure 1: Combined scanning protocol.

Parameter	Subgroup	N	Mean
K <sub>trans</sub>	IDC	42	2,5398
	DCIS	14	1,4264
	Fibroadenoma	11	1,3818
	NML-B	12	1,0342
V	IDC	42	71,110
	DCIS	14	47,479
	Fibroadenoma	11	50,673
	NML-B	12	37,333
K <sub>ep</sub>	IDC	42	3,7376
	DCIS	14	3,1850
	Fibroadenoma	11	3,0518
	NML-B	12	2,7467

Figure 2: Mean parameter value's per subgroup.

P07

**DISTRIBUTION OF CEREBRAL BLOOD FLOW IN THE CAUDATE NUCLEUS, LENTIFORM NUCLEUS AND THALAMUS IN PATIENTS WITH CAROTID ARTERY STENOSIS**

N.S. Hartkamp<sup>1</sup>, R.P.H. Bokkers<sup>1</sup>, H.B. van der Worp<sup>1</sup>, M.P.J. van Osch<sup>2</sup>, L.J. Kappelle<sup>1</sup>, J. Hendrikse<sup>1</sup>

<sup>1</sup>Universitair Medisch Centrum Utrecht, Utrecht

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

**Purpose:** Stenosis of a carotid artery may change the perfusion territories of the individual brain-feeding arteries. The aim of our study was to investigate the influence of internal carotid artery (ICA) stenosis on the distribution of blood flow to the caudate nucleus, lentiform nucleus, and thalamus.

**Methods:** We studied 18 healthy control subjects, 20 patients with a unilateral asymptomatic ICA stenosis, and 15 patients with a recently symptomatic unilateral ICA stenosis. The contribution of the ICAs and the basilar artery to

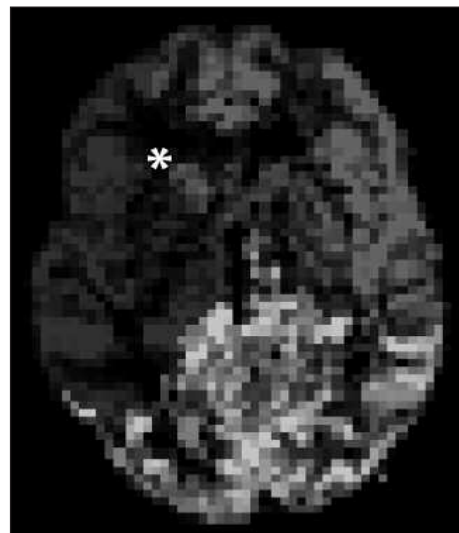


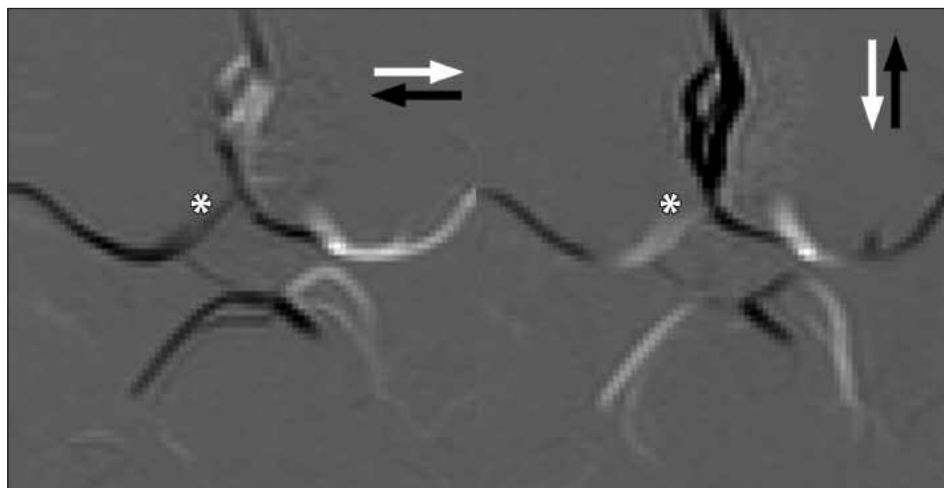
Image 1: Selective ASL perfusion image of a patient.

the perfusion of the basal ganglia were visualized with selective arterial spin labeling (ASL) perfusion MRI. Two-dimensional phase-contrast MRA measurements were used for detecting flow direction in the circle of Willis. Differences were tested with a two-tailed Fishers' exact test.

**Results:** In 4 of the 15 (27%) symptomatic patients, the caudate nucleus was partially fed by the contralateral ICA (figure 1, besides white star), compared none of the control subjects ( $p=0.03$ ). Collateral flow via the ipsilateral precommunicating part of the anterior cerebral artery (figure 2,

besides white star) was detected in 4 of the 5 (80%) subjects in whom the caudate nucleus was partially fed by the contralateral ICA, compared to 1 of 48 (2.0%) subjects without a contributing contralateral ICA ( $p<0.01$ ).

**Conclusion:** In patients with a symptomatic ICA stenosis, the caudate nucleus is fed by the contralateral ICA more often than in healthy controls. Perfusion-territory selective ASL-MRI may facilitate treatment decisions in patients with steno-occlusive carotid artery disease by providing information on the perfusion-territory of the symptomatic artery.



**Image 2:** Circle of Willis on 2D phase-contrast MRA scan.

P08

### INCREASED AMYGDALAR AND HIPPOCAMPAL VOLUMES IN OBESITY: AN MRI STUDY

R.L. Widya, A. de Roos, S. Trompet, A.J. de Craen, R.G. Westendorp, J.W. A Smit, M.A. van Buchem, J. van der Grond

Leids Universitair Medisch Centrum, Leiden

**Background:** The basal ganglia, hippocampus and thalamus are involved in the regulation of human feeding behavior. Recent studies show that obesity (body mass index (BMI)  $>30$  kg/m<sup>2</sup>) is associated with loss of gray and white matter. It is unknown if the sub-cortical brain structures that are actually involved in feeding behavior also show volume changes in obesity. Therefore, the purpose of this study was to evaluate the volumes of the basal ganglia, hippocampus and thalamus in obesity.

**Methods and results:** 3D T1-w MRI scans of the brain were analyzed using automatic segmentation to measure volumes of the nucleus accumbens, globus pallidus, amygdala, putamen, caudate nucleus, thalamus and hippocampus in 427 subjects (mean age 74.1 years, 54% male). Obese subjects showed larger left ( $p = 0.034$ ) and right ( $p = 0.001$ ) amygdalar volumes, and a larger left hippocampal volume ( $p = 0.019$ ), compared to normal-weight subjects (BMI  $<25$  kg/m<sup>2</sup>). None of the other sub-cortical structures differed in size between these groups. After correction for age, gender and pravastatin use, BMI was associated with left ( $\beta = 0.183$ ;  $p < 0.001$ ) and right ( $\beta = 0.198$ ;  $p < 0.001$ ) amygdalar volume, and with left ( $\beta = 0.153$ ;  $p = 0.003$ ) and right ( $\beta = 0.119$ ;  $p = 0.020$ ) hippocampal volumes.

**Conclusion:** This study shows that the amygdala and hippocampus are enlarged in obesity. Considering the function of these structures, this finding may indicate that hedonic memories could be of major importance in the regulation of feeding.

P09

## **PET-POSITIVE MIMIKS OF BRONCHOGENIC CARCINOMA**

B.F.B. Bartels, J.P. Esser, L.G.B.A. Quekel, H.J. Baarslag, C.M. Schaefer-Prokop  
*Meander Medisch Centrum, Amersfoort*

Er zijn een aantal bekende ziekte entiteiten, welke FDG avide zijn, maar geen pulmonale maligniteit blijken te zijn. De differentiële diagnostiek kan extra moeilijk zijn als de morfologische CT kenmerken van de afwijking lijken op een bronchogeen carcinoom.

Deze poster presentatie bespreekt 6 casus, welke zich

gepresenteerden met een focale pulmonale verdichting op CT, alsmede sterk toegenomen FDG-activiteit. De differentiële diagnose omvat Wegener granulomatosis, sarcoidose, tuberculose, organiserende pneumonie, reumatoïde artritis en een actinomyces infectie. Bij elke casus worden de voor de diagnose typische CT kenmerken en de samenhangende klinische bevindingen beschreven, om tot een juiste interpretatie te komen. Ter vergelijking zullen de CT bevindingen van histologisch bewezen T1 en T2 bronchus tumoren hier tegenover gezet worden.

De poster presentatie zal worden opgemaakt in een interactief format, zodat de lezer zelf tot een diagnose kan komen, alvorens het antwoord te lezen.

P10

## **THE MANY FACES OF LYMPHOMA**

A. Ghandi, J. Bakker, H. Berenschot, M.-D. Levin  
*Albert Schweitzer Ziekenhuis, Rotterdam*

**Purpose/aim:** The purpose of this exhibition is:

- To describe various presentations of primary lymphomas occurring at less frequent encountered sites in the human body, starting with the central nervous system and going downwards, including soft tissue and the musculoskeletal system
- To illustrate these lymphomas using different imaging techniques

### **Content Organization:**

- Pathophysiology of lymphoma
- Short comment on Hodgkin vs non-Hodgkin's lymphoma
- Review and depiction of imaging findings of rare primary lymphomas in various parts of the human body, such as leptomeningeal presentation, cutaneous primary lymphoma, primary testicular lymphoma and solitary occurrence of primary lymphoma in the musculoskeletal system, among others
- Illustrations of these cases, using CT, MRI and ultrasound
- Summary

**Summary:** The major teaching point of this exhibit is:

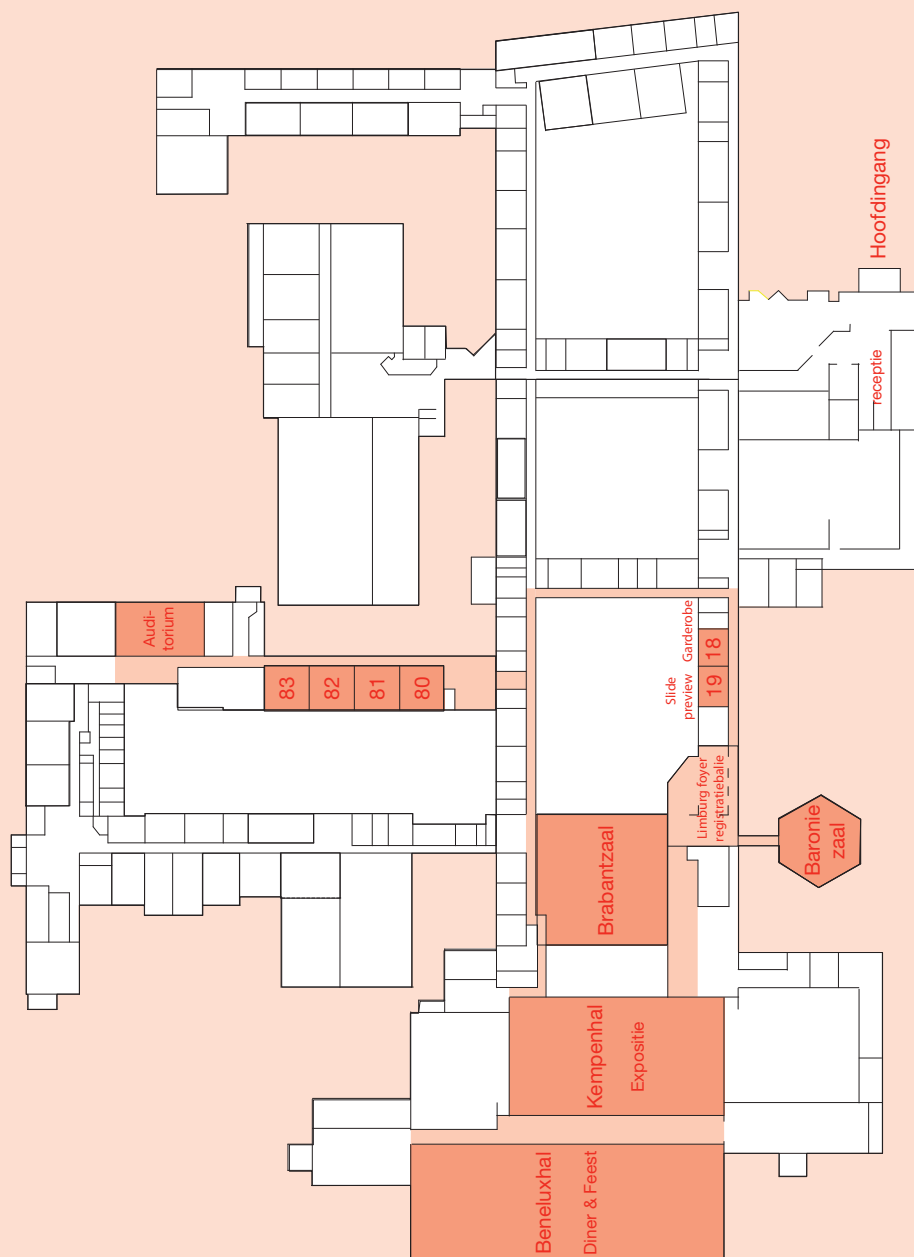
To illustrate less frequent presentations of primary malignant lymphoma in various organs and sites throughout the human body, using ultrasound, CT and MRI





# SYLLABUS

## PLATTEGROND EN PROGRAMMA



## Woensdag 15 september 2010

<b>Limburg Foyer</b>	<b>Baroniezaal</b>
Voorinschrijving	
19.00 - 20.00	
20.00 - 22.30	Wijproeverij: exclusief aangeboden door <b>AGFA</b>  HealthCare

## Donderdag 16 september 2010

	Brabantzaal	Auditorium	Zaal 80	Zaal 81	Zaal 82	Zaal 83	Baroniezaal
<b>Expositie Kempenhal</b>							
Ontvangst							
08.30 - 09.15							
09.15 - 09.30	Opening						
09.30 - 10.30	What's hot, what's new? Hoofdzaken van de DWI						
10.30 - 11.00		Parallelsessie 1 <b>Abdominale radiologie</b>	Parallelsessie 2 <b>Cardiovasculaire radiologie</b>	Parallelsessie 3 <b>Interventieradiologie</b>	Parallelsessie 4 <b>Interventie- / thorax- / mammariadiologie</b>	Parallelsessie 5 <b>Musculoskeletale- / Neuro- en Hoofdzaken radiologie</b>	<b>Radiologisch - historische sessie 1</b>
11.00 - 12.30							
Lunch & posterbezoek	Satellietsymposium Philips Healthcare						
12.30 - 13.45		Refresher course I <b>Bekkenbodem- problematiek</b>	Refresher course II <b>Mammariadiologie</b>	Refresher course III <b>Beeldvorming en behandeling van neuro-endocriene tumoren</b>	Refresher course IV <b>Traumatisch schedel- en hersenletsel</b>	Refresher course V <b>Musculoskeletale radiologie</b>	<b>Radiologisch - historische sessie 2</b>
13.25 - 15.00							
13.45 - 15.00							
Theepauze							
15.00 - 15.30	<b>Uitreiking Philipsprijs</b>						
15.30 - 16.00	<b>Quiz</b>						
16.00 - 16.45	<b>Richtlijn sessie</b>						
16.45 - 17.30	<b>AGFA</b>  HealthCare						
Borrel: excl. aangeboden door							
17.30 - 19.00							
19.00 - 02.00	Diner & feest (Beneluxhal)						

## Vrijdag 17 september 2010

	Brabantzaal	Auditorium	Zaal 80	Zaal 81	Zaal 82	Zaal 83
<b>Expositie Kempenhal</b>						
Ontvangst						
08.00 - 08.30						
08.30 - 09.30						
09.30 - 10.45	<b>Topsporter aan het woord</b>	Refresher course VI <b>Aorta en multigang- imaging met CT en MRI en introductie richtlijn coronaire CT</b>	Refresher course VII <b>Etaleren &amp; Presenteren</b>	Refresher course VIII <b>Prospectieve gerandomiseerde interventie studies</b>	Refresher course IX <b>Thoraxradiologie</b>	Refresher course X <b>Spoedeisende radiologie op de kindertijd</b>
10.45 - 11.15		Parallelsessie 6 <b>Neuro- en Hoofdzaken radiologie</b>	Parallelsessie 7 <b>Cardiovasculaire radiologie/ Nucleaire geneeskunde</b>	Parallelsessie 8 <b>Mammariadiologie</b>	Parallelsessie 9 <b>Onderwijs &amp; Diversen / Kinderradiologie</b>	Parallelsessie 10 <b>Abdominale radiologie / Acute radiologie</b>
11.15 - 12.45						
Koffiepaauze						
12.45 - 13.45						
13.45 - 14.15	Lunch & posterbezoek					
14.15 - 15.30	<b>Postersessie &amp; uitreiking Posterprijs</b> Sessie 'Best abstracts' & uitreiking van: <b>Radiologendagenprijs Lourens Penning Prijs Fellowshipdiploma's</b>					
15.30	Afscheidsborrel					

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