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18th ISRRT World Congress 12.–15.6.2014

POSTERS MEDICAL IMAGING

- 1. THE POTENTIAL HAZARDS OF MAMMOGRAPHY RADIOLOGISTS IN PERFORMING MLO VIEW WITH SIT POSITION AND COMPARE WITH STANDING POSITION - Authors:** Liu Shiu-chen; Sun Chin-chih – no poster sent by 6.6.2014
- 2. WEIGHT ENHANCEMENT EFFECT ON CT - Authors:** Liu Guangyue, Chen Xingpei, ChuYang
- 3. DETECTION OF PULMONARY EMBOLISM WITH ADJUSTED CONTRAST MEDIA AMOUNT - Authors:** Marianne Hansen
- 4. STRATEGIES TO MINIMIZE THE RADIATION DOSE DURING A CT EXAMINATION - Authors:** Raiano, R. Fusco*, F.Mazio, V.Montanino ,G. De Simone , I. Rossi ,C. Raiano, V. Raiano ,A. Petrillo
- 5. A STUDY ON IMAGE QUALITY AND RADIATION DOSE OF ITERATIVE RECONSTRUCTION ALGORITHM ON ABDOMINAL CT USING PH-5 PHANTOM -Author:** Seong Ju Lee
- 6. NEW ECG-GATED CTA TECHNIQUE COUPLED WITH COMPUTATIONAL FLOW ANALYSIS IN ASCENDING THORACIC AORTIC ANEURYSM - Authors:** Armando Pasta, Carmelo Parisi, Simona Maggio and Angelo Luca
- 7. OPTIMIZING FOR BETTER CARE RUBINSTEIN TAYBI – RARITY INTO REALITY - Author:** Diane Campbell
- 8. GOOD PRACTICE IN PAEDIATRIC TRAUMA-CT IMAGING - Authors:** J.Mannila, K.Huhtala
- 9. QUALITY ASSURANCE IN BRAIN CTAS: JUGULAR REFLUX PHENOMENON - Authors:** Catherine Therrien B Tech, Hosam Al-Jehani
- 10. EVALUATION OF CT UROGRAPHY WITH LOW IODINE CONTENT CONTRAST MEDIA AND 80KVP TUBE VOLTAGE - Authors:** Inpyeong Hwang, Jeong Yeon Cho, Sang Yun Kim, Seoung Hyup Kim
- 11. EVALUATION OF IMAGE QUALITY AND RADIATION DOSE WITH CHANGE OF ECG SYNCHRONIZATION METHOD AND TUBE VOLTAGE BY HEART RATE AND BODY MASS INDEX IN CORONARY CT ANGIOGRAPHY - Author:** Shinho Park
- 12. THE USEFULNESS OF EXTRAVASATION DETECTION ACCESSARY FOR EARLY EXTRAVASATION DETECTION THROUGH UNDERSTANDING PHYSICAL MECHANISMS AND PROPOSE THE PROPER CLINICAL INSTRUCTION GUIDE - Authors:** Sungjae Ahn , Yunsung Shin, Taehyun Nam, Changmin Dae, Kwanhong Min
- 13. PAEDIATRIC HEAD CT -DIFFERENT INDICATION, DIFFERENT PROCEDURE, DIFFERENT DOSE - Authors:** J.Mannila, K.Huhtala
- 14. RADIOGRAPHER'S COMPETENCE CRITERIA IN COMPUTED TOMOGRAPHY AFTER PRECEPTORSHIP PERIOD – DEVELOPING SELF-ASSESSMENT INSTRUMENT FOR HUS MEDICAL IMAGING CENTER CT-UNITS - Author:** Marjut Pawsey
- 15. RADIOLOGY TECHNICIANS AND DOCTORS LEVEL OF KNOWLEDGE ABOUT RADIATION EXPOSURE DIAGNOSTIC IMAGING PROCEDURES -Authors:** Nezaket Özgür,Müge Günalp, Behnan Gülünay- no poster sent by 6.6.2014
- 16. DOSES OF ENTRY ON DENTAL RADIOLOGY SALIVARY GLANDS: EXPERIENCE IN THE MUNICIPALITY OF SALVADOR, BAHIA – BRAZIL - Authors:** López, Guillermo; Muller, Juliana; Flores Paulo
- 17. RADIATION DOSES AND SCATTERING IN FACIAL AREA CONE BEAM COMPUTED TOMOGRAPHY EXAMINATIONS - Authors:** Minna Väänänen, Anja Henner, Anna-Leena Manninen
- 18. LOWERING RADIATION DOSE USING THE NOISE-REDUCTION ALGORITHM IN PERCUTANEOUS CORONARY INTERVENTION FOR PATIENTS WITH CHRONIC TOTAL OCCLUSION - Authors:** Masayuki Kumashiro, Shinobu Yokota, Atsushi Kawabe, and Kiyonori Yamaoka
- 19. EVALUATION OF RADIATION DOSE TO PATIENTS UNDERGOING INTERVENTIONAL PROCEDURES AT SEOUL NATIONAL UNIVERSITY BUNDANG HOSPITAL - Author:** Sunwoo Kim
- 20. THE OPTIMIZATION OF THE DEFECOGRAPHY EXAMINATION - Authors:** Leila Kannala,; Maari Korhonen,; Anna-Leena Manninen,; Anne Vaarala
- 21. EVIDENCE BASED CLINICAL PRACTICE IN COOPERATION WITH THE STAFF AND RADIOGRAPHER STUDENTS - Authors:** Sanna Roppola, , Henner Anja, Virpi Kansanoja, Vesa Repo, , Reponen Jarmo
- 22. THE CONCEPT FOR THE MENTAL RADIOACTIVITY STUDY FOR RADIATION MEDICAL TREATMENT - Authors:** Hiroki Ohtani, Yukari Yamaguchi, Mayuko Kishita, Kei Tsumura - no poster sent by 6.6.2014
- 23. TIME FOR CHANGE: NEW OPTIONS FOR PLACEMENT PROVISION - Author:** Alexandra Partner
- 24. USE OF SIMULATOR ANTHROPOMORPHIC (PHANTOM) FOR TEACHING TECHNIQUES OF RADIOLOGY: EXPERIENCE REPORT ON FEDERAL INSTITUTE OF BAHIA-**



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

- BRAZIL - Authors:** Juliana dos Santos Müller and Guillermo Alberto López
25. **CONTRAST-AGENT EDUCATION IN HUS MEDICAL IMAGING CENTER - Authors:** Heli Patanen and Merja Wirtanen
 26. **A CASE STUDY OF THE FIRST COHORT OF STUDENTS ON THE MSC DIAGNOSTIC RADIOGRAPHY PRE-REGISTRATION (FAST-TRACK) PROGRAMME AT QUEEN MARGARET UNIVERSITY, EDINBURGH - Author:** Alanah Kirby
 27. **THE INTRODUCTION FORM FOR PRACTICAL TRAINING OF CT - Authors:** A-M. Kulhomäki, M. Nevalainen
 28. **ACADEMIC LEARNING ENVIRONMENT AND STUDENT APPROACH TO LEARNING - Authors:** Kukkes, T., Urban, R., Solom, K.
 29. **STUDENTS PRODUCING LEARNING MATERIAL IN AN INTERNATIONAL PROJECT - Authors:** Maija Arvola, Hanna Kiuttu, Elina Niemelä, Eerika Riippi, Anja Henner
 30. **MULTIPROFESSIONAL SIMULATION-LEARNING IN HEALTH CARE PROFESSIONALS' PHARMACOTHERAPY CONTINUING EDUCATION - Authors:** Aura, Suvi; Savolainen, Liisa; Metsävainio, Kirsimarja; Miettinen, Merja; Turunen, Hannele
 31. **PATIENT-CASE (PTC) BASED SIMULATION IN TURKU UNIVERSITY OF APPLIED SCIENCE (TUAS) - Authors:** Jarno Huhtanen, Leena Walta
 32. **ANATOMIC TILT RADIOGRAPH OF THE DISTAL RADIUS - Authors:** Linn Iren Molt Rise and Kristin Dehli
 33. **SAFETY OF POST-OPERATIVE IMAGING WITH JOINT REPLACEMENT SURGERY IN COXA HOSPITAL - Authors:** Tiina Lehtinen, Päivi Laarne, Hannu Syrjä, Jyrki Nieminen, Petra Elo
 34. **TELECONSULTATION IN RADIOGRAPHY - THE USE OF ERADIOGRAPHY IN DECISION MAKING - Authors:** Sanni-Mari Savolainen & Silja Sjöholm
 35. **RADIOGRAPHERS' PERCEPTIONS OF THE IMPACT OF THE INTRODUCTION OF DIGITAL RADIOGRAPHY ON ELEMENTS OF PRACTICE - Authors:** Joanna Tait, Phil Cosson
 36. **A QUANTITATIVE STUDY TO ESTABLISH ANATOMICAL AND/OR PATHOLOGICAL PREDICTORS FOR THE 'INCORRECT' CLASSIFICATION OF RED DOT MARKERS ON WRIST RADIOGRAPHS TAKEN IN ACCIDENT AND EMERGENCY (A&E) DEPARTMENTS - Authors:** Rebecca Kranz - Student (Teesside University), P. Cosson - Senior Lecturer (Teesside University)
 37. **RADIOGRAPHIC TECHNIQUE AND CLINICAL SIGNIFICANCE OF FULCRUM BENDING PROJECTION IN SCOLIOSIS RADIOGRAPHY - Authors:** Damian SL Lau, Gordon WT Lam
 38. **COMBINATION OF RARE THREE(RIGHT) ARTERIAL VARIATION WITH ANOMALOUS ORIGINS OF THE VERTEBRAL ARTERY, ABERRANT SUBCLAVIAN ARTERY AND DOUBLE ORIGINE RT OPHTHALMIC ARTERY - Authors:** Yong Ju Kim
 39. **RESEARCH AND PRACTICE OF RADIOLOGY BUSINESS IMPROVEMENT BASED ON INFORMATION REUSE - Authors:** Zhentao Li, Chao Sun, Tao Liu
 40. **AUTONOMOUS WORK SHIFT PLANNING - Authors:** Heli Heikkilä, Markku Jaakkola, Vesa Oksanen and Päivi Paaso
 41. **TRADE UNION SUPPORTING THE DEVELOPMENT OF HEALTH CARE PROFESSIONALS EXPANDED ROLES AND TASK ALLOCATION IN FINLAND - Author:** Mervi Flinkman
 42. **EVALUATION OF OBJECT STORAGE IN THE CLINICAL ENVIRONMENT - Authors:** Tomohiro Fujii
 43. **SIMULATION WALKS AS A TOOL OF FAMILIARIZATION - Authors:** Korin Heidi, Seiko-Vänttinen Virva,
 44. **SUPPORT TO FEMALE RADIOLOGICAL TECHNOLOGISTS WHO KEEP WORKING - Author:** Kaoru Hashimoto
 45. **UTILITY OF 18F-FDG PET-CT IN THE EVALUATION OF INCIPIENT GASTRIC CANCER - Authors:** T.Mitsui, H.Hayakawa, D.Wakebe, S.Kai et al
 46. **ENHANCED PITUITARY MRI SCAN OF THE AMOUNT OF CONTRAST AGENT - Authors:** Liu Guangyue, Chen Xingpei, ChuYang
 47. **FAT-SUPPRESSED MOVING-TABLE GADOLINIUM-ENHANCED MRA WITH THE WATER-EXCITED 1-2-1 BINOMIAL PULSE TRAINS FOR THE ABDOMINAL AORTA AND LOWER EXTREMITIES IN PATIENTS WITH ATHEROSCLEROTIC DISEASE - Authors:** Masayuki Kumashiro, Noriyoshi Morimoto, Hideki Mitsui, Atsushi Kawabe, Yoshiharu Azuma and Kiyonori Yamaoka
 48. **PRESS SV AND STEAM SV MRS SEQUENCES FOR LIVER H1 SPECTROSCOPY - Authors:** Carmelo Parisi, Armando Pasta, Simona Maggio and Angelo Luca
 49. **APPLICATION OF IMAGE MODE VALUE IN EVALUATION THE MAGNETIC RESONANCE FAT RATIO OF LIVER - Author:** Chin-chin Sun
 50. **MRI OF CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD) WITHOUT SEDATION - Authors:** Turid Randa, Norway,-Eva Øksnes, -Maiken Kirkegaard Brix



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

51. **THE DIAGNOSTIC ACCURACY OF ULTRASOUND IN DETECTING PAEDIATRIC LONG BONE FRACTURES: A SYSTEMATIC REVIEW -**
Author: Mr Harry George Hopkinson
52. **RADIOGRAPHIC EVALUATION OF THE VISIBILITY OF PICC LINE TIP IN NEONATES: A SELF-ASSESSMENT MODULE -**
Authors: Saukko E., Järvinen J. Hälli T.), Svedström E.
53. **ESTABLISHMENT OF THE OPTIMAL ANGLE OF WATERS' VIEW IN CHILDREN, USING CRANIOFACIAL 3D CT -**
Authors: Eunyeong Choi, Gwangsu Jeong, Tachan Jeong
54. **HOW TO ENHANCE STATUS AND QUALITY OF CHEST X-RAYS -** Authors: Christina C. E. Pedersen, Pia E. L. Skoulund, Anne Dorte Blankholm
55. **RADIOGRAPHERS' RIGHTS IN CLINICAL PRACTICE -**
Authors: Kati Matilainen, S-M Ahonen, P Kankkunen , M Kangasniemi
56. **THE BENEFITS OF CLINICAL AUDITS -** Author: Mirja Hirvonen-Kari
57. **REPRODUCIBILITY OF PHANTOM-BASED QUALITY ASSURANCE MEASUREMENTS IN ULTRASOUND IMAGING-** Authors: M. Jauhiainen, P. Blomqvist, T. Kilpeläinen, P. Malaska, T. Vinnurva-Jussila
58. **OPTIMISING NEONATAL X-RAY QUALITY: RESULTS OF AN AUDIT -** Authors: N Woznitza, N Hayes, N Malisheva, D McGuinness
59. **RADIOGRAPHERS' PERCEPTION OF IMAGE QUALITY AND THEIR COMPETENCE WITH DIGITAL X-RAYS -** Author: Astrid Berntsen
60. **STATISTICAL ANALYSIS : CT COLONOGRAPHY AND BARIUM ENEMA -** Authors: Miss Siew Teng Boon, Co-Author: Mr Jia Jun Ng,; Co-Author: Dr Narayan Lath
61. **CHECKLIST FOR IDENTIFICATION OF THE PATIENT IN RADIOLOGICAL EXAMINATION -** Authors: Merja Paasio, Heidi Korin
62. **IMAGE QUALITY AND OPTIMIZATION DOSE FOR CHEST EXAMINATION IN COMPUTED RADIOGRAPHY AND DIGITAL RADIOGRAPHY -** Authors: Puntharika Buasang,B.Sc.(RT) , Pharadorn Chumpia, B.Sc.(RT) , Trongtum Tongdee,M.D.
63. **CHEST X-RAY SELF-ASSESSMENT, A PILOT STUDY -**
Authors: Tolonen M.. Hakso-Terävä A.. Takalo R.
64. **INFLUENCE OF INDOOR AIR QUALITY ON SICK BUILDING SYNDROME RELATED SYMPTOMS AMONG RADIOLOGICAL TECHNOLOGISTS -**
Authors: Yan-Chi Chang, Chia-Yu Keng
65. **IMPROVEMENT ACTIVITIES OF EXPOSURE MANAGEMENT SERVICE THAT IS BASED ON USE OF PDMS (PERSONAL DOSE MEASURING SYSTEM) AND RADIATION-RELATED MANUAL -** Authors: Jaeyeong Cho, Yoonjoo Lee, Yeonhee Kim, Seonmin Kim, Mihyang Eun, Hyeongchul Kim
66. **IN A UNIVERSITY HOSPITAL HEALTH PROFESSIONALS WORKING WITH IONIZING RADIATION SOURCES IN THE EVALUATION OF OCCUPATIONAL HEALTH AND SAFETY SITUATION -** Authors: Seyhan Erdem, Assoc.Prof.Dr. M. Necmi İlhan - no poster sent by 6.6.2014
67. **A PRELIMINARY STUDY OF BACTERIAL CULTURES OBTAINED -** Authors: James B. Temme; K. Honeycutt; S. Vas
68. **NUTRITIONAL AND LIFE STYLE DETERMINANTS OF RADIATION-INDUCED OXIDATIVE STRESS IN OCCUPATIONALLY EXPOSED WORKERS -** Authors: Iman M. Ahmad; James B. Temme
69. **DETECTABILITY OF MICROCALCIFICATION IN DIGITAL MAMMOGRAPHY SYSTEMS: EFFECT OF LOCATION AND DEPTH -** Authors: A Brindhaban, Shareif H, Failakawi D
70. **COMPARISON OF IMAGE QUALITY BETWEEN DIGITAL AND COMPUTED RADIOGRAPHY -** Authors: K. Alkhalifah, A. Brindabhan
71. **GAUGING PERSONAL EXPOSURE DOSES OF RESIDENTS FOLLOWING THE ACCIDENT AT FUKUSHIMA NUCLEAR POWER STATION -**
Author: Kunihiko Morozumi
72. **TACIT KNOWLEDGE AND WORKPLACE LEARNING – CREATING PRECONDITIONS FOR TACIT KNOWLEDGE UTILIZATION IN RADIOGRAPHER WORK COMMUNITIES -**
Author: Juha Kurtti
73. **OPTIMIZING PATIENT CARE WITH CT/MRI PERFUSION IN STROKE MANAGEMENT: A REVIEW OF PAST EXPERIENCES IN SINGAPORE GENERAL HOSPITAL -**
Authors: Low Wei Ying Cheryl, Kumar, K., Tan, T. M., Rumpel, H., Chan, L. L.
74. **EVALUATION OF CAROTID ARTERY BY DOPPLER ULTRASOUND IN PATIENTS AFTER RADIOTHERAPY OF THE HEAD AND NECK REGION -** Authors: Jolanta Tomczak, Bartosz Bąk, Grzegorz Oszkinis
75. **THE VALUE OF SPATIAL COMPOUND IMAGING IN 2D AND 3D ULTRASOUND ASSESSMENT OF CAROTID PLAQUES -** Authors: Michael Ying, Yongping Zheng



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

76. **COMPARISONS BETWEEN PATHOLOGICAL AND SONOGRAPHIC SIZE OF BREAST CANCER** - Authors: Yan-Chi Chang, Chia-Yu Keng
77. **SONOGRAPHY OF NONALCOHOLIC FATTY LIVER DISEASE AND LIPID PROFILE OF THE METABOLIC SYNDROME** - Authors: Yan-Chi Chang, Chia-Yu Keng
78. **ELASTOGRAPHY STRAIN RATIO MEASUREMENTS FOR THYROID NODULE DIFFERENTIATION: A SYSTEMATIC REVIEW** - Author: Holly J Elliott
79. **CARPAL TUNNEL AREA AS A RISK FACTOR FOR CARPAL TUNNEL SYNDROME: ULTRASONOGRAPHIC MEASUREMENTS OF MEDIAN NERVE AND TRANSVERSE CARPAL LIGAMENT** - Authors: Woo, H.C., White, P & Lai, W.K.
80. **SOTERGO: AN INTERACTIVE COMMUNICATION NETWORK** – Author Anna Kukka

POSTERS NUCLEAR MEDICINE

81. **DOSES TO THE STAFF IN NUCLEAR MEDICINE: TWO EXAMPLES** - Authors: Torvinen Marita, Torniainen Pentti, Manninen Anna-Leena, Vimpari Pirjo, Henner Anja

POSTERS RADIOTHERAPY

82. **COMPARISON OF THE MORPHOLOGY OF TEMPORO-MANDIBULAR JOINT BETWEEN POST-RADIOTHERAPY NASOPHARYNGEAL CANCER PATIENTS AND NORMAL SUBJECTS** - Authors: Vincent WC Wu, Michael TC Ying, Dora LW Kwong - no poster sent by 6.6.2014
83. **EXPERIENCED BENEFITS OF CYBERKNIFE® ROBOTIC RADIOSURGERY SYSTEM IN KUOPIO, FINLAND** - Authors: Kati Tolonen, Aija Juutilainen, Heidi Niskanen
84. **IMPROVING ACCURACY IN ADJUVANT RADIOTHERAPY OF LEFT-SIDED BREAST CANCER ACCOMPLISHED WITH VOLUNTARY DEEP INSPIRATION BREATH HOLD TECHNIQUE** - Authors: Marko Laaksomaa, Mikko Haltamo, Mika Kapanen, Seppo Peltola, Eeva Boman, Tanja Skyttä, Pirkko-Liisa Kellokumpu-Lehtinen, Simo Hyödynmaa
85. **IMPLEMENTATION OF BREATHING ADAPTED STEREOTACTIC BODY RADIOTHERAPY FOR TREATMENT OF LIVER CANCER** - Authors: Ineta Nemiro, Olga Utehina, Silvija Preinberga, Galina Boka, Viesturs Boka
86. **A SEARCH FOR OPTIMAL RADIATION THERAPY TECHNIQUE FOR LUNG TUMOURS STEREOTACTIC BODY RADIATION THERAPY (SBRT): DOSIMETRIC COMPARISON OF 3D CONFORMAL RADIOTHERAPY, STATIC GANTRY INTENSITY MODULATED RADIOTHERAPY (IMRT) AND VOLUMETRIC-MODULATED ARC THERAPY (VMAT) WITH FLATTENING FILTER (FF) OR FLATTENING FILTER-FREE (FFF) BEAMS** - Authors: Murphy S.H. Chiu, Dora L.W. Kwong



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

POSTERS MEDICAL IMAGING

87. THE POTENTIAL HAZARDS OF MAMMOGRAPHY RADIOLOGISTS IN PERFORMING MLO VIEW WITH SIT POSITION AND COMPARE WITH STANDING POSITION

Presenter: Liu Shiu-chen, *Department of Diagnostic Radiology, Chang-Gung Memorial Hospital, Kaohsiung Center, Taiwan*
Authors: Liu Shiu-chen; Sun Chin-chih

Introduction: The Bureau of Health in Taiwan progressively expands mammography screening services for women's health from 2004. The coverage rate of mammography screening has increased from 12.03% in 1996 to 29% in 2001 and 43.8% in 2012. This explains the successful of mammography screening, but also shows that the working load of radiologists increased with recently. The purposes of this article are to provide appropriate protection and to avoid mammography radiologic technologists' work hazard due to improper working posture.

Methods: This study was performed on 15 female mammography radiology technologists, who had obtained the certification of the Bureau of Health Promotion. We explored their working postures and force level according to the OWAS method to divide the work postures into four parts like lower extremity, upper extremity, waist and muscle power in mammography technique.

Conclusions : The results found that when the mammography radiology technologists standing in the rear ramp of the subjects with MLO view, their waist were sometimes bending, twisting, and one arm higher than shoulder to let patient close to the examination table.. The hazard represents the extreme danger of this posture. Compare with sitting posture, mammography radiology technologist will suffer from less hazard. The results of this study remind mammography radiology technologists, not only to improve the image quality of the mammogram, but also to enhance the safety of working posture.

88. WEIGHT ENHANCEMENT EFFECT ON CT

Presenter: Liu Guangyue, *Department of radiology, the affiliated Drum Tower hospital of medical college of Nanjing university, Nanjing , 210008, China*
Authors: Liu Guangyue, Chen Xingpei, ChuYang

Introduction: Enhanced CT scanning technique is a conventional CT scanning technique. Especially in recent years, the clinical application of multislice CT and high pressure injector, the CT image quality has been greatly improved. For the CT enhancement scanning many factors, many experts and scholars have done a lot of research, made a lot of achievements. The influence of body weight enhancement effect on CT are as follows. 1、General information: from 2005 September to 2013 April, the arterial CT value peak tracking method for enhanced CT scanning was performed in 605 cases of patients, the patients were divided into four groups for the CT enhancement scanning, the patients were divided into A group, B group, C group and D group. A group: 116 cases, weight 45-54KG, including male 44 cases, female 72 cases,

accounting for 38%; 72%; B group: 204 cases, weight 45-54KG, including male 111 cases, female 93 cases, accounting for 54%; 46%; C group: 194 cases, weight 45-54KG, including male 149 cases, accounting for 77%; female 45 cases, accounting for 23%; group D: body weight 45-54KG, 91 cases, male 79 cases, female 11 cases, accounting for 87%; 13%. 2、Equipment: the United States GE company's Lightspeed Pro64 row spiral CT; Medrad double syringe; non-ionic iodine contrast agent than the music or Omnipaque, contrast agent dose per case 80ml, the iodine concentration of contrast material for 350mg 1ml or 370mg 1ml, injection rate 3.0ml/s.

Methods: (1) The first patient is CT plain scan, image in the scan, the abdominal aorta was picked out from the image of the celiac artery. (2) Circle icon, the image of the abdominal aorta were labeled. (3) Extraction of 80ml contrast agent, disposable scalp

Results: The image scanning of CT value measurement (the image of the celiac artery abdominal aorta) show that: A group, the abdominal aorta of the average CT value of 313.602Hu; A group, the abdominal aorta of the average CT value of 284.951Hu; group C, the average CT value of abdominal aorta in group D, 275.086Hu; the abdominal aorta of the average of CT is 258.749Hu[Table 1]. Table 1 the four set of CT values Weight (KG) number of cases mean Standard deviation Standard error

89. DETECTION OF PULMONARY EMBOLISM WITH ADJUSTED CONTRAST MEDIA AMOUNT

Presenter: Marianne Hansen, *Rikshospitalet, Norway*
Authors: Marianne Hansen

Introduction: Modern CT machines are faster than previous generations, it is possible to scan a area of 50 cm in 4 seconds. The Contrast media timing is therefore even more essential and it is possible to adjust contrast media amount. In this poster a protocol used for detection of pulmonary embolism with Toshiba Aquilion ONE will be presented. This is the protocol we use at Rikshospitalet, Norway. The contrast reach the pulmonary arteries short after injection and since the scanner is fast enhance to the 16cm detector width the lung area is scanned in 4-5 seconds. We use sure start to time the scan after inserting the contrast media and amount depends on patient weight. We use 0,8 ml per kg Iomeron 350mg/ml until 90kg and we adjust contrast injection rate so it will inject in 10 seconds, and flush it in with 50 ml NaCl. Weight (kg) Contrast Amount (ml) Flow (ml/sec) 50 40 4 60 48 4,8 70 58 5,8 80 64 6,4 90+ 72 7,2 Table 1: Shows the relation between patient weight, contrast amount and contrast injection rate. Contrast media should be inserted in patients right arm, due to reduce artefacts from incoming contrast in vena subclavia. The patient should not inhale before holding their breath during the scan because of possible vasalva effect, which will result in non existent contrast media enhancement in pulmonary arteries. ROI shall be in truncus pulmonalis and the scan is triggered at 150 HU. Sure exposure and modulation in XY direction will adjust the mA, other parameters used in this protocol is listed in the table below. Thickness HP kV mA Rot. time Range D-FOV Sure Exp 0,5 x 80 111.0 100 R*** 0,5 402 400 (L) Std Table 2: Parameters for the protocol used to



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

Methods: Viewing and evaluate contrast enhancement in examinations done with this protocol, in different patient size and contrast media amount.

Results: I will show examples of contrast enhanced examinations in different patients. Patients with different sizes and thereby different contrast media amount. The quality of the examination is not only determined by contrast enhancement. Artifacts due to respiration, incoming contrast and movement can make the examination inadequate. We are able to present pulmonary arteries accurately and contrast enhanced, with adjusted contrast media amount, using this protocol.

90. STRATEGIES TO MINIMIZE THE RADIATION DOSE DURING A CT EXAMINATION

Presenter: Nicola Raiano, "Istituto Nazionale Tumori Fondazione Giovanni Pascale – IRCCS", Italy

Authors: Raiano*, R. Fusco*, F. Mazio*, V. Montanino*, G. De Simone*, I. Rossi, C. Raiano, V. Raiano, A. Pettilo*

**Division of Radiology, Department of Diagnostic Imaging, Radiant and Metabolic Therapy, "Istituto Nazionale Tumori Fondazione Giovanni Pascale – IRCCS", Via Mariano Semmola 80131, Naples – Italy.*

Introduction: Possible strategies to be used to reduce the dose to the patient obviously include the limitation of the examinations in those patients in whom it is strictly necessary and to avoid the execution of multiphase exams when there is no clinical need. Once evaluated the indication examination, in planning a CT scan of the abdomen, the strategies to be considered are not different from those adoptable examining other districts. The strategies to minimize the dose of radiation emitted during an examination of multidetector computed tomography are based on a fundamental concept: the attenuation of the contrast and the noise of the image are, respectively, directly and inversely proportional to the number of photons that reach the series of detectors. Therefore the main variables involved in the protocols of the reduction of the effective dose is the current of the X-ray tube, which is expressed in milliamperes (mA) and influences the flow of photons, the voltage of the X-ray tube (anode), which is expressed in kilovolts peak (kVp) and affects the energy of the photons, the exposure time that is determined for example by the pitch and the degree of attenuation of the photons that is influenced by body mass index of the patient; these variables at the same time contribute to the formation of images of good quality.

Methods: Strategies to minimize the radiation dose including those that modify the emission of X-rays and that reduce the X-rays duration: automatic exposure control, iterative reconstruction algorithms and the adaptation of the tube current to patient size.

Results: Ultimately, using the strategies mentioned above and can get images with signal / noise ratio higher than delivering the same radiation dose, or images with the same signal / noise ratio delivering a radiation dose lower. Another perspective on maximizing the contrast is represented spectral from imaging that

makes it possible to reconstruct images corresponding to different energy levels chosen by the user.

91. A STUDY ON IMAGE QUALITY AND RADIATION DOSE OF ITERATIVE RECONSTRUCTION ALGORITHM ON ABDOMINAL CT USING PH-5 PHANTOM

Presenter: Seong Ju Lee, Dept. of Radiology, Seoul National University Hospital, South Korea

Author: Seong Ju Lee

Introduction: Purpose To assess the image quality and radiation dose of Adaptive Iterative Dose Reduction 3D (AIDR 3D), Adaptive Statistical Iterative Reconstruction (ASIR), iDOSE, ASIR (Adaptive Statistical Iterative Reconstruction, MBIR (Veo) algorithm compared with a filtered back projection (FBP) algorithm on abdominal computed tomography (CT) at different x-ray tube voltages (120, 100, 80 kVp) and current (10-580 mAs) using PH-5 phantom. CT scans were performed with multi detector CT scanner Aquilion ONE (Toshiba Medical System), Discovery CT 750HD (GE Healthcare), Ingenuity (Philips Healthcare) And CT abdomen phantom (PH-5 Kyoto Kagaku Co. Ltd) with simulated 8 lesions and portal phase was used. Tube voltage and current are changed from 80 to 120 kVp and 10 to 580 mA. The CT data sets were reconstructed with filtered back projection and iterative reconstruction.

Methods: The image noise and HU were measured, and the SNR and CNR were calculated. The radiation dose was assessed with the volume CT dose index. To qualitative image analysis, five observers assessed image quality and measured diameter of lesion.

Conclusions: Compared with the FBP data set at 120kVp-200mA, the IR data set was similar to 120kVp-150mA, 100kVp-250 mA, 80kVp-400mA. The volume CTDI decreased by 26% between the 120kVp FBP data and 120kVp IR data and by 23% between the 120 kVp FBP data and 100kVp iterative data, also by 38% between the 120kVp FBP protocol and 80kVp iterative protocol. IR algorithm is considered to be a useful dose reducing method while maintaining the image quality when compared with a 120kVp-200mA with a FBP algorithm.

92. NEW ECG-GATED CTA TECHNIQUE COUPLED WITH COMPUTATIONAL FLOW ANALYSIS IN ASCENDING THORACIC AORTIC ANEURYSM

Presenter: Armando Pasta, Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT), Via Tricomi n.5, 90127, Palermo, Italy

Authors: Armando Pasta, Carmelo Parisi, Simona Maggio and Angelo Luca.

Introduction: Despite current diagnostic imaging techniques, an ascending thoracic aortic aneurysm (ATAA) is a life-threatening cardiovascular emergency with remarkable morbidity and mortality. The incidence of ATAA is estimated at 6 people per 100,000 per year, occurring most commonly in the 6th and 7th decade of life and in males more frequently than females (ratio 3:1) (Ince, 2007). Fatal complications such as rupture or dissection are most commonly



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

associated with ATAAs and can be prevented by rapid surgical repair. Predisposing risk factors include poorly controlled hypertension and bicuspid aortic valve (BAV) (Isselbacher, 2005). Indeed, patients with BAV have a 9-fold higher risk of ATAA development. Elective surgery is currently indicated when ATAA diameter exceeds 5.5 cm. However, ATAAs with smaller diameters than indicated by the surgical paradigm may rupture or dissect unpredictably, in 0–23% cases for diameter <5.0mm (Parish, 2009). These data emphasize the inadequacy of using aortic size as the sole factor for estimating the risk of ATAAs. There is clinical evidence of a mechanism of ATAA formation driven by flow alteration due to aortic valve (Hope, 2010). In this way, electrocardiogram (ECG)-triggering computed tomography angiography (CTA) is an useful tool to assess aortic valve functionality, which likely alters ATAA hemodynamic. This study aims to assess morphological variables of ATAAs with either tricuspid aortic valve (TAV) or BAV associated to disturbed hemodynamic flow evaluated by computational modeling. ECG-gated CTA will be used to measure not only aortic diameter but also valve parameters as orifice area and valve orientation.

Material and methods: For this study we used a Lightspeed VCT 64 detectors. All exams were acquired with retrospective ECG-triggering technique and administration of intravenous iodinated contrast agent. Computational modeling was used to evaluate ATAA with BAV (10 patients) and TAV (18 patients).

Results: Marked valve orientation determined disturbed flow, with high shear stress on anterolateral region of ATAA (20N/m² anterolaterally and 12N/m² posterolaterally). Reduced orifice area (1.9±0.4cm²) measured by ECG-gated CTA is related to helical blood flow in BAV ATAA and stenotic TAV ATAAs.

Conclusion: ECG-triggering CTA combined with computational modeling represents a promising technique to assess the hemodynamic disturbance in ATAAs with different valve morphologies (i.e., BAV vs TAV), which are responsible for progression of ATAAs. Reduced orifice area and marked aortic valve orientation are associated to altered hemodynamic of ATAAs. These findings can be used to identify a high-risk subgroup of patients with ATAAs that may clinically benefit from early imaging screening.

93. OPTIMIZING FOR BETTER CARE RUBINSTEIN TAYBI – RARITY INTO REALITY

Presenter: Diane Campbell, *University of Otago Dunedin New Zealand*

Author: Diane Campbell

Introduction: Rubinstein Taybi is a rare genetic disorder characterized by mental retardation, physical anomalies including extensive craniofacial abnormalities. There are very few reports in dental literature describing RTS' oral and dental presentations. Optimizing for better care in practice necessitates minimizing radiation to the patient in accordance with ALARA principle, to be as low as reasonably achievable. This determinant takes precedence over all other aspects when optimizing for better care to bring about the best treatment outcome. Fulfilling optimal treatment and patient management is complex and challenging. A 19 year old male

under long term care of the Dental School exhibited significant oral characteristics of RTS being unable to speak and eat properly due to significant chewing problems from a high arch palate, where the upper jaw is vastly too small to go over the lower jaw. Other significant RT dental traits included severely crowded irregular teeth, bilateral crossbite with negative overjet and an anterior open bite. These necessitated the clinical management of a multifaceted paediatric, orthodontic and surgical approach. Early treatment extractions of 4 premolar teeth resulted in insufficient room to align upper teeth with fixed orthodontic appliances alone. In order to widen the upper jaw an adjustable screw fixed expander was worn at night. This failed to bring about any improvement, necessitating extraction of an upper molar due to stressors and forces. Further extractions of lower wisdom teeth and upper 2nd molars followed with the objective of bringing front teeth closer together to reduce the extreme open bite.

Methods: A 15 cm field of view CBCT scan on Galileos, provided comprehensive, craniofacial information. CBCT offers a reduction in radiation compared to MCT imaging, although more than conventional dental x-ray imaging.

Results: It is unrealistic to speculate on the future growth of the jaws and there may be no reduction in the open bite. Surgically assisted expansion SARPE with maxillary reposition is still a possibility. Although RT is a rare disorder with clearly identified oral characteristics, the complexities involved in treatment are reported. When optimizing for better care, the prime determinant the optimization tenet of radiation protection, was achieved using CBCT imaging that plays a most important role.

94. GOOD PRACTICE IN PAEDIATRIC TRAUMA-CT IMAGING

Presenter: Johanna Mannila, *Helsinki University Hospital, Children's Hospital, Finland*

Authors: J.Mannila, K.Huhtala

Introduction: Children are much more sensitive to the harmful effects of radiation than adults. Therefore not even a high-energy trauma of a child should automatically lead to a routinely performed CT-scan. In the Helsinki Children's hospital (Helsinki University Hospital) we follow our local trauma protocol which guides the entire treatment of a trauma-patient. One of the significant part of the treatment is the radiological examination of the trauma-patient. A CT-examination for a child is always decided individually based on clinical findings and FAST US (Focused Assessment with Sonography for Trauma). Because of the potentially high radiation dose of CT it is important to have as far optimized examination protocols as possible and even a trauma-CT should always be focused only on the area of interest. In the Radiological department of the Children's hospital we base our examination protocols on the National guidelines for paediatric CT-examinations (Radiation and Nuclear Safety Authority 2012). We have generated trauma protocols for different scan-areas for several age and weight groups. We have also optimized our practice in contrast medium injection for trauma-body and trauma-abdomen examinations. For those protocols we use a dual-injection, which allows us to see both arterial and venous



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

phases in one exposure. We continuously monitor the image quality and patient dose and have been part of the dose collection for national reference levels.

Methods: We have optimized our CT-protocols in co-operation with different professions. We have regular trauma-case simulations with the entire trauma-team. We also have our own trauma-examination training in CT by using our child-phantom as a trauma patient.

Results: By focusing the CT-examinations we have lowered patient dose (~30kg body 256mGycm vs. abdomen 122mGycm) and reduced unnecessary exposures. By simulating trauma situations we have improved the co-work with the whole trauma-team. A trauma-CT for a child should be focused on the area of interest and decided case by case based on clinical findings and FAST US. Well planned trauma case procedure and examination protocols can lower patient dose, avoid repeated exposures and lead to a right diagnosis.

95. QUALITY ASSURANCE IN BRAIN CTAS: JUGULAR REFLUX PHENOMENON

Presenter: Catherine Therrien, *Montreal Neurological Hospital and Institute, MUHC, Canada*

Authors: Catherine Therrien B Tech, Hosam Al-Jehani, MBBS, MSc, FRCS

Introduction: As medical imaging technologist, quality assurance is a daily challenge in our practice. With the fast technological evolution, new diagnostic techniques and protocols are added to those already existing. With those novelties, previously unnoticed phenomena are now observed. CT angiogram (CTA) is a diagnostic exam requiring high flow rate injection, specific acquisition parameters and a good understanding of the anatomy, physiology and pathology studied. For cerebral studies, arterial phase (Circle of Willis), longer acquisition called DSA protocol and CT Perfusion needed an injection of 5cc/sec with the AquilionOne. After the acquisition of a new CT scanner in our institution, we were confronted with a few problematic brain CTA cases. In our experience with these exams, venous enhancement prior to arterial phase had been observed for different CTA exams of the brain. During the SureStart of the CTA for the Circle of Willis, the Test Bolus for brain DSA and Ct perfusion (CTP) protocols and in the cerebral DSA and CTP. The phenomenon was coupled with a decreased in the image quality: the enhancement of the final acquisition wasn't optimal or venous contamination is present. After trouble shooting the suboptimal studies, no technical issues were found in the injection and scanning protocols. The hypothesis of the injection side led us to an explanation. After reviewing the cases, a parameter in-common was the injection was done in the left arm. The jugular reflux phenomenon is known in the medical literature and a left side injection increases the possibilities that phenomenon occurred.

Methods: For quality assurance study, we evaluated acquisition and final images to identify any clue explaining the poor quality, verifying if any technical issues related to the acquisition and injection parameters used occurred during the scan.

Results: After the troubleshooting, no problem had been identified until the question related to injection side been asked. Injection in the left arm was used for every CTA exams with decreased quality. With this indication, a review of the literature confirmed the jugular reflux. In fact, anatomical and physiological factors increase the phenomenon when injection with the automatic injector on the left side. With that, the right side is prioritized when injecting for CTA to avoid it.

96. EVALUATION OF CT UROGRAPHY WITH LOW IODINE CONTENT CONTRAST MEDIA AND 80KVP TUBE VOLTAGE

Presenter: Jongjin An, *Seoul National University Hospital Department of Radiology, South Korea*

Authors: Inpyeong Hwang, Jeong Yeon Cho, Sang Yun Kim, Seoung Hyup Kim

Introduction: Purpose: The aim of the present study was to investigate the image quality and feasibility of CT urography with low iodine content contrast media and low tube voltage.

Methods: Materials and methods: This prospective study enrolled fifty-five patients who underwent CT urography. The subjects were randomized into two arm of excretory phase CT urography protocol; 480 seconds after intravenous injection of 1.5m L/kg

Results: In effective dose, 240mgI/mL protocol showed significantly lower dose estimate (3.7 vs. 6.7 mSv, $P < .001$). Each score of qualitative rating was significantly lower in 240 mgI/mL group. Two subjects showed major streak artifact affecting normal structure in 240 mgI/mL group while no subjects showed major streak artifact in 350 mgI/mL group. However, all subjects showed more than standard diagnostic acceptability (score ≥ 3) in each group.

97. EVALUATION OF IMAGE QUALITY AND RADIATION DOSE WITH CHANGE OF ECG SYNCHRONIZATION METHOD AND TUBE VOLTAGE BY HEART RATE AND BODY MASS INDEX IN CORONARY CT ANGIOGRAPHY

Presenter: Shinho Park, *Seoul National University Bundang Hospital, South Korea*

Author: Shinho Park

Introduction: To investigate image quality and radiation dose with different ECG-synchronization method and tube voltage(kVp) by heart-rate(HR) and body mass-index(BMI) in coronary computed tomographic angiography(CCTA) which is using a 256-multi-detector computed tomography(MDCT).

Methods: This study was proceeded with 208 patients in our health promotion center. ECG-gated CCTA was practiced by different ECG method varied by HR and different kVp varied by BMI. The patients were divided into 4 groups by HR and BMI.

Results: Attenuation was higher in group A than B(group-A, 452 ± 74 HU; group-B, 333 ± 45 HU, $p < 0.0001$), group-C was higher than



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

D(group-C, 441±77 HU;group-D, 355±75 HU, $p<0.0001$). Noise was similar in group A with B(group-A, 21±4 HU;group-B, 21±2 HU, $p=0.521$), and there was no significant differences between group-C and D(group-C, 21±3 HU;group-D, 21±2 HU, $p=0.561$). SNR and CNR were higher in group A than group B(group-A, 22±4 ; group-B, 17±3, $p<0.0001$), (group-A, 17±3 ; group-B, 12±2, $p<0.0001$)

98. THE USEFULNESS OF EXTRAVASATION DETECTION ACCESSORY FOR EARLY EXTRAVASATION DETECTION THROUGH UNDERSTANDING PHYSICAL MECHANISMS AND PROPOSE THE PROPER CLINICAL INSTRUCTION GUIDE

Presenter: Sungjae Ahn, *Department of Radiology, Seoul National University Bundang Hospital, South Korea*

Authors: Sungjae Ahn • Yunsung Shin • Taehyun Nam • Changmin Dae • Kwanhong Min

Introduction: In contrast enhanced CT study, large volume of contrast is injected faster than previous day followed by developing CT machines. To minimize the possibility of an extravasation, Our hospital made certain steps for patients' safety. The most important thing is use of the extravasation detection accessory(EDA) in all contrast enhanced CT examinations to help to detect potentially serious extravasations. The sensitivity and enhance effectiveness of the EDA patch is greatest for contrast extravasations that accumulate in the tissue directly underneath the patch. In cases where extravasated contrast migrates into sub-cutaneous tissue or septal planes, these types of extravasations typically do not reveal any localized whealing or swelling. The sensitivity and effectiveness of the EDA patch is also lower but there is no doubt, EDA using can be helpful. Seoul National University Bundang Hospital(SNUBH) has two different mechanisms of EDA systems. One is using of radiofrequency(RF) to detect changes of electrical permittivity. The other one is using of Infrared Ray(IR) to detect changes of photon wavelength band. Both mechanisms, RF and IR, depth penetration is limited. Therefore, miss arrangement of EDA sensor to catheter tip depth(Y-axis) and location on the skin(X-axis) can cause unexpected outcome. In this study, we compare two different mechanisms of EDAs and propose proper clinical instruction guide-line.

Methods: In phantom study, Two EDAs' sensitivity were evaluated in two sections, changes of X-axis location and Y-axis depth. In clinical study, detection Sensitivity(SS) and specificity(SP) were statistically analyzed for 1000 subcutaneous injections.

Results: Results:In phantom study, Y-axis SS was 87% in RF and 100% in IR. X-axis SS was 100% in RF and 67% in IR. In clinical study, RF's SS was 92.3% and SP was 98.4%. IR's SS was 89.5% and SP was 98%. Conclusions : By this study, As a result, detector sensor arrangement is very important. Thoroughly, surface sensor location need to be nearer than 10mm from end tip of the catheter and catheter tip depth has to be maintaining less than 6mm.

99. PAEDIATRIC HEAD CT -DIFFERENT INDICATION, DIFFERENT PROCEDURE, DIFFERENT DOSE

Presenter: Johanna Mannila, *Helsinki University Hospital, Children's Hospital, Finland*

Authors: J.Mannila, K.Huhtala

Introduction: Because of the potentially high radiation exposure of Computed tomography, MRI is the first choice for paediatric head imaging outside neonatal period (ultrasound being the first choice when the fontanelle is open). However, MRI is not always available and paediatric patients often require anesthesia. In our hospital 70% of paediatric head CTs are performed for trauma or other acute indication and 30% are done only to examine the ventricular size in a patient with ventriculo-peritoneal shunt for hydrocephalus. In routine head examination the image quality must be good enough to see the gray-white –matter differentiation. The ventricular size can be diagnosed with only a few axial slices and much lower image quality, and thus lower dose. We have optimized our paediatric head ct protocols according to the national Guideline for paediatric CT examinations. If the indication for ventricular size examination is evident the radiographer can perform the examination without consulting a radiologist. Otherwise a radiologist always confirms the indication for paediatric head ct examination.

Methods: We have optimized the head ct protocols on indication and age. The ventricular size examination is performed with 4-7 slices and usually 15mm interval between them. One of the slices is placed at the level of the ventricular shunt tip to localise it.

Results: The patient dose in the head examination varies from DLP 230-650 mGycm. In ventricular size examination DLP is only 13-60 mGycm. The head ct examination should be performed with different protocols according to the patients indication and the protocols should be optimized by patients age. It's important for the radiographer to use the right protocol and consult a radiologist if the indication isn't clear. The patient dose with ventricular size protocol is only 6-10% of the head ct protocol dose.

100. RADIOGRAPHER'S COMPETENCE CRITERIA IN COMPUTED TOMOGRAPHY AFTER PRECEPTORSHIP PERIOD – DEVELOPING SELF-ASSESSMENT INSTRUMENT FOR HUS MEDICAL IMAGING CENTER CT-UNITS

Presenter: Marjut Pawsey, *HUS Medical Imaging Center, Radiology department in Haartman Hospital, Finland*

Author: Marjut Pawsey

Introduction: The radiographer's work has changed and developed to respond to the increased demands placed on radiology services. The technological advancements have become more complex and have increased in all imaging modalities. This creates challenges also for radiographer's competence development in Computed Tomography (CT). The study reported here is the second part of the project where the aim was to develop a self-assessment instrument



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

to describe radiographer's competence in CT after preceptorship in HUS Medical Imaging Center CT-units. The first part of the project was reported in the Journal of Clinical Radiography and Radiotherapy (1/2013). The criteria were defined at first for radiographer's competence in CT then based on the criteria an instrument was created and tested in the projects last stage. The instrument is a 5-point Likert Scale. The objective of the study was to develop an instrument to measure the radiographer's competence in CT after the preceptorship.

Methods: The instrument was then tested and a questionnaire was targeted at radiographer's who had undergone a preceptorship period during 2012 in HUS Medical Imaging Center CT-units. Ten questionnaires were returned (n=10).

Results: The results showed that of the radiographers' competencies the strongest was in patient safety. Especially the risks and safety matters with contrast agents were well recognized. Competence in CT imaging and radiation optimization were areas that seemed to need some development. Development in CT education could be targeted more to these areas in the future. The resultant instrument could be utilized for evaluating and monitoring the preceptorship in CT.

101. RADIOLOGY TECHNICIANS AND DOCTORS LEVEL OF KNOWLEDGE ABOUT RADIATION EXPOSURE DIAGNOSTIC IMAGING PROCEDURES

Presenter: Nezaket Özgür, *Ankara University Faculty Of Medicine Ibn-I Sina Hospital, Turkey*

Authors: Nezaket Özgür, Müge Günalp, Behnan Gülünay

Introduction: Radiological imaging of patients to physicians in the diagnosis but rather provide valuable information, especially since they provide emergency life-saving importance of early diagnosis in patients may have are. However, the radiation used during the imaging process are carcinogenic and teratogenic effects. The negative effects of radiation, especially pregnant women and children as well as shots of patients who are also important for radiology technicians. In this study, commonly used in radiological examinations of patients exposed to ionizing radiation dose of about physicians and radiology technicians aimed to investigate the level of knowledge

Methods: Ankara University Faculty of Medicine Ibn Sina Hospital and Cebeci Campus surgical and medical clinics for employees assistant and intern doctors and radiology technicians 05.03.2012-09.03.2012 between radiological imaging studies of patients expose

Results: Examination conducted in the estimation of the radiation dose to the right was found to be the most successful groups of radiology technicians. Intern doctor at least rate of correct predictions was observed in the group. High doses of radiation as Radiological tests known as the right abdominal ultrasound and abdominal MRI examinations was. Chest computed tomography radiation dose is estimated at a minimum rate tests was correct.

102. DOSES OF ENTRY ON DENTAL RADIOLOGY SALIVARY GLANDS: EXPERIENCE IN THE MUNICIPALITY OF SALVADOR, BAHIA – BRAZIL

Presenter: Guillermo López, *Federal Institute of Science, Education and Technology of Bahia, Brasil*

Authors: López, Guillermo; Muller, Juliana; Flores Paulo

Introduction: The use of ionizing radiation in the field of dentistry has long been regarded as a set of radiological techniques with low doses of radiation in comparison with the other terms, however this scenario is changing with the introduction of new technologies for diagnosis in Dental Radiology. It is known that during the radiological examination, the radiation dose should be reduced to a minimum without loss of diagnostic information, it is important to minimize for children, youth, and elderly individuals who are more sensitive to radiation. The soft tissues alter the absorption of radiation and increase the dispersion, and can influence the contrast and density of the film and, consequently, the accuracy of diagnosis. (Schropp et al, 2012). Under these assumptions the objective of this study was to compare the entrance dose of radiation in bodies of the head with digital periapical radiological equipment in relation to the skull phantom containing dry bones and human tissue equivalent materials, and as a consequence the evaluation of entrance dose skin (DEP) and salivary glands.

Methods: Periapical effects with the use of digital equipment in two phantoms were performed. Doses input were obtained with the use of a solid state sensor and an ionization chamber, in the period from July to December 2013.

Results: The results demonstrate the importance of the adequacy of positioning equipment and concomitant use of low-dose radiation in periapical examinations in maxillary and mandibular region. It is noteworthy that the non-compliance of the beam in the proper position for the examination may result in an increase in dose in organs near the region to be studied, such as: parotid and sublingual gland.

103. RADIATION DOSES AND SCATTERING IN FACIAL AREA CONE BEAM COMPUTED TOMOGRAPHY EXAMINATIONS

Presenter: Minna Väänänen, *Oulu University of Applied Sciences, Finland*

Authors: Minna Väänänen, Anja Henner, Anna-Leena Manninen

Introduction: The use of a cone beam computed tomography (CBCT) for facial area imaging is increasing continuously. This imaging method has become more available in past years especially in facial area examinations. It enables accurate and three-dimensional bone tissue imaging. The radiation dose of CBCT is lower in comparison with a conventional CT but higher in comparison with a panoramic radiograph. Thyroid gland and eyes are radiosensitive tissues and are exposed to radiation in CBCT facial imaging. Information about scattered radiation is useful for staff working in CBCT examinations especially in a case when somebody needs to stay in the



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

examination room to oversee the patient. The purpose of this study was to find out the level of the radiation doses (ESD, entrance surface dose) for the eyes and thyroid gland caused by a facial CBCT examination, to test the usefulness of bismuth shield for thyroid gland, and to measure the scattered radiation around the CBCT device. The aim of this study was to provide estimations of the facial area radiation doses and scattering to staff working in CBCT examinations to allow dose optimization and radiation protection. The bismuth shield was tested to find out the potential dose reduction for the thyroid gland. Also the scattered radiation was measured near the patient for the purpose of the radiation protection for the staff.

Methods: Measurements of this study were done with Scanora CBCT (Soredex, Finland), the head phantom and DoseAware system (Philips, Netherlands). The radiation doses were measured from the thyroid and the eye level and near the phantom for the scattering.

Results: The highest doses for eyes or thyroid gland were when they located near the imaging area. The bismuth shield reduced remarkably (35-48%) the surface dose of the thyroid gland, which makes the use of shields worthwhile. The measurements of the scattered radiation to the environment were not that high. But considering the stochastic effects, it's always better to stay behind the leaded glass or outside the X-ray room. The results of this study allow the optimization of CBCT examinations.

104. LOWERING RADIATION DOSE USING THE NOISE-REDUCTION ALGORITHM IN PERCUTANEOUS CORONARY INTERVENTION FOR PATIENTS WITH CHRONIC TOTAL OCCLUSION

Presenter: Masayuki Kumashiro, *Department of Radiology, Kurashiki Central Hospital, Okayama, Japan*

Authors: Masayuki Kumashiro^{1,2}, Shinobu Yokota¹, Atsushi Kawabe², and Kiyonori Yamaoka²

¹ Department of Radiology, Kurashiki Central Hospital, Okayama, Japan ² Department of Radiological Health Science, Division of Medical Technology and Science, Course of Health Science, Graduate School of Health Science, Okayama University, Okayama, Japan

Introduction: Chronic total occlusion (CTO) reperfusion has been a great advance in interventional cardiology but at a high radiation dose to both patient and operator. We tried to reduce radiation dose with use of the noise-reduction algorithm fluoroscopic technique in patients with CTO in percutaneous coronary intervention (PCI). Visibility and radiation dose were compared with this new technique and the conventional technique. 100 consecutive patients who were examined during 1-year period, 88 men and 12 women with ages varying from 41 to 92 years (68 years old on average) underwent the traditional equipment (Philips Allura Xper FD10 Biplane) and another 100 consecutive patients who were examined during 1-year period, 88 men and 12 women with ages varying from 38 to 85 years (68 years old on average) underwent the new equipment with the noise-reduction algorithm (Philips Allura

Clarity FD10 Biplane). Images were evaluated in randomized, blinded, offline readings. The images were displayed in pairs, with the reference images on one monitor. Two experienced cardiologists graded images of peripheral collateral arteries and the guide wire according to the criteria. The diagnostic quality of images was evaluated on a scale of 1 to 5. Overall image quality was defined as the sum of scores from the two cardiologists. Fluoroscopy times (min), total number of frames and total airkerma in free air at the interventional reference point (mGy) were calculated and compared with each other.

Methods: According to two cardiologists, there was no difference in image quality between traditional X-ray technology and lowering radiation dose technology with the noise-reduction algorithm (ClarityIQ).

Results: And there were no difference in both of fluoroscopy times (83.1±54 vs. 82.4±41 min) and total number of frames (6398±3138 vs. 6241±859) between traditional X-ray technology and new technology with the noise-reduction algorithm. But the technology with Clarity IQ was significantly decreased the total air kerma in free air at the interventional reference point (5055±3440 vs. 3369±2017 mGy, P <0.01).

105. EVALUATION OF RADIATION DOSE TO PATIENTS UNDERGOING INTERVENTIONAL PROCEDURES AT SEOUL NATIONAL UNIVERSITY BUNDANG HOSPITAL

Presenter: Sunwoo Kim, *Seoul National University Bundang Hospital, South Korea*

Author: Sunwoo Kim

Introduction: In the past 30 years, the numbers and types of interventional procedures have increased dramatically. Apart from its benefits, the interventional radiology (IR) is known to generate high radiation doses to patients and medical staff involved. Interventional radiological examinations may be associated with excessive radiation exposures which may cause skin injuries and higher probabilities of stochastic effects. The purpose of this study is to assess the radiation dose to patients undergoing interventional procedures at Seoul National University Bundang Hospital.

Methods: Data were collected from 716 patients who underwent interventional procedures. Nine (UAE, TACE, BAE, TFCA, PTBD, AVF-PTA, PTGBD, PERMCATH, CHEMOPORT) procedures were reviewed. The values of DAP, fluoroscopy time, and number of the images were analyzed.

Results: DAP values were 405.75, 379.6, 170.5, 105.49, 80.58, 71.22, 14.61, 6.13 and 4.47 Gy·cm² for UAE, TACE, BAE, TFCA, PTBD, AVF-PTA, PTGBD, PERMCATH and CHEMOPORT, respectively. There was no clear correlation between the DAP values and fluoroscopy time values or between the DAP values and number of the images values. Very wide variations were found in patient dose from each different interventional procedure. So, it is important that patient doses routinely recorded and managed.



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

106. THE OPTIMIZATION OF THE DEFECOGRAPHY EXAMINATION

Presenter: Leila Kannala, *Department of Radiology, Oulu University Hospital, Finland*

Authors: Leila Kannala, radiographer; Maari Korhonen, radiographer; Anna-Leena Manninen, physicist; Anne Vaarala, radiology

Introduction: Defecographic studies are performed to clarify reasons for functional anorectal disorders. Image quality and patient dose vary widely due to the imaging procedure and patient itself. In defecography, lateral view is used to record the voluntary evacuation of radio-opaque material from the rectum. Also some exposures may be required for the diagnosis. During the examination, the radio-opaque material is in the middle of the field-of-view and causes an increase of the dose rate due to the automatic brightness control system (ABC). This leads to an increase in dose to the pelvis and the image quality is degraded. In the present study, defecography protocol was optimized by means of self-evaluation of the imaging procedure. This study included 172 patient who underwent defecographic examination at Oulu University Hospital from 2013-2014. 34 patients before optimization and 138 patients after optimization were evaluated. Before optimization, the ABC setting was selected to use whole area of the detector to adjust the brightness of the image, whereas in optimized group, two lateral areas of the detector was used. Also, in the optimized group the density of the liquid barium was reduced by mixing barium with ultrasound gel in ratio of 2:1. The mean DAP dose and fluoroscopy time (Tf) of these two groups was compared. The patient's size was ignored because the evaluation was done retrospectively by RIS (Research Information Systems) sampling. The aim of this study was to optimize the local defecography protocol by minimizing the radiation dose of the pelvis and ovaries and at the same time reducing the overexpose of the interface between the target and air.

Methods: Fluoroscopic imaging equipment with a flat panel detector (Siemens Artis Zee Multi-Purpose, Erlangen, Germany) with a low dose fluoroscopy protocol (FL-) and pulse rate of 1 p/s (adjustment), 3 p/s (examination) and 1-2 p/s (slow phase) was used.

Results: Before optimization, the mean DAP was 441 $\mu\text{Sv}\text{m}^2$ and the mean Tf was 50 second, whereas after optimization the mean DAP was 104 $\mu\text{Sv}\text{m}^2$ and the Tf was 59 second. In addition, the better contrast of the images was found as a result. The optimization of defecography is needed, because of the relatively high absorbed doses of the pelvis. The contrasts of the optimized images were superior to the images before optimization due to reduced overexpose. The mean DAP dose for optimized defecography examination

107. EVIDENCE BASED CLINICAL PRACTICE IN COOPERATION WITH THE STAFF AND RADIOGRAPHER STUDENTS

Presenter: Sanna Roppola, *Raahe hospital, Finland*

Authors: RT Sanna Roppola, PhD, Henner Anja, RT Virpi Kansanoja, RT Vesa Repo, PhD, Reponen Jarmo

Introduction: Radiographer students have 75 ECTS (2000 hours) in clinical practice. They work as team members and have different tasks during their studies. Evidence based way of working and learning is a motivating way to develop one's own work. In Oulu University of Applied Sciences (OUAS) cooperation between school and society partners (hospitals, companies etc) has been developed for many years. One of the partners is Raahe hospital, where the students can be in clinical practice having courses e.g plain radiography, mammography, computed tomography, ultrasound and administration. The tasks and learning objectives for the clinical practice are planned together with students, staff and teacher. The tasks are planned develop both student's competencies and clinical practice.

Materials: A written developing plan was made in collaboration between Raahe radiology department and OUAS, degree program of Radiography and Radiotherapy. The plan consists of different topics/tasks, which the students perform in clinical practice. The results of these tasks can be used as self assessment material in clinical audits or they give new information to the staff. Student's and teacher's presentations of the latest articles and conferences are used as updating education. There are also Bachelor Thesis's carried out.

Conclusion: Students have carried out these tasks for years. Patient dose is followed up yearly by collecting patient doses (ESD). Students also carry out user's quality assurance tests and compare them to DRLs given by Radiation and Nuclear safety Authority in Finland. Teaching events in CT course have covered topics like basic concepts in CT, patient information and guiding (what patients want to know), factors effecting to patient dose in CT, use of contrast media in CT, use of shields in CT (bismuth and lead) and children's CT examinations. Bachelor Thesis about patients' and staff of wards satisfaction, doses in CT and different guide booklets for patients and staff, quality assurance guides have been produced in cooperation. The written scheme is useful in developing the clinical practice systematically and gives evidence based information. One Bachelor Thesis is developing dental panoramic imaging in multi professional team. Both staff and students as well teacher are involved in this planned project and we will carry on this way.

108. THE CONCEPT FOR THE MENTAL RADIOACTIVITY STUDY FOR RADIATION MEDICAL TREATMENT

Presenter: Hiroki Ohtani, *Tokyo Metropolitan University, Japan*
Authors: Hiroki Ohtani, Yukari Yamaguchi, Mayuko Kishita, Kei Tsumura

Introduction: There has been concern to the living environment of radioactivity since a nuclear power plant disaster. Since the mental situation to which it cannot be convinced only from the scientific standpoint of radiation or radioactivity is concerned, there is uneasiness of radioactive contamination or external exposure.



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

However, the psychology of radiation is not clarified. The necessity of discussing radioactivity is clear from the general people's viewpoint. In this research, we conceived of radioactivity science from the mental side, and aimed at stabilization of people's living environment and radiation medical treatment.

Methods: Subject extraction based on the brainstorming method was performed. We analyzed about psychological influence, scientific uneasiness, uneasy dissolution, the message to the future, and the patient's uneasiness.

Results: About the influence of a low dose radiation, it was uneasy that a threshold is unknown. It was the uneasy cause that I cannot understand the ambiguity of a threshold value. Even if exposed to radiation, a patient wants to know the merit which performs radiation medical treatment. Since it was exposed to radiation also by medical treatment, the patient complained about radiation photography. There was a patient who thinks metastasized by being exposed under treatment of cancer.

109. TIME FOR CHANGE: NEW OPTIONS FOR PLACEMENT PROVISION

Presenter: Alexandra Partner, *University Of Derby, UK*
Author: Alexandra Partner

Introduction: Diagnostic Radiography is facing many challenges during the current economic climate. The National Health Service (NHS) is facing increased pressures whilst trying to improve quality (Institute for Innovation and Improvement, 2013). There is an emphasis to become cost-efficient, more effective and more streamlined. This is having an impact, not just on service delivery but on the quality of the learning experience for student radiographers. Clinical Placement is considered an essential part of undergraduate education as it provides a platform for students to apply their theoretical knowledge in a practical setting (Department of Health, 2002). Placement is a core and essential part of diagnostic radiography degree programmes that enables direct patient contact and according to the DOH it (2002:3) "helps to develop competence in all aspects of patient management as well as developing clinical reasoning processes". At our higher education institution we offer a range of clinical placements for students on the 3 year degree, this facilitates experiential learning in a variety of clinical settings reflecting the diversity and the need for qualified radiographers to be able to adapt to workload and changes. The 'real world' learning that placement offers is incredibly important to a student's success and transition to become a competent allied health professional. Yet with all points taken into consideration placement is under threat. NHS trusts are finding that staff shortages and budget restraints means they are struggling to cope with the same numbers of students and the amount of support available to them.

Methods: The Radiography programme team at the University of Derby viewed potential new placement ideas and a project leader was appointed. Work started on expanding community hospital placements and the introduction of private, voluntary.

Results: Current third, second and first year students were asked to vote on these new introductions via a student representative meetings, the results were unanimously in favour. There are now four private hospitals in the placement rotation with one more potential on board, offering clinical placements to our final year students. Community placements have increased from three to seven with two more awaiting confirmation in the future. An unexpected gain was the variety.

110. USE OF SIMULATOR ANTHROPOMORPHIC (PHANTOM) FOR TEACHING TECHNIQUES OF RADIOLOGY: EXPERIENCE REPORT ON FEDERAL INSTITUTE OF BAHIA-BRAZIL

Presenter: Juliana Müller, *Federal Institute Of Bahia-Brazil*
Authors: Juliana dos Santos Müller and Guillermo Alberto López

Introduction: In Brazil, the Ministry of Education and Culture is the body responsible for the evaluation and authorization of the Higher Courses in several areas, among them the Course of Technology in Radiology. It is recommended, as criterion of minimum infrastructure, the necessity implementation of specific laboratories, which among them includes a radiological practical lab. The educational reality in the field of Radiology in Northeast Brazil denotes a deficiency in structuring these laboratories, impacting the training of new technologists in Radiology. In disagreement with this reality the Federal Institute of Bahia (IFBA) provides the Radiological Physics Laboratory with a collection of equipment needed for professional training of Technical Radiology, highlighting an anthropomorphic phantom Pixy Manufacturer model Radiological Device Support. The simulations performed in this laboratory promote the acquisition of skills to care for the patients allowing immersion of students in secure environments to develop the interactive process of knowledge. Breaks the assumption that one has the principle of optimization which must ensure exposures as low as possible. Within this context, this paper aims to present the importance of using anthropomorphic phantom when graduating students of radiology, providing theoretical and practical support and systematization of knowledge to students, aiming their future education based on sound implementation of optimization techniques and procedures.

Methods: This study was an experience report of the faculty for curricular subjects: radiological study I, II and Supervised. The study period was from February to December of 2013.

Results: The criteria described in this work could contribute for a new teaching strategy, one valid for the development of competencies, skills and attitudes implementing technical instrument. It is considered that these procedures must be performed correctly to avoid over dosage and minimize exposures to the patient, followed by training, denotes the importance of using the Phantom in the relation of knowledge and training in Radiology Technologist.

111. CONTRAST-AGENT EDUCATION IN HUS MEDICAL IMAGING CENTER



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

Presenter: Heli Patanen, *HUS Medical Imaging Center, Finland*
Authors: Heli Patanen and Merja Wirtanen

Introduction: Radiographers performing CT or MRI examinations may need to deliver contrast medium. At 1990's radiographers in Finland gradually began to insert i.v. cannulas but not administering contrast medium. Administration of contrast medium began some years later, about 20 years ago. In Finland this cannot be done without a special permit. Radiographers, as licensed health care professionals, whose task it is to administer contrast medium (iodinated or gadolinium) must pass an examination to be entitled to carry out this task. Today there is no nationwide examination for radiographers. In the Hospital District of Helsinki and Uusimaa (HUS) all licensed health care professionals have a common educational exam to pass. This contains general medication, i.v. medication, epidural medication and blood transfer. In addition, radiographers must pass an examination of contrast medium. The license must be validated every 5th year. If not passing the exam, it can be repeated two times, three attempts altogether. After passing the exam, skills like inserting cannula, must be proved and recorded. When all this is done, radiographer gets a certificate. At radiological departments in hospitals, this must be done before a radiographer can be on-call-shifts. The aim of this education is radiographer's good knowledge of contrast medium. Emphasis is on iodinated contrast medium and gadolinium. At the major role is safe administration of contrast medium. When preparing the material to study, the purpose was to give basic knowledge of safe administration and recognition and treatment of complications. Instructions concerning contrast medium and recording of the administration must be studied

Methods: All the material to be studied and the exams are web-based. There are a few questions available that can be used for practicing the material. Certain content must be learned by heart to be able to deepen one's knowledge and skills on practice.

Results: License to administer contrast medium and other medication is signed by the head of department and the nurse in charge. The exams are to be made without material. They also make it possible for radiographers to study for the examinations, and supervise the exams. Multiple choice questions are equal for all radiographers versus essay answers which may be open to interpretation.

112. A CASE STUDY OF THE FIRST COHORT OF STUDENTS ON THE MSC DIAGNOSTIC RADIOGRAPHY PRE-REGISTRATION (FAST-TRACK) PROGRAMME AT QUEEN MARGARET UNIVERSITY, EDINBURGH.

Presenter: Alanah Kirby, *Queen Margaret University, Edinburgh, United Kingdom*
Author: Alanah Kirby

Introduction: Following a consistent increase in the number of graduate applicants for the BSc (Hons) Diagnostic Radiography

programme, the development of a fast-track option at Masters level was investigated. The rationale had several strands. These students had already proved that they could study at undergraduate level and so were considered capable of being fast-tracked into a vocational programme at this level. Attrition rates in health care education are sometimes due to students choosing their careers inappropriately. It was thought that graduate applicants would have chosen their career options more carefully, reducing attrition. By offering this programme at Masters level, applicants would see an improvement in their academic achievement rather than repeating an undergraduate degree. Compressing the programme from 4 years to 25 months would reduce the cost for students and allow them to graduate, register and practice in radiography much sooner. Compressing the time scale would necessitate longer academic and clinical blocks and this would allow more effective reinforcement of both knowledge and practical skills. The profession of diagnostic radiography would be enhanced by the inclusion of mature practitioners with a different skill set to the usual graduates. The academic profile of the profession would be raised at ground level as these postgraduates would be capable of research and audit which is essential to improve patient experience. The burden to the health service could be reduced as radiographers would not have to be released from their clinical duties for further education to improve their research awareness.

Methods: This is a case study of the first cohort of the MSc Diagnostic Radiography pre-registration (fast-track) programme with data collected from audits of the applications, academic results, clinical experience, and employment success.

Results: A programme was developed and validated in September 2011 for 10 students to start in January 2012. One advertisement was placed in a national newspaper and the programme was entered on the university website. Eleven applications were received within 2 months and the first cohort of 8 students started in January 2012. Of these, 6 had a science degree (75%). Seven students graduated in Feb 2014: 6 with an MSc (1 with distinction) and 1 with a PgDip. Six students had job offers before graduation.

113. THE INTRODUCTION FORM FOR PRACTICAL TRAINING OF CT

Presenter: Anne-Mari Kulhomäki, *Kuopio University Hospital, Department of Clinical Radiology, Finland*
Authors: A-M. Kulhomäki, M. Nevalainen

Introduction: The purpose of this thesis work was to produce an introduction form for radiographer students in the Department of Clinical Radiology in Kuopio University Hospital (KUH). The aim was to deliver a user-friendly introduction form for those radiographer students who are at their practical training of computed tomography (CT) in KUH. The idea was to promote radiographer students' guidance and make the introduction process more systematic. The target groups are radiographer students conducting their clinical practice and the guiding radiographers at KUH. The



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

thesis was carried out as a development project. The written report consists of information about student guidance, introduction, National Qualifications Framework (NQF), competences of radiographers' study program and CT. In addition a review of the process of planning and implementation is included. The introduction form was created by using competences of radiographer students' study program at Savonia University of Applied Sciences and the working process of CT at KUH. The competences are guidance and nursing, technological and radiographic knowledge and safety.

Methods: The introduction form was evaluated by radiographer students (3) and the guiding radiographers (5) in KUH. The topics of the theme interview were: users' experience of the form generally, content of the form and the appearance of the form.

Results: In summary, the introduction form was generally evaluated as user-friendly, it has logical structure and it can be easily transformed for other modalities at the Department of Clinical Radiology at KUH. Results from follow-up study could be used for evaluation whether skills tests for students are needed.

114. ACADEMIC LEARNING ENVIRONMENT AND STUDENT APPROACH TO LEARNING

Presenter: Tiina Kukkes, *Tartu Health Care College, Estonia*
Authors: Kukkes, T., Urban, R., Solom, K.

Introduction: Efficiency of student learning depends on the interaction of the student-related factors and the factors of the academic environment. Awareness of the interaction of those factors allows the teacher to develop the academic learning environment that facilitates efficient learning.

Methods: 68 first year radiography students were studied to determine their approach to learning and their perception of the learning environment. CEQ and SPQ-2 F were implemented for data collection and the SPSS program for data analysis.

Results: Results of the study failed to show statistically significant relationship between the preconditions of the learners and their approach to learning and learning outcomes but the preconditions were related to the students' perceptions of their work load and clarity of study goals. Two factors of the learning environment, i.e. satisfaction with teaching and general satisfaction with the subject course, were the most probable factors to show the student's surface or deep approach to learning.

115. STUDENTS PRODUCING LEARNING MATERIAL IN AN INTERNATIONAL PROJECT

Presenter: Anja Henner, *Oulu University of Applied Sciences, Finland*
Authors: Maija Arvola, Hanna Kiuttu, Elina Niemelä, Eerika Riippi, Anja Henner

Introduction: Panoramic examinations are produced by radiographers and oral hygienists. 3 ECTS module of panoramic dental imaging was produced in a project together with radiographer students. The students planned and made the materials for web-based course in English. Materials for panoramic imaging concerned the equipment, quality assurance and dose optimizing. A head phantom was used in image quality and dose optimization as well as picture analysing. The students evaluated the project and the benefits of it by themselves but the course was evaluated also by oral hygiene students.

Methods: The students made five different power point presentations with texts and images as well x-ray images of the phantom and photos taken by themselves. The presentations are from the equipment and its use, positioning including positioning criteria.

Results: The student radiographers were very satisfied to the results they reached. It was interesting to plan the whole project in a small group quite independently. The literature of dental imaging is now familiar for them. They learned a lot of panoramic equipment and quality assurance of dental imaging. The head phantom was useful in positioning and it was instructive to take a photo of the position and then analyze the image taken of the phantom.

116. MULTIPROFESSIONAL SIMULATION-LEARNING IN HEALTH CARE PROFESSIONALS' PHARMACOTHERAPY CONTINUING EDUCATION

Presenter: Suvi Aura, *Kuopio University Hospital, Finland*
Authors: Aura, Suvi; Savolainen, Liisa; Metsävainio, Kirsimarja; Miettinen, Merja; Turunen, Hannele

Introduction: It has been estimated that 10 % of the patients treated in hospital suffer from adverse events, significant part of which relates with pharmacotherapy. Multiprofessional continuing education of pharmacotherapy is part of patient safety promotion interventions in Kuopio University Hospital (KUH). The requirements in medication competence have expanded, due to rapid development in health care technology and medical procedures. In Department of Clinical Radiology there are a growing number of procedures, where the patient needs either pain or sedative medication. Multiprofessional simulation education was carried out in KUH Department of Clinical Radiology (20 radiologists and 65 radiographers) at autumn 2012. Learning outcomes included e.g.: Understands the importance of monitoring vital signs for patient safety; can evaluate changes in vital signs; knows the most common pain- and sedative medication and their effects, clinically most important adverse reactions and interactions. The education consisted of orientating lectures and multiprofessional in situ-simulations at radiography unit in small groups (1 radiologist and 3 radiographers). Every simulation had two scenarios: medication administration during biopsy and treatment of severe radio contrast agent reaction.



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

Methods: The feedback was collected from radiologists and radiographers with electronic questionnaire. The questionnaire included structured and open-ended questions.

Results: The participants evaluated education highly useful (mean 4,9), when scale was 1-5. The self-evaluation of medication competence was before education weak (23%), satisfactory (37%) or reasonable (37%), whereas after education the self-evaluation was reasonable (50%) or good (43%). The participants described that simulations enhanced their learning due to positive learning atmosphere, realistic scenarios, and reflection. In addition, development of team work and communication was found important.

117. PATIENT-CASE (PTC) BASED SIMULATION IN TURKU UNIVERSITY OF APPLIED SCIENCE (TUAS)

Presenter: Jarno Huhtanen, *Turku University of Applied Science, Finland*

Authors: Jarno Huhtanen Master of Health Science, Leena Walta Ph.d. Doctor of Health Science

Introduction: How radiographer or radiographer student learn depends on learning strategies. Radiographers use different kind of learning styles in their everyday practice. Their learning could be enhanced using active experimentation and reflective observation. Radiographer students' have problems in transferring theory knowledge in to practice. Student use mainly learning style that includes theory assimilation to practice and reflection of their own work which differ from the learning styles of radiographers. Simulation as a learning environment and educational tool supports learning as an individual. Especially simulation develops team work abilities. There is strong correlation between learning outcomes and simulation hours. Simulations have been used in radiographer education at Turku University of Applied Science (TUAS). Theoretical background based on Miller's four level of learning outcome, which can be achieved by clinical assessment. Purpose of simulation is to combine theoretical and clinical knowledge. Simulation used in radiographer education at TUAS has been divided in four steps. Steps follow each other and they form together greater understanding of the subject being studied. First step is a group work and based on Patient Case (PtC). Second step in simulation is students' self-study. Third step is simulations from every PtC's. Fourth step is reflection which happens in two-phases.

Methods: Evaluation of Ptc-based simulation was based on student portfolios (N=19,n=18) in Fall 2013. Students' were 1st year radiographer students. Data was analyzed independently by two teachers. Method was inductive content analysis.

Results: Based on the inductive content analysis simulation provides more opportunities for students to get both the theoretical and clinical understanding of the given subject and PtC's. This way students' are more prepared and "fit for practice". Results based on student evaluation were positive. E.g. motivation towards learning, learning as a group and functionality were named as positive outcomes from the PtC-based simulation.

118. ANATOMIC TILT RADIOGRAPH OF THE DISTAL RADIUS

Presenters: Kristin Dehli and Linn Iren Molt Rise, *Oslo University Hospital, Rikshospitalet, Norway*

Authors: Linn Iren Molt Rise and Kristin Dehli

Introduction: Distal radius fractures are common injuries that often require internal fixation. The position of the distal screws varies depending on the position of the radius locking plate, and the different angles of screw placements. Screw position relative to the articular surface may be difficult to determine on standard lateral radiograph. An anatomic tilted radiograph may be helpful to provide a better view than the standard lateral radiograph. The purpose of this study is to describe a reliable method for obtaining an anatomic tilt lateral radiograph, currently in use at Oslo university hospital, Rikshospitalet.

Methods: Standard PA radiograph is performed and exported to PACS. Using an angle tool, the radiographer measures the radial inclination on the PA image. The measured inclination angle determines the anatomic tilt angle of the lateral radiograph.

Results: The use of angle measurement tools in PACS to find the correct angle for optimal positioning of the anatomic tilt lateral radiograph is an easy and helpful method. This obtain good visualization of the subchondral bone and radiocarpal joint after volar plating of distal fractures.

119. SAFETY OF POST-OPERATIVE IMAGING WITH JOINT REPLACEMENT SURGERY IN COXA HOSPITAL

Presenter: Tiina Lehtinen, *Coxa Hospital for Joint Replacement, Finland*

Authors: Tiina Lehtinen, RT, Päivi Laarne, PhD, Hannu Syrjä, MD, Jyrki Nieminen, MD, PhD, Petra Elo, MD, PhD

Introduction: Coxa Hospital for Joint Replacement is located in Tampere, Finland and provides joint replacement surgery for hip, knee, shoulder, elbow, ankle and wrist joints. Coxa Hospital for Joint Replacement was the first surgical operating unit to introduce post-surgery C-arm imaging as a part of orthopaedic surgery. An immediate post-operative x-ray will be taken of all replaced joints either in the operating theatre or a dedicated imaging room in the immediate vicinity of the operating theatre. In the imaging situation, all personnel participating in using radiation must have sufficient knowledge about protecting themselves and the patient from radiation. Projections taken correspond to projections used in follow-up monitoring. An orthopaedic surgeon will be present during the entire duration of imaging, so separate referral is not required. Immediate imaging at the surgical unit and the presence of an orthopaedic surgeon speed up the diagnosis of a possible early complication, such as periprosthetic fracture, and, if needed, the patient can be immediately taken back to the operating theatre for further measures. On average, 16 patients are operated on and imaged daily. Pre-surgery x-rays and later post-surgery control x-rays are taken in a normal manner at the department of radiology.



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

Methods: An orthopaedic surgeon participates in the development of radiation protection practices together with the radiographer. In post-operative imaging, surgical nurses have passed the required radiation protection training.

Results: The post-operative C-arm imaging immediately after the operation provides a high quality projection of the joint corresponding to follow-up monitoring. Possible immediate complications may be diagnosed at an early stage and decisions on further treatment and rehabilitation may be made without delay. With continuous training, radiation doses typically diminish. Good organisation, development of production planning and appreciation of competence contribute to staff satisfaction and coping at work.

120. TELECONSULTATION IN RADIOGRAPHY - THE USE OF ERADIOGRAPHY IN DECISION MAKING

Presenters: Sanni-Mari Savolainen & Silja Sjöholm, *Turku University of Applied Sciences, Finland*
Authors: Sanni-Mari Savolainen & Silja Sjöholm

Introduction: Information and communication technology (ICT) is a natural part of today's health care system. Radiography and imaging studies on the other hand are an essential part of different stages in modern patient care. ICT plays a huge role in a radiography working environment and that is why we have named this union eRadiography in our thesis. The aim of this thesis is to illustrate radiographer's experiences of consultation and teleconsultation, and how much it is used and needed to support their decision making. This thesis focuses on a situation where a radiographer has to make independent decisions concerning patient care in conventional radiography. This subject is of current interest because of the increasing shortage of radiologists in Finland which forces radiographers to work without the physical presence of radiologists. This in turn aroused the question of how the modern ICT -solutions are used alongside with the old ones in teleconsultation. This thesis also raises the question of how to develop eRadiography in the future.

Methods: Data collection was executed by half structured interviews of four radiographers in four different radiography departments in the Medical Imaging Centre of Southwest Finland and the data was first transcribed and then analysed with content analysis.

Conclusions: Main reasons for the use of teleconsultation are insufficient referrals, challenging patients, young patients and the lack of radiographer's work experience. Radiographer's mainly ask consultation from radiologists, referring physicians and colleagues in a weekly basis. These consultations are conducted face-to-face or by teleconsultation. Most commonly used methods of teleconsultation are telephone and Microsoft Lync which was seen as a solution to future development of teleconsultation.

121. RADIOGRAPHERS' PERCEPTIONS OF THE IMPACT OF THE INTRODUCTION OF DIGITAL RADIOGRAPHY ON ELEMENTS OF PRACTICE

Presenter: Phil Cosson, *Teesside University, UK*
Authors: Joanna Tait, Phil Cosson

Introduction: There have been significant changes in radiography that are understandable considering the progression of healthcare and the demand on imaging for diagnosis. CR was introduced in the 1980's, then DR was introduced in the 1990's with departments now becoming DR-exclusive. The differences between CR and DR include, but are not limited to: acquisition speed, image quality (IQ), and patient dose, although the impacts of these differences may not all be perceived as advantageous. Current literature describes DR as enabling increased productivity, reduced dose, and better image quality when compared to CR. The purpose of this research is to explore the perceptions of radiographers of the impact DR has had on their practice.

Methods: Qualitative research was carried out using a phenomenological approach. A convenience sampling method was used to recruit for semi-structured interviews with an inclusion criteria of qualified radiographers who work with DR.

Results: Interviews were transcribed and analysed by thematic data analysis. Four areas of radiography were identified to have been impacted upon by the introduction of DR; efficiency, patient safety, job requirements, and technology. DR has both positive and negative impacts on practice although any disadvantages are outweighed by the advantages. There are areas of concern for future practice due to the reliance upon technology now, in particular regarding exposure factor knowledge.

122. A QUANTITATIVE STUDY TO ESTABLISH ANATOMICAL AND/OR PATHOLOGICAL PREDICTORS FOR THE 'INCORRECT' CLASSIFICATION OF RED DOT MARKERS ON WRIST RADIOGRAPHS TAKEN IN ACCIDENT AND EMERGENCY (A&E) DEPARTMENTS

Presenter: Rebecca Kranz, *Teesside University, UK*
Authors: Rebecca Kranz - Student (Teesside University), P. Cosson - Senior Lecturer (Teesside University)

Introduction: Radiographers may help reduce diagnostic error via radiographer abnormality detection schemes (RADS). There is a paucity of published evidence behind the proposed dismissal of the widely implemented red dot method in favour of preliminary clinical evaluation (PCE). Attempts to evaluate the diagnostic accuracy of red dot – which involves the placement of 'red dots' or asterisks on accident and emergency (A&E) radiographs to highlight the presence of abnormality – feature methodological weaknesses that preclude strong conclusions of performance, primarily due to the voluntary nature of most red dot schemes or lack of participation in training programmes. Other explorations of error in radiology have



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

examined extrinsic factors affecting reporters, such as fatigue and level of experience. However, in plain-film radiography there has been little assessment of anatomical and/or pathological characteristics as potential predictors of erroneous image interpretation. The identification of such may expand the knowledge base of red dot and inform the image interpretation training of radiographers to focus on 'problem' areas; improving diagnostic accuracy and thus the impact radiographers may have on patient management. Therefore, the aims of this study were to establish the prevalence of red dot in a sample and investigate anatomical and/or pathological predictors for its incorrect classification.

Methods: A&E wrist cases in a digital teaching library were examined for red dot prevalence and anatomical/pathological features. Logistic regression analyses identified which features were predictors of false positive (FP) and 'false negative' ('FN') error.

Results: Red dot was incorrectly classified in 8.5% of cases (n=398); 6.3% were 'FNs' and 2.3% FPs (1 d.p.). Old fractures (odds ratio (OR) 5.070 (1.256-20.471)) and reported degenerative change (OR 9.870 (2.300-42.359)) predict FPs, whilst fracture-type (Frykman V (OR 9.500 (1.954-46.179)) and VI (OR 6.333 (1.205-33.283))) and non-Frykman abnormalities (OR 4.597 (1.264-16.711)) predict 'FNs'. Verification with larger samples and controlling for red dot participation would reinforce these findings.

123. RADIOGRAPHIC TECHNIQUE AND CLINICAL SIGNIFICANCE OF FULCRUM BENDING PROJECTION IN SCOLIOSIS RADIOGRAPHY

Presenter: Damian S L Lau, *Department of Radiology, Duchess of Kent Children's Hospital, Hong Kong*

Authors: Damian SL Lau, Gordon WT Lam

Introduction: Radiography of the spine is essential for patients with idiopathic scoliosis because it helps in monitoring the progression of spinal deformity, pre-operative assessment and planning as well as evaluating treatment outcomes. For patients who need surgical intervention, assessment of the spinal flexibility is important because it gives information about the vertebral levels that need to be treated with arthrodesis. Conventional method to assess spinal flexibility is to compare the Cobb angle measured on standing anteroposterior (AP) or posteroanterior (PA) projection with that measured on AP lateral bending projection. In our hospital, routine projections of scoliosis used to be standing PA projection (which minimizes the radiation dose to the breast, thyroid and gonads of patients), standing lateral projection, and AP side bending projections with patient supine. Since 1997, our hospital has used a new fulcrum bending projection to assess spinal flexibility of the patients with idiopathic scoliosis. This paper aims to introduce this new radiography projection in the assessment of idiopathic scoliosis with an emphasis on its radiographic technique and clinical significance.

Methods: The fulcrum bending projection is performed using a radiolucent triangular-shaped plastic fulcrum. The radiographic techniques including patient positioning, placement of the fulcrum and beam centring will be described and illustrated in the paper.

Results: In our experience, the fulcrum bending projection is not difficult to perform. However, precise placement of the fulcrum is critical. This projection has clinical significance in pre-operative planning of patients with idiopathic scoliosis and provides useful formation in the assessment of spinal flexibility. In our hospital, the fulcrum bending projection has replaced the two AP side bending projections in most of the patients.

124. COMBINATION OF RARE THREE(RIGHT) ARTERIAL VARIATION WITH ANOMALOUS ORIGINS OF THE VERTEBRAL ARTERY, ABERRANT SUBCLAVIAN ARTERY AND DOUBLE ORIGINE RT OPHTHALMIC ARTERY.

Presenter: Yong Ju Kim, *Department of Radiology, Seoul National University Hospital, Seoul National University College of Medicine, Seoul, Korea*

Authors: Yong Ju Kim

Introduction: 72-year-old woman hospitalized for Lt carotid artery stenosis showed rare arterial variation on the right side with anomalous origine of the vertebral artery, aberrant subclavian artery and double origine of Rt ophthalmic artery. We reviewed the previous literature and discussed anatomical variation.

Case 1 An aberrant right subclavian artery to arise separately from the arch aorta.

Case 2 The right vertebral artery had its origin from the right common carotid artery at the inferior border of the right thyroid gland, and it had an aberrant entrance to the C4 transverse foramen.

Case 3 The Rt ophthalmic artery had double origin from the right internal carotid artery at supraclinoid and infraclinoid portion.

Methods: (case report) We recently experienced combination of rare three arterial variation in cerebral angiography. **Results:** The possible embryonic mechanism of this previously unreported variant combination is discussed.

A combination of these three variation is rare, but the true incidence of right vertebral artery-carotid artery and double origine of ophthalmic artery underlying an aberrant right subclavian artery is not known. We need more discussion about embryology and anatomy variation.

125. RESEARCH AND PRACTICE OF RADIOLOGY BUSINESS IMPROVEMENT BASED ON INFORMATION REUSE

Presenter: Zhentao Li, *Radiology Department in Peking University People's Hospital, Beijing, P.R.China*

Authors: Zhentao Li, Chao Sun, Tao Liu



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

Introduction: This paper is to discuss the effects of reuse of all information in the radiology domain, other than original application, and to apply such reuse to the improvement of radiology business. 1. MPPS messages are mainly used to send the progress information to Information Systems other than RIS. We reuse those MPPS messages in radiology domain. Shortly after RIS receives an MPPS IN PROGRESS message, selected information of current patient will be shown to technician by a pushing service on RIS tablet client. 2. Hardcopy films also contain information that cannot be easily reused. Useful information are letters but pixels in form. It can be read easily by man, but hardly by computer. We obtain these information from DICOM pixel data through OCR. Information is transferred from pixel to text in order to reuse in future retrieval and printing on demand. 3. Information reuse plays an important referential role in education and research by means of analysis on radiology examinations and reports. An information system was developed based on the idea of reuse, which can mark, classify, arrange and store examination information and reports, and can be applied to radiological education and research by summary and query.

Methods: DICOM, image pixels and examination reports are reused in information transmission, information form conversion and information management, realizes the pushing examination, recognizing digital films, and knowlknowledge database.

Results: Reuse of existing radiological information makes full use of information. This method can expand the information application range, avail more users of resources in radiology as well as their professional counterparts, and realize simplified work, digitized business and structured expertise.

126. AUTONOMOUS WORK SHIFT PLANNING

Presenter: Heli Heikkilä, *Northern Ostrobothnia Hospital, Finland*

Authors: Heli Heikkilä, Markku Jaakkola, Vesa Oksanen and Päivi Paaso

Introduction: The emergency radiology unit of Oulu University Hospital in the Northern Ostrobothnia Hospital District carried out a development project involving a change to autonomous work shift planning. The project was implemented initially as a one-year experiment. Autonomous work shift planning means nursing staff members themselves plan work shift lists according to mutually agreed conditions. Employees choose their own work shifts from a set of shifts that the employer has specified beforehand on the basis of staff and/or competence needs. The employer ultimately decides and is in charge of the implementation of work shift planning. The employer approves the work shift plan and also controls and monitors adherence to the agreed conditions. The reasons behind autonomous work shift planning are practical organisation of work, ergonomics, improved work efficiency and better integration of work and life outside of work. Workplace autonomy is an innovative working time model. It is being developed in collaboration with the staff and management and it has a positive impact on both individuals and the organisation. Autonomous work shift planning is work community cooperation at its best. Working time autonomy emphasises a new operating culture—the employee's responsibility

for the unit's functionality and development. Working time autonomy shifts the way of thinking from the individual's perspective to the perspective of the organisation and operation. The employee's role changes, because the former presenter of wishes regarding work shifts becomes an active, responsible planner of work shifts.

Methods: Initially all the employees were introduced to the principles of the collective labour agreement (periodic work), ergonomic working times that support job well-being and work shift planning.

Results: Everyone learned to make her/his work shifts her/himself and nearly everyone has been satisfied with autonomous work shift planning. Autonomous work shift planning improved everyone's own time management, as working time autonomy makes it possible to combine working time and leisure time more systematically. Employees have a better chance to participate in planning and developing her/his own work, which affects commitment to the work.

127. TRADE UNION SUPPORTING THE DEVELOPMENT OF HEALTH CARE PROFESSIONALS EXPANDED ROLES AND TASK ALLOCATION IN FINLAND

Presenter: Mervi Flinkman, *The Union of Health and Social Care Professionals, Tehy, Finland*

Author: Mervi Flinkman

Introduction: Many countries globally are looking at new ways to improve efficiency in health care delivery by reviewing the roles and responsibilities of health professionals, including radiographers. Also in Finland, the scope of practice and new advanced roles for health care professionals has been developed since the beginning of the previous decade. Advanced roles and task allocation have been identified as a way to improve access to health care in the situations when there is a limited supply of physicians and other health care professions. Moreover, new ways of arrange work is needed when elderly population is ageing rapidly. Radiographers' level of education has been raised in many countries during the past decades and this has made the development of depth and breadth of radiographic practice possible. Moreover, the patients have accepted and are satisfied with the new expanded roles in the health care delivery. Also in Finland, advanced roles for radiographers have been developed and tasks have been transferred from physicians to radiographers. Example part of ultrasound examinations have now been transferred to radiographers.

Methods: The Union of Health and Social Care Professionals, Tehy,

have participated ways to the development of the task allocation and the progression of the health care professionals expanded roles in Finland.



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

Results: They have produced reports and guidebook concerning scope of practice, expanded roles and task allocation of health care professionals; They have participated negotiations and have done active collaboration with the different ministries when the legislation, regulations, recommendations and new curriculums for health care professionals have been prepared; They has been has negotiated so that currently collective agreements are taking better account new expanded roles and task allocations.

128. EVALUATION OF OBJECT STORAGE IN THE CLINICAL ENVIRONMENT

Presenter: Tomohiro Fujii, *Kure Kyosai Hospital, Japan*
Authors: Tomohiro Fujii

Introduction: Digital data in Healthcare organizations has increased explosively . More data is a digital medical image generated from radiological imaging apparatus .Digital medical imaging has a significant impact on the diagnosis .In order to save this new data , protection , and to maintain , Healthcare organizations , will require larger storage environments . However, IT budgets are limited, it is necessary for cost control. Our hospital introduced Object Storage as storage of the imaging system, as server disk space was insufficient it became necessary to expansion of capacity. Object Storage is storage suitable for storing unstructured data such as images. Even thought the introduction and protection costs, running costs, potential, storage stability data, its advantage is large. This time, I connected the PCAS with the Object Storage, evaluated the performance in clinical practice. Therefore we report examined the usefulness.

Methods: Object Storage uses the HTTP protocol. However, in the communication between object storage and PACS, we send the file by the CFS (Content File Server). And when we view the file of the PACS by the CIFS protocol.

Results: Regarding the file transfer speed, Object Storage was faster than traditional storage many situations. In a small file size, transfer speed slowed down. When file size increases, the transfer rate was fast. The results, the use of Object Storage as storage of PACS are also useful in the future.

129. SIMULATION WALKS AS A TOOL OF FAMILIARIZATION

Presenter: Heidi Korin, *Medical Imaging Centre of Southwest Finland*
Authors: Korin Heidi, RT, MNsc, Clinical specialist, Medical Imaging Centre of Southwest Finland; Seiko-Vänttinen Virva, RT, MNsc, Administrative nurse manager, Medical Imaging Centre of Southwest Finland

Introduction: A new T-hospital opened on 2013 in the Hospital District of Southwest Finland. In the new building relocated also an emergency radiological unit of Medical Imaging Centre of Southwest Finland. This department serves unit of Emergency Medical Services

and also outside office hours other units of the university hospital. Beside this, radiological examinations are performed outside radiological department. The operational environment requires radiographers to be able to perform examinations in rapidly changing situations. Therefore competence and proper familiarization are critical success factors to perform safe and high quality examinations in the changing environment. Moving and launching a new radiological unit implied a challenge since the services needed to operate round the clock. Simulation walks were planned and conducted before the opening of a new radiological unit. The aim of the simulation walks was to support the familiarization of the radiographers for new facilities and operational environment as well as increase their confidence prior to the actual change and move to the new unit.

Methods: Simulation walks consisted of three tasks: acting in imaging room, outside radiological unit and an emergency evacuation of patients. Radiographers performed these tasks in small groups. Afterwards a feedback and evaluation discussion was conducted.

Results: Radiographers were satisfied with simulation walks. Tasks were evaluated well and radiographers felt that tasks supported familiarization. Feedback and evaluation discussion of the simulation allowed recognize factors needing repair or change before the opening of the new radiological unit. In conclusion, simulation walks are suitable for familiarization. The tasks included in simulation walks need to be carefully planned, concrete and demonstrate real-work activities.

130. SUPPORT TO FEMALE RADIOLOGICAL TECHNOLOGISTS WHO KEEP WORKING

Presenter: Kaoru Hashimoto, *Rehabilitation Center, MIDORI Hospital, Japan*
Author: Kaoru Hashimoto

Introduction: According to “The Global Gender Gap Report 2013”, the Gender Gap Index of Japan ranks 105th in 136 countries and hits the lowest level in developed countries. The number of female radiological technologist is increasing in Japan. The portion of female members of JART is 12.7% in 40's, 6.5% in 50's, 33.3% in 20's and 29.2% in 30's. The portion is expected to increase in the future. Patients' need for female technologists is increasing and management's need for female workers is also growing. However both working and learning environment is actually far from sufficient for women. “M-shaped” curve, the slump in the labor force participation rate of women who have and raise children, is still seen in Japan. According to a questionnaire survey, more than 80% of students want to continue working after their marriage and delivery. On the other hand the survey showed that nearly 70% of female technologists in 20's wanted to quit or change their jobs after their delivery. Our national policy thinks women's active participation in society is the key of the economic growth strategy of Japan. Though the portion of women in managerial posts is only 9% now, the policy aims that the portion of women in leadership positions in every field of society will be over 30% by 2020. The measures such as the zero childcare waiting list projects or the



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

return to work program must be taken to realize the goal. JART, the Japan Association of Radiological Technologists should create a friendly working environment for female radiological technologists.

Methods: The Japan Association of Radiological Technologists holds Female radiological technologist summit every year since 2011. The representatives of the 47 prefectures clarify the challenges and discuss the solutions for working women for two days.

Results: In 2011 we reviewed the environment surrounding women and discussed work-life balance. In 2012 we debated networking as a support to women who continue working. And in 2013 we learned the skills of facilitator and planned the workplaces for women in the local communities. Women have to think and act by themselves to improve the working environment for women. The number of women in managerial posts at workplace and executive women in professional associations are expected to be increasing.

131. UTILITY OF 18F-FDG PET-CT IN THE EVALUATION OF INCIPIENT GASTRIC CANCER

Presenter: Daiji Wakebe, *Department of Diagnostic Radiology and PET center, Shonan Atsugi Hospital, Japan*

Authors: T. Mitusi, H. Hayakawa, D. Wakebe, S. Kai et al.

Introduction: Many past reports have investigated the usefulness of 18F-FDG positron emission tomography/ computed tomography (PET/CT) for malignant tumors. By contrast, with the low incidence of gastric cancer in Western countries and the fact that PET/CT testing just became subject to coverage by health insurance in Japan in April 2010 for malignant tumors excluding early gastric cancer, there have been few reports on PET/CT for gastric cancer and its clinical usefulness has yet to be sufficiently established. We therefore retrospectively investigated the clinical usefulness of PET/CT for gastric cancer. Subjects were patients whom incipient gastric cancer diagnosis were established with pathological testing and who underwent treatment with whole-body PET/CT from May 2006 through December 2013. Regions of interest were set in the stomach lesion sites of the images and maximum count standardized uptake value (SUVmax) was calculated. When no abnormal uptake was observed, the SUV of the gastric wall near the lesion was measured and defined as SUVmax.

Methods: The evaluation items were as follows, (1) The relationship between SUVmax and histological type, invasion depth, and tumor burden. (2) Detection rate of distant metastasis with PET/CT. (3) Detection rate of local lymph node metastasis

Results: During the study period, a total of 58 patients were enrolled. Statistically significant correlations were observed between SUVmax and histopathological classification, invasion depth, and tumor burden ($p < 0.005$). Distant metastasis was detectable in all patients but assessment of local lymph node metastasis (sensitivity: 48%, specificity: 100%) and peritoneal metastasis (sensitivity: 14%, specificity: 100%) was insufficient.

Although there are some limitations, 18F-FDG PET-CT appears to be used.

132. ENHANCED PITUITARY MRI SCAN OF THE AMOUNT OF CONTRAST AGENT

Presenter: Liu Guangyue, *Department of radiology, the affiliated Drum Tower hospital of medical college of Nanjing university, Nanjing, 210008, China*

Authors: Liu Guangyue, Chen Xingpei, ChuYang

Introduction: After the clinical symptoms in patients, as in non lactating abnormal lactation, clinicians can ask the patient to image Department of pituitary MRI scan. In the ordinary series after scanning, often should be enhanced scan. Enhanced injection dose contrast agent to enhance the imaging effect is larger, therefore, were studied with injection of contrast agent dose of enhancement, the report is as follows.

Methods: 1、 In 2009 October to 2011 Annual report monthly, using the principles of randomized, 20 patients were divided into two groups, 10 patients per group. A group of injection of contrast agent 7ml, enhanced scan; another group of injection of contrast agent

Results: Injection of contrast agent 7ml group: the enhancement effect is good, the image organization hierarchy, fine structure clear display. Injection of contrast agent 15ml group: the enhancement effect is too strong, image organization level is not clear, fine structure display poor, some of the smaller lesion is easily covered up. Before pituitary scanning, conventional head MRI scan should be performed, to exclude the brain lesions.

133. FAT-SUPPRESSED MOVING-TABLE GADOLINIUM-ENHANCED MRA WITH THE WATER-EXCITED 1-2-1 BINOMIAL PULSE TRAINS FOR THE ABDOMINAL AORTA AND LOWER EXTREMITIES IN PATIENTS WITH ATHEROSCLEROTIC DISEASE

Presenter: Masayuki Kumashiro, *Kurashiki Central Hospital, Department of Radiology*

Authors: Masayuki Kumashiro(1),(2), Noriyoshi Morimoto(1), Hideki Mitsui(1), Atsushi Kawabe(2), Yoshiharu Azuma(2) and Kiyonori Yamaoka(2)

Kurashiki Central Hospital, Department of Radiology(1) Okayama University, Graduate School of Health Science, Course of Health Science, Division of Medical Technology and Science, Department of Radiological Health Science(2)

Introduction: Recently, several approaches to contrast agent-enhanced moving-table MR angiography (MTMRA) have been widely accepted as a technique for the evaluation of the entire aorta and the main arteries in relatively short examination times by using fast gradient echo techniques. The very short TRs used for data acquisition are effective at suppressing background tissues with



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

moderate or long T1 value. However, because fat has a relatively short T1, it can remain bright and obscure small vessels and other enhancing structures of potential interest. One method for addressing this problem is through mask subtraction. However, there must be no change in the patient position between the non-enhanced and dynamic gadolinium-enhanced imaging. This requirement is easily met in the lower extremities, whereas it is more difficult to achieve in the abdomen, because of effects of respiration and peristalsis. Another approach is the use of a fat-saturated technique. Selective suppression pulse is fine established technique for fat in suppression. However, fat-suppressed images were acquired with a pre-pulse for fat-suppression during every repetition time. Therefore, the examination time was too long to permit imaging during a breath hold, which increased motion artifacts significantly. For the technique of the decrease in imaging time, the use of a spectrally selective suppression pulse only near the center of k space (partial fat -suppressed technique) made it possible to greatly reduce the signal from fat while allowing image acquisition within a breath hold.

Methods: Fat suppressed moving table Gd-enhanced MR angiography (FS-MTMRA) was performed at three different stations continuously before and after power injection of gadopentetate dimeglumine with a dual-phase single injection protocol.

Conclusions: The scores of the FS-MTMRA were only showed significantly higher (P 3) to the almost of the vessels except for RA, ATA and PTA in the FS-MTMRA without subtraction technique.

134. PRESS SV AND STEAM SV MRS SEQUENCES FOR LIVER H1 SPECTROSCOPY

Presenter: Carmelo Parisi, *Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT), Via Tricomi n.5, 90127, Palermo, Italy*

Authors: Carmelo Parisi, Armando Pasta, Simona Maggio and Angelo Luca

Introduction: Magnetic resonance spectroscopy (MRS) is an analytic instrumental technique, which permits to evaluate detailed information on the molecular structure of the compound under examination. This in-vivo quantification can be performed measuring the absorption of radio-frequency electromagnetic radiation in the molecules that are subjected to a strong static magnetic field. These radiations cause transitions of nuclear spin in atoms such as H-1 or C-13. First applications of in-vivo MRS were in the field of neuroradiology, particularly with respect to the evaluation of brain tumors. With the advent of new powerful technology, it is possible to extend the potentiality of MRS for the diagnosis of diseases in complex organs such as the liver. Indeed, preoperative imaging diagnosis of hepatic tumors, such as hepatocellular carcinoma (HCC), in cirrhotic liver is still challenging, although imaging techniques have improved during the past two decades with the availability of ultra-high-field magnets for whole-body clinical scanning and the increased signal-to-noise ratios. In this study, we present a novel MRS technique determined by fitting

sequences normally used for neuroradiologic screening. Specifically, the PRESS SV and STEAM SV sequences were adapted to understand the changes of chemical compounds in liver diseases such as HCC, liver metastasis and cholangiocarcinoma. We were able to quantify key metabolites such as the choline that is generally targeted to understand the progress of the liver lesion. MRS quantification of choline on patients with HCC were performed before and after chemoembolization therapy.

Material and methods: We used a magnet-type superconducting 1.5 T GE Healthcare to adapt STEAM SV and PRESS SV sequences (i.e., tuning FID system, processing of spectrum, voxel and bands saturation and respiratory trigger). Metabolites were quantified in 28 patients with chronic liver diseases.

Results: We found that the content of choline (22.4 ± 6.6 ppm) was higher in HCC lesions and that markedly decreased after chemoembolization therapy (15.4 ± 8.6 ppm). Effective treatments reduced the relevant amplitude signal in the area of tumor necrosis.

Conclusion: This study demonstrates the importance of a spectroscopic investigation for the diagnosis of HCC and the monitoring of therapeutic response. Although our technique needs further improvements, the adaption of both PRESS SV and STEAM SV sequences can greatly facilitate the *in-vivo* diagnosis by providing a series of quantitative data of liver lesions, not only based on morphofunctional information.

135. APPLICATION OF IMAGE MODE VALUE IN EVALUATION THE MAGNETIC RESONANCE FAT RATIO OF LIVER

Presenter: Sun Chin-Chin, *Department of Diagnostic Radiology, Chang-Gung Memorial Hospital. Kaohsiung Center, Taiwan*

Author: Chin-chin Sun

Introduction: More and more people suffer from fatty liver disease in the world even without hepatitis infections or alcoholic intake and undergo various methods of fatty liver therapy (1). In the early stage of hepatic pathology, the degree of liver steatosis is a method to evaluate the liver function (2). Many methods are able to evaluate fatty liver including liver biopsy, ultrasound, computed tomography and Magnetic Resonance (MR) modality. But the only noninvasive way to separate the fat and water signal is MR modality, which includes spectroscopy and imaging methods (3-7). Advanced application of fat quantification can be used in pancreatic focal or infiltration lipomas (8). In this paper, we propose to carry out an MR fat ratio reconstruction on ImageJ (National Institutes of Health, Bethesda, MD), a public image processing and analysis program in Java™ (13). Post processing fat quantification images with ImageJ and mode value of patient's whole liver. The ImageJ program was used to analyze the MR output images.

Methods: Dixon and IDEAL methods were applied in the study. In the Dixon method 1.5T magnetic resonance modality got two images in one TR (Repetition Time) with inphase and outphase images. The inphase imaging parameter is TR=142ms TE=4.6ms Flip=65 and the outphase parameter is TR=142ms TE=2.3ms Flip=65



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

, with a slice thickness of 5 mm and spacing of 1 mm and 30 slices were achieved with scan time of 22 seconds in a single holding of breath. In the IDEAL method, 1.5T GE Discovery 450 magnetic resonance modality got four images of inphase, outphase, water, fat images in one scan with three echo times. The IDEAL parameter is TR=6.2ms, TE=2.1, 4.2, 3.1ms, LAVA (Liver Acquisition with Volume Acquisition) pulse sequence. Slice thickness of 5 mm and spacing of 1 mm and 30 slices were archived with a scan time of 27 seconds in a single holding of breath. Finally we display the case of a volunteer who undergoes fatty liver treatment and displays the mode value of fat ratio image to verify the fat ratio change before and after the treatment.

Results: Before fatty liver therapy, the mode value of the liver fat ratio is over 5%. After 3 months of fatty liver therapy, the mode value of the fat ratio decreased to under 5%. The patient with alanine transaminase levels of twice of standard concentration (>80U/L) decreased to standard concentration (<40U/L). According to the mode value of the whole liver, we can objectively analyze the fat ratio in two dimensional images. Compare with liver biopsy or standard single and multiple points in evaluation liver fat ratio, this method was noninvasive and objective analysis the whole liver.

136. MRI OF CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD) WITHOUT SEDATION

Presenter: Turid Randa, *Department of Radiology, Haukeland University Hospital, Bergen, Norway*

Authors: Turid Randa, Department of Radiology, Haukeland University Hospital, Bergen, Norway, -Eva Øksnes, Department of Radiology, Haukeland University Hospital, Bergen, Norway -Maiken Kirkegaard Brix, Department of Radiology, Haukeland University Hospital, Bergen, Norway

Introduction: Autism Spectrum Disorder (ASD) is a developmental disorder characterized by affected communication, lack of social interaction and stereotypic behaviour. In the Autism Study we use a multimodal imaging approach in order to get a better characterization of the disease. In the period from December 2011 to January 2014, boys aged 7-13 years diagnosed with ASD and a typically developing (TD) age matched control group were recruited. Both groups underwent a MR-scan that lasted about 30-40 minutes and included a T1 SPGR volume scan, functional MRI (fMRI) and MR Spectroscopy (MRS). The children had the possibility to watch a movie in the MR scanner while scanning the 3DT1 and Spectroscopy. It is crucial for the data quality that the children lay still whilst in the scanner. This can be challenging for any child, but especially for the children with ASD because they are not fond of changes in their everyday routine and they are often sensitive to noise. In clinical settings, sedation is a common solution to achieve a diagnostic MRI scan in children with behavioral problems. In scientific studies, including functional MRI and spectroscopy, this is not an option. The child has to be awake in order to perform the fMRI task; secondly the anesthesia may influence the MRS. Last but not least the ethic committee would probably not allow a study that intends to sedate healthy children. The radiographers' role in projects involving children is crucial. In the Autism study we focused especially on the radiographers meeting with the children.

Methods: We used the same radiographer to inform the child and parents. To create enthusiasm in completing the fMRI we used standardized training for the fMRI task. The possibility to watch a movie in the MR scanner was a key to success.

Results: When performing MRI without sedation in ASD children, one should expect incomplete scanning in quite a large proportion. The number of successful scans was 15 (71%) in the ASD group and 25 (86%) in the TD group. The Autism study has given us the opportunity to develop specific strategies in how to best work with this patient group. Experience from this study can be transferred to children with other diagnoses, and increase the number of successful MRI studies done on children without sedation.

137. THE DIAGNOSTIC ACCURACY OF ULTRASOUND IN DETECTING PAEDIATRIC LONG BONE FRACTURES: A SYSTEMATIC REVIEW

Presenter: Harry Hopkinson, *Teesside University, UK*
Author: Mr Harry George Hopkinson

Introduction: Paediatric fractures are a common occurrence; one third of children sustain fractures before the age of 17 with the clavicle and forearm being the most common fracture sites. The developing paediatric skeleton is more porous and pliable and injuries result in fractures unique to children such as torus and physeal fractures. The current diagnostic pathway involves clinical examination followed by radiographic referrals. However, it has been found that out of all recurrent misdiagnoses recorded in paediatric patients, nearly half were buckle or physeal fractures despite them representing 1.8% of the yearly caseload. Misdiagnosis can delay fracture treatment and lead to long-term consequences. Ionising radiation exposure from radiography carries a carcinogenic risk; children are more radiosensitive than adults and the multiple examinations required during treatment and follow-up for fracture patients increases their cumulative dose. Ultrasound has not traditionally been regarded as a modality to assess bone, however it is now seen that the reflection of the sound wave demarcates the hyperechoic cortical bone and any step or interruption indicative of a fracture is easily visible. Children's bones are well suited to be imaged using ultrasound; their cartilaginous physes are readily distinguishable from soft tissue which is not possible using radiography. Therefore, ultrasound has been suggested as a viable alternative. The aim of this systematic review is to answer the research question, "how does the diagnostic accuracy of ultrasound to detect paediatric long-bone fractures compare to a reference standard of patients' clinical outcomes or plain-film radiography?"

Methods: Studies were found using electronic databases and grey literature. Titles, abstracts then full-texts were screened before QUADAS-2 methodological assessment and data extraction. Accuracy data was pooled and secondary outcomes were investigated.

Results: From 125 studies, eight comparing ultrasound to radiography were selected. Sensitivities of ultrasound ranged from



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

75.3%-97%, specificity 73-100%. Results of 175 patients found ultrasound significantly less painful. Evaluating all relevant literature found ultrasound to be a viable alternative in diagnosing paediatric long-bone fractures. Further research is encouraged to compare ultrasound and radiography to clinical outcomes to highlight cases where ultrasound may have greater accuracy.

138. RADIOGRAPHIC EVALUATION OF THE VISIBILITY OF PICC LINE TIP IN NEONATES: A SELF-ASSESSMENT MODULE

Presenter: Ekaterina Saukko, *The Medical Imaging Centre of Southwest Finland, The Hospital District of Southwest Finland*
Authors: Saukko E. (MHS), Järvinen J. (Lic. Phil.), Hälli T. (MSc), Svedström E. (MD, PhD) All authors are from same the institution.

Introduction: Peripherally inserted central catheters (PICC) have become a well-established means of safe central venous access in infants and children. In neonates main indications for PICC line include many types of medication, parenteral nutrition, blood product administration and blood sampling. PICC lines are typically inserted for durations ranging from a few days to several months. They are usually inserted in the upper extremity via a peripheral arm vein. In Finland, a PICC line placement is generally performed at the bedside by neonatologist. A PICC line insertion should be followed by immediate chest radiography to confirm appropriate position of the catheter. To enable proper visibility of the catheter, contrast medium (CM) is infused in it. Radiographic confirmation of the PICC line placement is essential, because it is not possible to verify the position of the catheter tip clinically. The most critical risks involved in the use of PICC lines are related to the location of the tip. Exact measurements are required, because inappropriate location and vessel perforation can be lethal. The project was an object of the self-assessment module and was carried out in collaboration with specialists in different areas. In our work, we concentrated on investigating how the variation of imaging parameters such as kVp and mAs, affect the visualization of the catheter tip on the radiograph. The visualization was assessed by measuring the contrast-to-noise ratio (CNR) with and without CM. Our hypothesis was that the current kVp levels higher than 90 were related to poor visualization. We assumed that mAs levels would have to rise, if we decrease kVp.

Methods: Two catheters were imaged between two PMMA phantoms with CM in the other using mobile x-ray device. Parameters kVp and mAs were varied. Dose was checked using thermo luminance dosimeters. CNR was evaluated in the tip and in the middle of catheters.

Results: CNR evaluations supported our hypothesis and the visibility of the catheter tip with CM improved well with tube voltage from 66 to 79 kVp. The mAs measurements carried out with 75 kVp, indicated a decline in CNR as the noise increased with mAs levels below 1.4. New parameters reduced dose by 26 % and visibility of CM increased by 23 %. The skin dose measurements confirmed the relatively low dose of the study. Nonetheless, the multiple studies of neonates increase their lifetime risk of cancer.

139. ESTABLISHMENT OF THE OPTIMAL ANGLE OF WATERS' VIEW IN CHILDREN, USING CRANIOFACIAL 3D CT

Presenter: Seongmi So, *Seoul National University Children's Hospital in Seoul, South Korea*
Authors: Eunyeong Choi, Gwangsu Jeong, Tachan Jeong

Introduction: Waters' view (occipitomeatal view) is one of the common radiologic studies, which is usually performed for the diagnosis of inflammatory or traumatic lesions involving paranasal sinuses. Waters' view is still frequently performed in children, because its radiation dose is lower than that of CT, and the diagnostic accuracy for acute sinusitis on Waters view is acceptable. However, this study should be performed adequately in order to maintain diagnostic image quality, because there are many overlapping skeletal structures along the course of the X-rays. To avoid overlapping of the skeletal structures and obtain the image of good quality, the optimal projection angle of the X-ray should be known. The optimal angle of Waters' view (the angle between OML (orbitomeatal line and detector) has been reported to be 37° in adults, according to the report by Mahoney, et al. However, the optimal angle in children has not been reported yet. Therefore, in this study, we evaluated the optimal angle of Waters' view in children by using 3D craniofacial CT.

Methods: From January 2008 to December 2012, a total of 1192 patients who underwent craniofacial CT in Seoul National University Children's Hospital was collected by reviewing PACS system. Among them, 188 patients with any known craniofacial abnormalities

Results: The optimal Waters' angle gradually decreased as age increased, because the reference points were changed as the maxillary sinuses grew. The maximum Waters' angle was 61.2° at 01 months of age and the minimum angle was 30.2° at 237 months of age. Pearson's coefficient correlation value was -0.911 ($p < 0.011$), which means good negative correlation of the Waters' angle with age.

140. HOW TO ENHANCE STATUS AND QUALITY OF CHEST X-RAYS

Presenter: Christina Carøe Ejlskov Pedersen, Aarhus Universitetshospital, Billeddiagnostisk afdeling, Denmark
Authors: Christina C. E. Pedersen, Pia E. L. Skoulund, Anne Dorte Blankholm

Introduction: Chest x-rays (CXR) is the most common x-ray examination. However, this examination has a low status among radiographers resulting in decreased image quality. The change from Film Screen (FS) to Digital Radiography (DR) has changed the communication between radiologists and radiographers as the two staff groups do not see the images in the same quality. At the same time the "here and now" feed-back is also gone. We conducted an audit on CXR to enhance and maintain the image quality and to improve the status in CXR procedures. We used the European



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

Guidelines (EG) (1) to set up the criterias for taking CXR. Some of the criteria were: good inspiration; the whole lung field in the picture; symmetrical positioning; no foreign objects and collimation (up/down and sideways <4cm). The results showed good inspiration on 80% (LAT) and 72% (PA); covered the entire lung field 68% (LAT) 88% (PA); 70% were symmetrically positioned; there were no foreign objects on 86% (LAT) and 96% (PA); collimation PA up/down 48% sideways 80%, LAT up/down 72% sideways 48%. An action plan was made on selected areas for improvement, collimation was chosen as the focus, and a status on the focus area was planed after six months. Results were presented to department staff at meetings and on a board in the x-ray room.

Methods: The audit was created on CXR in two projections PA/LAT and performed once a year. We created a schedule with 26 accepted criteria for a good quality CXR according to the EG(1). Data were collected retrospectively from 50 CXR over a period of 14 days.

Conclusions/Results: Performing audits on a regular basis are important. Recurrent audits highlight the need for periodical intervention through focus areas to enhance and maintain the image quality. Regular audits and focused interventions enhanced and maintained CXR quality. This shows quality development and assurance is an important tool.

141. RADIOGRAPHERS' RIGHTS IN CLINICAL PRACTICE

Presenter: Kati Matilainen, *University of Eastern Finland, Faculty of Health Sciences*

Authors: Kati Matilainen, S-M Ahonen, P Kankkunen , M Kangasniemi

Introduction: An X-ray examination must be performed in a manner which minimizes the radiation exposure of the examinee. This is radiographers' well-known duty as a responsible radiation operator. As there is no duties without rights, the other side of this entity needs to be clarified. The aim of this study was to describe radiographers' perceptions and experiences of their rights in diagnostic radiography (excluding isotope examinations) from the radiation safety perspective. The purpose of the study is to increase conceptual knowledge on the rights of the radiographers' in radiation safety procedures, and thus to make them visible in radiation practice.

Methods: A qualitative method was used; the data consists five thematic group interviews and was collected from two radiological units in finnish urban area. Inductive content analysis was applied.

Results: Radiographers' perceptions of their professional rights in the context of diagnostic radiography branch in two different kind of themes. The rights were related i) practice as an expert in diagnostic radiography, and ii) to the rights for well-being supportive conditions at their work. The rights of radiographers' are fulfilled in variance.

142. THE BENEFITS OF CLINICAL AUDITS

Presenter: Mirja Hirvonen-Kari, *HUS Medical Imaging Center, Helsinki University Central Hospital, Finland*

Author: Mirja Hirvonen-Kari

Introduction: The concept of clinical auditing is introduced in the European Commission Council directive 97/43/EURATOM, and European Union member states should carry out clinical auditing in accordance to national procedures. Clinical audit is a systematic and independent review of medical radiological procedures, carried out assures the quality of radiology. Clinical audit should address both the critical issues of the radiation protection for the patient, and all aspects of radiological services covering structure, process, and outcome (Table 1). It should be a systematic and continuing activity with multidisciplinary involvement. (ESR 2011b, Patel 2010a and 2010b, Järvinen 2009). Clinical audits should be arranged to expediently complement the self-assessment of activities. Finland is a pioneer country in implementing clinical audit into practice. Nearly all departments utilizing diagnostic radiation underwent their first audit period before the end of 2005. The second clinical auditing period began 2006 in Finland. Auditing is a laborious, time-consuming, and expensive process for radiology departments. Auditing effects on radiological processes should therefore be evaluated to determine whether a positive outcome has been gained.

Methods: The results were analyzed using frequencies, crossover tables and the Pearson Chi-Square, and the audit report recommendations underwent deductive content analysis.

Results: The audits were generally performed by a radiologist and a radiographer. During the firsts clinical audit period, ten audit categories and during the second period 35 categories (n=42) were in good condition in all departments. The audit reports contained 80 improvement recommendations concerning the first audit period, and 53 recommendations concerning the second audit run. Approximately six recommendations per departments (range 4-12) were given to the X-ray departments in the first period.

143. THE PURPOSE OF THIS WORK WAS TO STUDY HOW RELIABLY RECOMMENDED QA PARAMETERS COULD BE REPRODUCED BY SEVERAL SONOGRAPHERS IN REALISTIC SETTINGS

Presenter: Mervi Jauhiainen, *HUS Medical Imaging Centre, Finland*

Authors: M. Jauhiainen, P. Blomqvist, T. Kilpeläinen, P. Malaska, T. Vinnurva-Jussila

Methods: Six sonographers measured six high end US scanners with altogether 20 transducers located in three different radiological units. Every sonographer measured five scanners once and one scanner twice with a CIRS model 040 general purpose phantom



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

using one frequency per probe. The values for the basic settings of the scanners were fixed and the more sophisticated features, e.g. spatial/frequency compounding, were switched off. The QA parameters studied were homogeneity, visualization depth, vertical and horizontal distance measurements, axial and lateral resolution and the correct visibility of anechoic and high contrast masses. The evaluation of the homogeneity and the masses was visual. For the other QA parameters, the inter- and intra-observer coefficients of variation (CoV) were calculated for each transducer. To obtain one estimate for every QA parameter, the mean inter- and intra-observer CoVs were calculated including all the transducers.

Results: The mean inter-observer CoVs were as following: visualization depth $11 \pm 4\%$, vertical distance $1,7 \pm 0,4\%$, horizontal distance $1,4 \pm 0,6\%$, axial resolution $22 \pm 7\%$ and lateral resolution $16 \pm 8\%$. The mean intra-observer values were about half of these values with similar standard deviations. **CONCLUSION:** The inter-observer variability in measuring phantom based QA parameters in a realistic environment can be relatively high. This should be noticed when planning and teaching a phantom based QA protocol and evaluating the results.

144. OPTIMISING NEONATAL X-RAY QUALITY: RESULTS OF AN AUDIT

Presenter: Nick Woznitza, *Homerton University Hospital, UK*
Authors: N Woznitza, N Hayes, N Malisheva, D McGuinness

Introduction: Babies who require specialist neonatal care present diagnostic and therapeutic dilemmas to the treating clinicians. X-ray imaging is a tool frequently used to assist clinical management however the effects of ionizing radiation on this vulnerable population are well documented. Quality assurance programs are an established method to maximise diagnostic quality while keeping radiation exposure to a minimum. Robust, defined film quality standards enable objective measurement of image quality. Any system of film quality assessment must be reliable, with high inter-observer agreement to facilitate consistent quality assurance across the department. The aim of this study was to examine the film quality of x-rays produced at a tertiary referral neonatal unit in the United Kingdom and to establish inter- and intra-observer variation when applying a film quality checklist.

Methods: 174 x-rays were randomly selected from a large, tertiary neonatal service. Two radiographers, after bespoke training, independently rated each x-ray for quality using pre-defined criteria. Observer agreement was determined using Kappa (K) statistic.

Results: 100(59%) x-rays were rated high quality (score \geq 27) by both observers. Correct use of lead protection produced most discrepancies between observers was the most common cause of reduced image quality. Observer agreement was variable (K= 0.08-0.87, all $p < 0.05$). Identification of common error patterns assists departments in maintaining high diagnostic standards and minimize radiation exposure. Targeted training allows radiographers to accurately assess image quality with a high degree of reliability.

145. RADIOGRAPHERS' PERCEPTION OF IMAGE QUALITY AND THEIR COMPETENCE WITH DIGITAL X-RAYS

Presenter: Astrid Berntsen, *Gjøvik University College, Norway*
Author: Astrid Berntsen

Introduction: Digital imaging technology was implemented in Norwegian radiology departments from around year 2000 and onward. This significantly changed radiographers' workflow, their tasks and responsibilities, as well as their conceptions of image quality. Digital X-ray changed the way radiographers handled images, since they can alter the image quality in a number of ways, which were previously impossible. As a result, the radiographers have become more autonomous in assessing and handling image quality. However, the question is, how do radiographers determine the image quality in a digital world and do they have sufficient knowledge to be confident in their assessments? The quality of digital images depends on several factors, and the radiographers are struggling to find common guidelines for assessing digital image quality. The purpose of the study was (a) to scrutinize radiographers' perception of image quality and (b) their competence with digital X-rays, as well as (c) to investigate what can be done to improve radiographers' confidence in their assessment and handling of imaging quality.

Methods: Qualitative interviews with 10 radiographers with content analysis.

Results: a..Radiographers reported that their conceptions of image quality had changed with digital imaging and that it had become more subjective. They now use their own experience much more to assess the quality. b..Radiographers report that they felt they lack competence on digital imaging. They miss knowledge, feedback, discussion and cooperation with the radiologists. c..More systematic work of image quality in the radiological department, more regular feedback from the radiologists.

146. STATISTICAL ANALYSIS : CT COLONOGRAPHY AND BARIUM ENEMA

Presenter: Siew Teng Boon, *Singapore General Hospital Department of Radiology*

Authors: Lead Author: Miss Siew Teng Boon, Bachelor in Medical Radiation Technology; Co-Author: Mr Jia Jun Ng, Bachelor in Medical Radiation Science; Co-Author: Dr Narayan Lath MBBS, FRCR

Introduction: Colorectal cancer is the number one cancer in nation, with a rapid increase in incidence of colorectal cancer over the last decade. Interval colonic screening is the mainstay for early detection. Currently, colonoscopy is considered the best available test for this purpose, accounting for majority (up to 90%) of colonic screening tests. Barium Enema (BE) and CT Colonography (CTC) are other accepted alternate methods of colonic screening, accounting for the rest. This study focused on the number of CTC and BE cases



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

performed in our institute and their temporal trend over past 3 years.

Methods: The number of CTC, BE and colonoscopy cases were tabulated from 2011 to 2013. Data collected was analyzed.

Results: CTC and BE, contributed 8.6%-10.9% of the total number of screenings. The statistics showed declining BE numbers. CTC numbers are increasing, but not completely accounting for decrease in BE cases, some of which appear to be replaced by colonoscopy. While colonoscopy remained the mainstay test for colonic screening, CTC has taken over BE as the alternate screening procedure. In future, CTC may become the only alternative to colonoscopy. However at present, BE still has a role to play.

147. CHECKLIST FOR IDENTIFICATION OF THE PATIENT IN RADIOLOGICAL EXAMINATION

Presenter: Merja Paasio, *Medical Imaging Centre of Southwest Finland*

Authors: Merja Paasio, RT, Head radiographer, Medical Imaging Centre of Southwest Finland; Heidi Korin, RT, MNSc, Clinical specialist, Medical Imaging Centre of Southwest Finland

Introduction: The highest value in hospital is the patient. The patient has right to get right care on a right time. The safety of the patient is the basis of the quality of the healthcare. Safe care should be accomplished by a best way possible, using the best existing resources. The most effective methods need to be used to avoid causing any harm to the patient. Risk of an error exists, although the employees are highly skilled. Turku University hospital has used an incident reporting system since 2009. It is meant to be an instrument to decrease treatment injuries and improve patient safety. Reporting is based on voluntary, anonymous announcements without any accusations. The reports are observed by the administration and the problem will be attacked if possible. One of the opportunities to fail in the radiological examination is related to the identification of the patient. To decrease mistakes in the identification and to unify the behaviour of the radiographers in spite of the disturbances, a checklist for patient identification was developed in Medical Imaging Centre of Southwest Finland. The aim of the checklist is to confirm that teams regularly carry out the critical safety manners to minimize the most common faults that could be avoided. The Checklists have been used for instance in surgical operations for a long time, but they are just making they way to the radiological departments. However, there is evidence supporting that the checklists are a cheap, easy and effective way to improve patient safety.

Methods: A checklist was developed by radiographers in one of the radiological departments. Critical factors related to the identification of the patient and radiological examination in different modalities were identified and gathered into a checklist.

Results: Checklist is divided into three sections: before, during and after the radiological examination. It contains different functions to follow during the examination. It aims to unify identification and to create the culture that appreciates patient's safety. The checklist is modifiable to serve the different units at the best means. Hence, it is easy to use and improves patient's safety during the radiological examinations. Implementation of the checklist requires leadership and careful planning.

148. IMAGE QUALITY AND OPTIMIZATION DOSE FOR CHEST EXAMINATION IN COMPUTED RADIOGRAPHY AND DIGITAL RADIOGRAPHY

Presenter: Puntharika Buasang, *Department of Radiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, THAILAND*

Authors: Puntharika Buasang, B.Sc.(RT) , Pharadorn Chumpia, B.Sc.(RT) , Trongtum Tongdee, M.D.

Introduction: In rapidly developing medical imaging technology, digital radiography (DR) has replaced screen-film radiology – computed radiography (CR). DR produces faster processing, comfortable workflow, greater transfer and storage image data. However, it comes with a larger price tag. With the many advantages, it is therefore important to consider the relative dose of CR and DR for optimal quality image and reasonable radiation dose. The purpose of this study is to study chest examination optimal exposure for acceptable images in CR and DR while maintaining a low dose of radiation. The study measured surface air kerma dose in laboratory x-ray procedures when using a chest phantom with CR and DR in twenty-five different exposures. All images were scored by radiologists and evaluated based on quality of images. This eventually led to the comparison of imaging quality and radiation dose for optimization of chest x-ray techniques. The optimal protocol will be used for patient undergoing chest x-ray at Siriraj Hospital.

Methods: The phantom PBU-60 chest x-ray (20 cm. thickness) in PA upright position was studied with twenty-five exposures using varied kVp and mAs , CR (Fuji, Velocity U) and DR (Philips, the Digital Diagnost system)

Results: Image scoring in DR are higher than CR in every exposures. Although the DR dose is higher, it can give higher image resolution than CR in a low exposure range. The study shows that the optimal protocol for chest radiograph in CR is 85 kVp and 4 mAs and those DR is 70 kVp and 2 mAs. Radiation dose from our protocol is 0.053, 0.015 mGy in CR and DR, respectively; both are lower than IAEA DRL for chest PA of 0.4 mGy.

149. CHEST X-RAY SELF-ASSESSMENT, A PILOT STUDY

Presenter: Maria Tolonen, *Department of Diagnostic Radiology, Oulu University Hospital, Finland*



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

Authors: Tolonen M. radiographer. Hakso-Terävä A. radiographer. Takalo R. MD. Department of Diagnostic Radiology, Oulu University Hospital, Finland

Introduction: The purpose of self-evaluation is to examine one's own knowledge and activities and to determine if the objectives drawn for operating are met. A chest x-ray is a basic examination that is used in determining different symptoms and diseases. It is the most common radiological examination and it accounts for about half of all radiological examinations. A chest x-ray is easy to get, cheap and its radiation dose is low. Actual imaging is easy to take, although there are many things that should be taken into account. It's easier helps to make the right diagnosis if the image has been taken according to criteria for a good radiographic image. Even if the criteria are not realized, the image may be sufficient, depending on the indications. The purpose of this self-evaluation is to improve the quality of chest x-rays and also to help radiographers evaluate the success of images and reduce the need to retake images. A wide range of patients in different conditions visit our unit; the majority of them are older, which poses challenges. The goal is that we could take sufficiently good chest x-ray images regardless of the patient's condition. Our unit has two imaging units that are very different to use.

Methods: Seven chest x-ray images, of standing adults were selected for evaluation. We made pre-information forms and 72 % of our department staff answered them. We compiled a summary of the evaluations, the results of which we presented to the staff.

Results: The evaluations showed that radiographers are able to assess chest x-ray images according to criteria. One question in the evaluation was to consider whether you would retake that particular image. The responses were greatly dispersed and especially assessment of lateral was more difficult. Many paid more attention to image framing. The self-assessment project started from the fact that managers often considered whether or not an image should be retaken.

150. INFLUENCE OF INDOOR AIR QUALITY ON SICK BUILDING SYNDROME RELATED SYMPTOMS AMONG RADIOLOGICAL TECHNOLOGISTS

Presenter: Yan-Chi Chang, *Taichung Veteran General Hospital, Taiwan*

Authors: Yan-Chi Chang, Chia-Yu Keng

Introduction: Indoor air quality is a significant issue since people spend at least 80% of time indoors. Indoor air pollution exposure can lead to health problems such as irritation to the eyes, nose and throat, headaches, nausea, and allergic reactions. The term "sick building syndrome" comprises various non-specific symptoms such as eye, skin, and upper airway irritation, headache, and fatigue. Factors associated with the perceived indoor air quality are not fully understood, but they include temperature, humidity, odors, particulate matter, bioaerosol and volatile organic compound

contamination. There were many studies evaluating indoor air quality and SBS, however, most of the research on SBS has been performed in office workers. Only a few investigators examined health effects of indoor air quality in hospitals where the health of medical workers may be affected. As many aspects of the working conditions, and indoor environments, may differ between hospitals and offices, it is not clear whether knowledge gathered from the large office studies are valid also in the hospital environment. It is especially important for people working in an environment in which air ventilation may be restricted, such as radiological technologist. No data was available about indoor air quality and illnesses associated with radiology technologist in hospital. We therefore conducted indoor field measurements and a questionnaire-based study of health effects of indoor air in a medical center in Taiwan. The aim of this study is to investigate the association between the prevalence of work-related symptoms and the indoor air quality of working environments for radiology technologist in hospitals.

Methods: Study population was obtained from medical workers in Taiwan. We distributed the questionnaires to the participants. In this study, air samples will be collected by diffusive air samplers, at approximately 1.5 m above the floor for 24 h on weekdays.

Results: In conclusion, our results suggest that a large proportion of radiological technologists may have symptoms compatible with the sick building syndrome. We showed significant relations between symptoms and exposures. Our study in hospitals supports earlier findings found in office workers. And closed working space does seem to entail exposures with adverse health effects that cannot be compensated for by a higher ventilation flow.

151. IMPROVEMENT ACTIVITIES OF EXPOSURE MANAGEMENT SERVICE THAT IS BASED ON USE OF PDMS (PERSONAL DOSE MEASURING SYSTEM) AND RADIATION-RELATED MANUAL

Presenter: Yeonhee Kim, *Seoul National University Hospital Healthcare System Gangnam Center, Seoul, Republic Of Korea*

Authors: Jaeyeong Cho, Yoonjoo Lee, Yeonhee Kim, Seonmin Kim, Mihyang Eun, Hyeongchul Kim

Introduction: Anxiety associated with radiation leak that occurred in Japan Earthquake that occurred in March 2011 has spread worldwide. Also, the interest of people about radiation dose that can affect the human body increased. And people began to recognize the importance of the exposure dose control in the medical field. Anxiety of people who receive radiation inspection requests accurate information and management differentiated service. But if the appropriate service is not performed in correctly, it has caused clients' complaints and decreased staff's work-efficiency. So, we have built a system to make it available to relevant departments where the expertise is lacking. This study is designed to increase internal and external customer's satisfaction through a radiation-related manual and PDMS(Personal Dose Measuring System).



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

Methods: The survey was conducted about the radiation-related problems and knowledge levels to target the 75 employees of the other department with the exception of the radiology department, between 22 to 24 april 2013.

Results: 1)By managing the individual exposure dose and describing in using simple and systematic terms to radiation, has improved external customers anxiety of exposure-related. in addition, trust of customers also increased. 2)After building a manual and individual exposure dose management system, the post-hoc surveys of internal customers - the 80.4% of the survey respondents answered that it was helped to work. understanding of the theory of radiation was 89.1%, Satisfaction was high.

152. IN A UNIVERSITY HOSPITAL HEALTH PROFESSIONALS WORKING WITH IONIZING RADIATION SOURCES IN THE EVALUATION OF OCCUPATIONAL HEALTH AND SAFETY SITUATION

Presenter: Sayhan Erdem, *Gazi University - Turkey*

Authors: Seyhan Erdem, Assoc.Prof.Dr. M. Necmi İlhan

Introduction: Radiation can cause harmful effects on human health has been known for a long time . These effects of radiation burns , radiation sickness , natural life shortening , cancer and genetic disorders. Prevention of radiation damage « pre- recruitment " and " periodic control » examination is of great importance . Recruitment of pre- examination against radiation abnormally sensitive recruitment of persons in preventing , periodic check-ups , the maximum permissible doses exceeded determine whether aid as otherwise remain hidden potential internal contamination incidents reveal . Radiation hazards and to prevent damage should be kept in mind another point , radiation workers, may be exposed to during a mission to educate people about the dangers of radiation , and has warned them to be exposed to unnecessary danger .

Methods: In this work we do in a university hospital health professionals working with ionizing radiation sources in the evaluation of occupational health and safety situation is intended.

Results: Quality of health services provided to the community health workers' working and living conditions in which are closely related. Professional health care workers who work with radiation through the radiation risk is faced with teleportation. The health effects of ionizing radiation, health care workers can be identified primarily within the regular health checks are necessary.

153. A PRELIMINARY STUDY OF BACTERIAL CULTURES OBTAINED

Presenter: James Temme, *University of Nebraska Medical Center, U.S.A*

Authors: James B. Temme; K. Honeycutt; S. Vas

Introduction: The responsibility of all healthcare team members is to decrease nosocomial infections as a part of delivering quality patient care. Prior research has demonstrated equipment utilized by multiple patients as being a reservoir for potential pathogens which can lead to healthcare-related infections. The potential of Magnetic Resonance Imaging (MRI) equipment in harboring microorganisms is currently not documented in the literature. The purpose of this study is to determine if MRI equipment harbors potential pathogens that can potentially lead to nosocomial infections. Surface surveillance bacterial cultures were taken from four MRI units at a Midwestern Academic Medical Centers in the United States. The quantity and type of microorganisms recovered from the four MRI surfaces will be reported, including the potential of these MRI surfaces to serve as a fomite for health-associated infections.

Methods: Four MRI unit surveillance cultures were collected after all patient work was completed for the day. The MRI unit's bore, coil, table and control panel was cultured using a commercial swab collection and transport system.

Conclusions: The results of this preliminary study indicate the MRI units cultured did not harbor microorganisms that are reported as common etiologic agents of healthcare-related infections. The cultured bacterial and fungal organisms were considered normal skin flora or environmental contaminants that patients routinely encounter. Standard disinfection protocols performed on the MRI equipment preliminarily appear to inhibit the colonization of healthcare-related disease causing microorganisms.

154. NUTRITIONAL AND LIFE STYLE DETERMINANTS OF RADIATION-INDUCED OXIDATIVE STRESS IN OCCUPATIONALLY EXPOSED WORKERS

Presenter: James Temme, *Division of Radiation Science Technology Education, School of Allied Health Professions, University of Nebraska Medical Center, Omaha, Nebraska, USA*

Authors: Iman M. Ahmad, PhD; James B. Temme, MPA, R.T.(R)(QM)

Abstract: Oxidative stress results when the balance between the productions of reactive oxygen species (ROS) exceeds the antioxidant capability of the target cell. It has been shown that ionizing radiation (IR) produces ROS in living systems that leads to an oxidative damage to cellular proteins, lipids, and DNA. Cells have several cellular enzymatic and non-enzymatic antioxidants that detoxify ROS and protect the cell from oxidative damage. Medical x-ray workers are occupationally exposed to low level IR, which may lead to oxidative stress and affect their antioxidant status. In this exhibit a review of the effect of changing life style, such as cigarette smoke and dietary manipulations on radiation-induced oxidative stress on x-ray workers has been discussed. Three research articles were selected for review. A study by Klucinski et al., 2008 showed that a significant decrease of antioxidants GPx, SOD and CAT activity in x-ray groups as compared to controls was observed. A second study by Kayan, et al., 2009 showed significant increases in blood LP levels in the smoker and nonsmoker x-ray group when compared to age-matched controls, emphasizing the role of oxidative damage in the pathogenesis of ionizing radiation and smoke in blood. In the



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

third study, Zeraatpishe et al., 2011 showed that oral administration of lemon balm infusion in x-ray groups resulted in a significant improvement in antioxidant enzymes level and marked reduction in LP. The results of the review in this exhibit can be used to address a major awareness for improving occupational radiation protection.

155. DETECTABILITY OF MICROCALCIFICATION IN DIGITAL MAMMOGRAPHY SYSTEMS: EFFECT OF LOCATION AND DEPTH

Presenter: Ajit Brindhaban, *Kuwait University*
Authors: A Brindhaban, Shareif H, Failakawi D

Introduction: Digital Mammography (DM) systems are used for the early detection of breast cancer through imaging characteristic tumor masses (TM) and/or micro-calcifications (MC). It is known to detect subtle changes in breast tissue well before the patient or physician can detect them through physical examination. Screening mammograms are strongly recommended for women above the age of 40 years. Several different DM systems are commercially available and are widely used in screening. The spatial resolution or ability to detect small MC is not uniform among these systems. The smallest MC detectable by DM systems is restricted by the system design and thickness of tissue being imaged. However, the location of MC within the field of view and the depth at which it is situated may present additional difficulties. The Computerized Imaging Reference Systems INC. (CIRS), Virginia, USA, has developed a Full Field Digital Phantom (Model 085) for the purpose of testing resolution of DM systems. The phantom contains L-shaped line-pair targets of 4, 8 and 12 line-pairs per mm (lp/mm) distributed over a 24 cm x 18 cm field of view (FoV) in side 1 cm thick tissue equivalent material. The objective of this study was to evaluate the spatial resolution of DM images, using the CIRS Model 085 phantom, in perspective of depth and location of MC within breast tissue.

Methods: Images of the CIRS, placed at different depths within material equivalent to 5 cm thickness of compressed breast tissue, were obtained using two different DM systems. The exposure factors were kept constant for all images on both DM systems. Regions of interest (ROI) were created around the line-pair targets at the center and 4 corners of the FoV. The mean and the standard deviation (SD) of pixel values within each ROI recorded. The SD values were used as a measure of spatial resolution and statistical analysis was carried out using 1-way ANOVA at $p < 0.05$ level.

Results & Discussion: The results showed that both imaging systems resolved 4 lp/mm and 8 lp/mm but, failed to resolve 12 lp/mm. Among the resolved, line-pair targets, there were no significant differences in spatial resolution or detectability of MC with depth ($p > 0.077$). When the line-pair targets were located in the periphery of the FoV, resolution was significantly lower ($p < 0.042$) than at the center. The spatial resolution was significantly better on the anode side of the compared to the cathode side along the cathode-anode axis in the periphery of the FoV. This difference can be attributed to the variation in focal spot size along the anode-cathode axis. There

were no differences in spatial resolution in the direction perpendicular to the anode-cathode axis.

156. COMPARISON OF IMAGE QUALITY BETWEEN DIGITAL AND COMPUTED RADIOGRAPHY

Presenter: Khaled Al-Khalifah, *Kuwait University*
Authors: K. Alkhalifah, A. Brindabhan

Introduction: Computed Radiography (CR) systems and Digital Radiography (DR) systems have been used in radiographic imaging for some years. Both systems offer image display within a very short time, compared to screen-film systems, after an exposure is made. With wide dynamic range and linear response to radiation dose, CR and DR systems offer unparalleled flexibility in the selection of exposure factors. However, subtle differences between the two systems render differences in the quality of images they produce. Image quality parameters such as the spatial resolution (SR) and brightness resolution (BR) of the imaging systems are determined by the design and the materials used in the detectors. The SR of an imaging system affects the appearance of fine details of structures. When fine detail is lacking, the image often appears blurred. The primary factors that affect the recorded detail in an imaging system are the detector geometric properties and the image processing system. The BR, on the other hand, are determined by the ability of the detectors and the processing units to differentiate small differences in x-ray intensity. Establishing the limits of SR and BR of imaging systems will enable radiologic technologists to make an informed choice of imaging system for the task at hand. The purpose of this study was to compare a CR system with a DR system in terms of their SR and BR using a commercially available phantom.

Method: A CIRS (Computerized Imaging Reference Systems INC., Virginia, USA) Model L777 CR/DR Test Tool was used to assess a Fuji CR ST-VI the image plate type C is used gray scale of 12 bits with a standard 35 cm x 43 cm image plate (0.200 mm pixel pitch) and a Carestream Model DRX-1 DR system with 35 cm x 43 cm detector (0.139 mm pixel pitch). The test tool, containing 6 discs of varying subject contrast and 16 line-pair patterns, was imaged on both imaging systems in the Bucky. The Automatic Exposure Control (AEC) and kVp values 60, 80 and 110 were used. The images were evaluated by 5 independent reviewers for the visibility of line-pair patterns and circular discs. Statistical analysis was done using Mann-Whitney test at $p < 0.05$ level.

Results: At all 3 kVp settings, the DR system displayed significantly ($p < 0.008$) better SR with 2.58 line-pairs per mm (lp/mm) compared to 2.09 lp/mm by the CR system. The changes in kVp did not show any significant ($p > 0.883$) changes in SR in both CR and DR systems. As for BR, no significant ($p > 0.222$) changes were observed for different kVp setting within each system or between systems at all 3 kVp settings. The mean BR was equivalent to a subject contrast equivalent to 0.36 mm thickness of Aluminum. The conclusion: Carestream DR system exhibited better SR capabilities than the Fuji CR system but had similar BR capabilities. The results presented



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

here are specific to the systems tested, comparisons of multiple systems are need to establish superiority of performance.

157. GAUGING PERSONAL EXPOSURE DOSES OF RESIDENTS FOLLOWING THE ACCIDENT AT FUKUSHIMA NUCLEAR POWER STATION

Presenter: Kunihiko Morozumi, *The Japan Association of Radiological Technologists*

Author: Kunihiko Morozumi

Introduction: The Japan Association of Radiological Technologists, between March 16 and April 17, 2011, dispatched members to conduct a radiation survey among evacuees following the accident that occurred at TEPCO's Fukushima Daiichi Nuclear Power Station on March 11 that year. Moreover, at the request of Fukushima Prefectural Police Headquarters, it implemented radiation surveys on bodies of the deceased prior to autopsy from April 11 to August 10. Also, it was consigned by the Ministry of Environment to establish the Radiation Exposure Advice Center, through which it handles telephone and internet inquiries about exposure. The accident released radioactive substances into the atmosphere, leading to contamination over a wide area including Fukushima and neighboring prefectures. Many residents are still displaced from their homes, and although rezoning of evacuated areas is progressing and radiation levels in districts preparing to lift evacuation orders are falling due to the attenuation of radiation and effects of decontamination, there is still unease over low level radiation exposure. Accordingly, it will be important to minutely gauge individual exposure doses and, based on the resulting information, take fine-tuned measures to reduce doses in the living environment for local areas and individuals.

Methods: The measurement results from personal dosimeters were organized as mapping (geographical distribution) and trend (changes over time in everyday life, etc.) data so that they could be easily understood in the local and personal living environments.

Results: The method of calculation based on personal doses as opposed to air doses is scientific, and whereas additional exposure during the recovery process is permitted over the range of 1~20 millisieverts under international standards, there are many evacuees who claim that only 1 millisievert is safe. This Association is cooperating with the ongoing implementation of measures geared to reducing exposure doses in the living environment for local areas and individuals.

158. TACIT KNOWLEDGE AND WORKPLACE LEARNING – CREATING PRECONDITIONS FOR TACIT KNOWLEDGE UTILIZATION IN RADIOGRAPHER WORK COMMUNITIES

Presenter: Juha Kurtti, *Tehy - The Union of Health and Social Care Professionals*

Author: Juha Kurtti

Introduction: Workplace learning is often gradual. We even don't perceive working action as learning process if we work in routines. Expertise in a hectic work community appears at least partly as a matter of routine. Does it preclude professional growth or development? In that point of view it is necessary to draw attention worker's or team tacit knowledge usage on workplaces. Tacit knowledge and the sharing thereof with the purpose of increasing competence at work are of growing interest to health care researchers. The purpose of this study was to examine in collaboration with radiographers how they utilized tacit or experience based knowledge in their work community. Furthermore study tried to identified radiographers way of action when tacit knowledge couldn't able to share between colleagues and teams.

Methods: Data consisted of forty-four (N=44) radiographers in one radiological department. The approach was constructive action research. Data was collected by using participatory observation, focus-group interview and research diary for two and a half years.

Results: Radiographers use tacit knowledge into the work process to manage challenges of clinical radiography. Problem solving based on analytic-intuitive decision-making process. They share tacit knowledge both in an organized and an informal manner using articulation and documentation. Addition to experts' junior radiographer can also possess tacit competence in the field of information technology. Tacit knowledge has individual-centered base and therefore it is possible to share and utilize only partial.

159. OPTIMIZING PATIENT CARE WITH CT/MRI PERFUSION IN STROKE MANAGEMENT: A REVIEW OF PAST EXPERIENCES IN SINGAPORE GENERAL HOSPITAL

Presenter: Cheryl Low, *Singapore General Hospital*

Authors: Low Wei Ying Cheryl, Kumar, K., Tan, T. M., Rumpel, H., Chan, L. L.

Introduction: Stroke is the 4th leading cause of death and disability in Singapore. The year 2011 saw 9% of total deaths in Singapore attributable to stroke. During the years 2008 to 2012, the crude incidence rate of stroke has been increasing. However, the age-standardized incidence rate has been decreasing consistently, with the year 2012 seeing a 6.5% drop compared to 2008. With the burden of stroke being expected to increase dramatically in the years to come, it is important to constantly review the standard practices in hospitals. Optimal patient care, timely identification of stroke, accurate diagnosis and treatment for patients presenting with such symptoms is of essence in stroke management. The objective of this study is to review the use and impact of Computed Tomography Perfusion (CTP) and Magnetic Resonance Perfusion (MRP) scans in the management of stroke in Singapore General Hospital (SGH).

Methods: A retrospective review of all CTP and MRP scans performed for stroke in SGH from 2011-2013. The patient demographics, clinical presentation, time to acute stroke and scan findings and patient management are recorded.



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

Results: 17 perfusion scans were performed (9CTP, 8MRP). Patients were aged 29 to 73 years (10men, 4women). Of these, 9 had vascular risk factors. The mean presentation to perfusion scan time was 4.6 and 9.8 days for CTP and MRP respectively. There were 9 anterior, 4 posterior and 1 with both circulation insufficiencies. They underwent acute thrombolytic therapy, anti-platelet treatment or endarterectomy. CTP and MRP had been selectively performed in the delayed setting to further aid patient management.

160. EVALUATION OF CAROTID ARTERY BY DOPPLER ULTRASOUND IN PATIENTS AFTER RADIOTHERAPY OF THE HEAD AND NECK REGION

Presenter: Jolanta Tomczak, Department of Vascular and General Surgery, Poznań University of Medical Sciences, Poland
Authors: Jolanta Tomczak, Bartosz Bąk, Grzegorz Oszkinis.

Introduction: Atherosclerosis induce more than 90% stenosis and occlusion of carotid arteries. According to statistics, 20-30% of patients with precranial stenosis of the carotid artery segments are in group of risk of stroke. The assessment of risk of atherosclerosis appearance in carotid arteries is possible, even before the plaques occur, using the thickness of intima-media complex (KIM), by high-resolution ultrasound. Doppler ultrasound (USG Doppler), due to its non-invasiveness and repeatability is one of the necessary methods of diagnostic carotid arteries diseases. Risk factors affecting the formation of atherosclerotic lesions include: hypertension, diabetes, obesity, smoking, hypercholesterolemia, hyperhomocysteinemia, genetic predisposition and exposure to ionizing radiation. Currently, radiotherapy of head and neck cancer includes mainly IMRT methods (Intensity Modulated Radiation Therapy), which is as accurate as possible to fit the high therapeutic dose to the irradiated target while minimizing the dose to critical organs. The IMRT technique theoretically allows greater protection for critical organs than 3D-CRT (3D Conformal Radiotherapy). In head and neck cancer, carotid arteries are localized in a region of high doses, due to their proximity to the lymph nodes or also an area of the tumor spreading. The aim of the study was to assess the impact of modern IMRT methods on the rate of change of atherosclerotic plaque and increased KIM in the carotid arteries using USG Doppler in patients with head and neck cancer. Patients enrolled in the study underwent routine treatment planning process with the inclusion of additional contouring of the carotid arteries.

Methods: The study included 40 patients, aged 40-70 years diagnosed with cancer of the head and neck region, with the intention of radical treatment, using IMRT, IMRT with chemotherapy and surgical treatment alone as a control group.

Results: USG Doppler of carotid arteries was carried out before irradiation treatment and 3, 6, 12 months after radiotherapy was completed (will be still continued until 24 month). The study also include dose calculation from radiotherapy treatment plans of patients. There is desirability of using USG Doppler to regular control of younger patients after head and neck radiotherapy and

those with existing carotid artery stenosis and risk for recurrence of head and neck cancer.

161. THE VALUE OF SPATIAL COMPOUND IMAGING IN 2D AND 3D ULTRASOUND ASSESSMENT OF CAROTID PLAQUES

Presenter: Michael Ying, Department of Health Technology and Informatics, The Hong Kong Polytechnic University
Authors: Michael Ying, Yongping Zheng

Introduction: Ultrasound is a useful imaging method for the assessment of carotid artery. Measurement of common carotid artery intima media thickness (IMT) is commonly used to assess atherosclerosis. Increased carotid IMT is highly associated with increased risk of cerebrovascular and cardiovascular diseases. Recent studies suggested that carotid plaque area and plaque volume are more accurate than carotid IMT in assessing the atherosclerotic burden, and are more accurate surrogate markers for cardiovascular diseases. With the availability of three-dimensional (3D) ultrasound, carotid plaque volume can now be measured. Nonetheless, accurate measurement of plaque area and volume requires clear delineation of the boundaries of the plaque, and images with minimal artifact. Spatial compound imaging is a useful ultrasound technique to improve lesion's boundaries delineation and reduce image artifacts. Therefore, this study was undertaken to determine the value of spatial compound imaging in ultrasound assessment of carotid plaques by assessing the carotid plaques in two-dimensional (2D) and 3D ultrasound with and without spatial compound imaging.

Methods: Fifteen patients with carotid plaques were examined with 2D and 3D ultrasound. Scans were performed twice with and without the use of spatial compound imaging. Conspicuity of plaque boundaries and image artifact of the two image sets were compared.

Results: For both 2D and 3D ultrasound, the use of spatial compound imaging improved the delineation of carotid plaque boundaries and reduced the image artifacts. These improvements of image quality allow more accurate 2D measurement of carotid plaque area and 3D measurement of plaque volume, and thus enable more accurate assessment of atherosclerotic burden of patients. Acknowledgement: This study was partially funded by a research grant from the Hong Kong Polytechnic University (G-YN46).

162. COMPARISONS BETWEEN PATHOLOGICAL AND SONOGRAPHIC SIZE OF BREAST CANCER

Presenter: Yan-Chi Chang, Taichung Veteran General Hospital, Taiwan
Authors: Yan-Chi Chang, Chia-Yu Keng

Introduction: Tumor size of breast cancer is known to have both prognostic significance and treatment implications. In clinical



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

practice, initially preoperative assessment of tumor size is commonly estimated by palpation. And before surgery, image techniques including mammography and sonography are used to predict tumor size. However, little is known about the accuracy of imaging techniques in predicting the size of breast cancer. Mammographic estimates of maximum tumor dimension may be unreliable for several reasons. One is variation in the distance between the tumor and the film. There are also effects from indistinct tumor boundaries and compression during examination. Furthermore, standard imaging projections sometimes do not capture the maximum tumor diameter. The purpose of this study is to compare presurgical sonographic measured tumor size with actual tumor size.

Methods: A total of 207 breast cancer patients were included. We excluded multiple lesions. Tumor size by sonography before surgery was recorded at largest axis length. Histopathologic examinations of the specimens for largest axial length are also recorded.

Results: In this study, US modalities tended to underestimate tumor size which is in agreement with previous smaller studies. The number of infiltrating lobular carcinomas in this series was small. We did not find a significant difference in the accuracy of US in assessing the size of infiltrating lobular carcinomas. However, measurements in this subset of patients had a higher associated standard error. In conclusion, US is well correlated with pathology in assessment of breast cancer size.

163. SONOGRAPHY OF NONALCOHOLIC FATTY LIVER DISEASE AND LIPID PROFILE OF THE METABOLIC SYNDROME

Presenter: Yan-Chi Chang, *Taichung Veteran General Hospital, Taiwan*

Authors: Yan-Chi Chang, Chia-Yu Keng

Introduction: Fatty liver was once considered to be an incidental pathologic finding that was without clinical significance. According to previous literatures, half of the patients with nonalcoholic steatohepatitis develop liver fibrosis, 15% develop cirrhosis. Nonalcoholic fatty liver disease include hepatic steatosis, with/without active inflammation, and the situation, was recognized as a clinical entity since 1962. Some studies proved that nonalcoholic fatty liver disease is associated with obesity, and diabetes. And there are studies suggested that dyslipidemia is also associated with nonalcoholic fatty liver disease. This study was designed to determine the association between nonalcoholic fatty liver disease (NAFLD) and lipid profile of patients of metabolic syndrome.

Methods: A total of 108 NAFLD, excluded other liver diseases, are included. High-density lipoprotein (HDL), Cholesterol(Chol), Triglyceride(TG), Normal ultrasound liver scan were recorded for statistics.

Results: In conclusion, NAFLD is related to lipid profile of patients of metabolic syndrome. The mechanisms might be a matter of speculation. For lean patients, genetic conditions might increase serum triglyceride levels and cause peripheral insulin resistance at a receptor level. For overweight patients, the primary abnormality may be insulin resistance or obesity, which secondarily increases serum lipid level via enhanced peripheral lipolysis.

164. ELASTOGRAPHY STRAIN RATIO MEASUREMENTS FOR THYROID NODULE DIFFERENTIATION: A SYSTEMATIC REVIEW

Presenter: Holly Elliott, *Teesside University, UK*

Author: Holly J Elliott

Introduction: Thyroid nodules (TN/s) are common in adults, thought to be present in 4-8% of the worldwide population. Not all TNs are malignant, though the incidence of thyroid carcinoma is said to be increasing. The current gold standard for diagnosing thyroid malignancy is fine-needle aspiration (FNA) yet this is invasive, costs money, can result in inadequate samples as well as cause patient pain. Strain ratio elastography (SRE) is a non-invasive, quantitative method of evaluating tissue stiffness. As malignancies are associated with an increase in tissue stiffness it has the potential to differentiate TNs. When using SRE the operator compares the TN in question with an adjacent area of normal tissue, the reference tissue, and calculates the strain ratio (SR) between the two; where SR is 1 the TN is presumed the same elasticity as its surrounding tissue. The depth of this reference tissue is critical for SRE as changes in the distance of reference tissue to the probe, the stress source, vary SR measurements substantially. The contraindications and disadvantages of FNA, alongside the increasing incidence of thyroid malignancy and possible inappropriate utilisation of NHS resource allocation, have indicated it would be beneficial to develop a non-invasive, accurate diagnostic method for TN differentiation. A systematic review evaluating the potential diagnostic accuracy of SRE for TN differentiation has not yet been performed. The aim of this systematic review therefore was to answer the question whether SRE measurements are a diagnostically accurate method of differentiating thyroid nodules as malignant or benign and thus have the potential to be used instead of or alongside or FNA.

Methods: A systematic search of CINAHL, Medline and ScienceDirect was conducted in Nov 2013. Studies were selected in three phases by two blinded reviewers. The QUADAS2 tool was used to assess methodological quality prior to conducting a narrative synthesis.

Results: Ten studies were included though methodological diversity was high. Sensitivity and specificity ranged from 65.8–100 and 50–92 % respectively. TN population and manufacturer have little effect on diagnostic accuracy though reference tissue depth allocation, compression source and operator may have. Non-invasive SRE appears to have the potential to differentiate TNs single-handedly



Helsinki, Finland

Optimizing for Better Care

18th ISRRT World Congress 12.–15.6.2014

however due to limitations within this review, larger studies need to be carried out to ascertain its true potential

165. CARPAL TUNNEL AREA AS A RISK FACTOR FOR CARPAL TUNNEL SYNDROME: ULTRASONOGRAPHIC MEASUREMENTS OF MEDIAN NERVE AND TRANSVERSE CARPAL LIGAMENT

Presenter: Hoi Chi Woo, *The Hong Kong Polytechnic University*
Authors: Woo, H.C., White, P & Lai, W.K.

Introduction: Carpal tunnel syndrome (CTS) is a common hand disorder which is caused by median nerve compression within the carpal tunnel of the wrist. Anatomically, the carpal tunnel is formed by the carpal bones and the transverse carpal ligament (TCL). It consists of nine flexor tendons and the median nerve (MN). The most widely used ultrasound methods for CTS diagnosis are the measurement of cross-sectional area (CSA) of the MN at the level of the carpal tunnel inlet (proximal, pisiform-scaphoid level), mid-tunnel and tunnel outlet (distal, hamate-trapezium level), as well as flattening ratio (FR) and swelling ratio (SR). However, to date there has been little research on other potentially useful parameters, such as the measurement of bowing and thickening of the TCL. To determine the cause of compression, a full view of the structures in the carpal tunnel region is recommended. This study addresses this gap by assessing the ultrasound morphologic features of MN and TCL at the carpal tunnel in CTS patients against the findings in normal healthy subjects. The key issue addressed is that personal factors, such as age, body mass index and wrist circumference are associated with increased risk of developing CTS. It is also important to gain a deeper understanding of contributing risk factors: awkward posture, repetitive motion and forceful exertion, so as to prevent early manifestation of CTS. These problems must be resolved to avoid long-standing CTS which can lead to permanent nerve damage and persistent numbness. This study, therefore, will be the first attempt to examine this issue in great depth and strive to develop novel solutions for such problems.

Methods: A cross-sectional research design was used in this study: questionnaire survey, physical examination (Phalen's and Durkan's tests) and ultrasonographic assessment (MNCSA, FR, SR, TCL bulge and thickness at the carpal tunnel inlet and outlet).

Results: MNCSA and FR were significantly increased at both carpal tunnel inlet and outlet, but they were decreased at distal radius. Bowing of TCL was larger at tunnel inlet than at outlet, but there was no difference in its thickness. This indicates that TCL appears more curved at the tunnel inlet, thus narrowing the tunnel and exerting pressure on the median nerve. This study therefore provides insights into risk factors associated with development of CTS and their relationships to wrist morphology.

POSTERS NUCLEAR MEDICINE

1. DOSES TO THE STAFF IN NUCLEAR MEDICINE: TWO EXAMPLES

Presenter: Anja Henner and Pirjo Vimpari, *Oulu University of Applied Sciences, Finland*

Authors: Torvinen Marita, Torniainen Pentti, Manninen Anna-Leena, Vimpari Pirjo Henner Anja

Introduction: The staff in nuclear medicine department is exposed to radiation from patients during the imaging and from radionuclides when performing and giving injection of radionuclide to patients. The dose follow up with dosimeters is running in four weeks periods and both effective (whole body) and equivalent doses of eye and fingers are recorded. It is still quite difficult to find out what are the doses near the patient or the radiation source during quality assurance tests. This is why these measurements were planned to carry out.

Materials: The dose meter was DGM-1500 safety meter (energy level from 35 keV to 1,25 MeV, dose rate from 0,01 μ Sv/h to 100 000 μ Sv/h, dose level from 1,001 mSv to 1000 mSv). In bone gamma examination Tc-99m-HDP, activity 555 MBq was given to the patient. Tc-99m energy is 140 keV and it's half life is 6 hours. Doses were measured at distances 25 cm, 50 cm, 100 cm and 200cm from the patient. The meter was standing on the same height as the patient was lying. Other measurements were made with Co-57 source used in quality assurance tests. The activity of the source was 235MBq on the day the measurements were performed. The measurements were made according the conditions and time used in Nuclear Medicine laboratory when the Co-57source is in use for QA purposes.

Results: During the bone gamma examination mean dose rate was 4,126 μ Sv/h (2,72 μ Sv/h - 6,26 μ Sv/h) and mean time the staff exposed to radiation was 6min 59 s (from 5 min 10 s to 10 min 47 s). In this department yearly 1268 bone examinations are performed. Six members of the staff perform about 211 examinations / year. Calculated by the mean dose and mean time, the highest cumulative dose (at distance 25 cm) to one person is about 405,58 μ Sv and the smallest (distance 100 cm) 6,34 μ Sv. When the times and distances were followed up in real patient cases, the highest cumulative dose was 1426,53 μ Sv. Doses from Co-57 source are highest during the transport of the source to the examination rooms and when positioning the source for tests. The time spent in transporting varies 15 second to 1,5 minutes. The fingers are quite near the source during transportation. The Co-57 source is inside a lead protected box but still outside the box e.g in 15 cm distance dose rate is 0,64 μ Sv/h and at distance of 40 cm 0,26 μ Sv/h. When setting the Co-57 source for QA-test dose rate at distance of 25 cm was 10 μ Sv/h. If the person spends 10 seconds at this distance the dose is 0.03 μ Sv and after 20 seconds it is 0,06 μ Sv. The doses from one patient examination or one QA-test are low but the cumulative dose during one year is remarkable and the staff may have 40 year career in nuclear medicine. That is why the radiation protection is important in every day work and best way is to make the staff aware of even of the small doses. These measurements show it is best to way to protect from radiation in nuclear medicine is take longer distance and shorter time.



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

POSTERS RADIO THERAPY

2. COMPARISON OF THE MORPHOLOGY OF TEMPORO-MANDIBULAR JOINT BETWEEN POST-RADIOTHERAPY NASOPHARYNGEAL CANCER PATIENTS AND NORMAL SUBJECTS

Presenter: Vincent Wc Wu, *Hong Kong Polytechnic University*
Authors: Vincent WC Wu, Michael TC Ying, Dora LW Kwong

Introduction: Nasopharyngeal carcinoma (NPC) is endemic in southern China, and its incidence in Hong Kong is relatively high: within top ten of the cancer incidence in 2010. Despite of its high incidence, NPC is comparatively curable. Radiotherapy with various techniques, such as conventional radiotherapy, intensity modulated radiotherapy (IMRT) and intensity modulated arc therapy, is the mainstay of NPC treatment due the relatively high radiosensitivity of tumour and its deep-seeded anatomical position. Because tumour arising from the nasopharynx is in proximity to many organs at risk, radiation induced toxicities are unavoidable. One of the common complications is trismus, which is caused by the radiation induced damage to the temporo-mandibular joint (TMJ). Trismus, which is referred as the restricted mouth opening or jaw movement, is found in 5%-17% of the patients. Trismus at early stage may only affect the speech functions, but in severe cases nutritional intake and oral hygiene conditions may deteriorate seriously. This is a preliminary study aimed to investigate the morphological changes of TMJ after radical radiotherapy in NPC patients.

Methods: The maximum interincisal distance (MID), TMJ disc thickness, pterygoid muscle echogenicity, joint smoothness and vascularity of 20 post-radiotherapy NPC patients assessed by the Philips HD11XE ultrasound unit were compared with 10 normal subjects.

Results: The MID of the patient group was significantly smaller than the control group ($p = 0.004$). The joint condyle was less smooth than that of the control group. The differences in disc thickness and joint vascularity were not significant. Besides, the pterygoid muscle echogenicity was relatively higher in the patient group, which was demonstrated in over 55% of the TMJs. Conclusion: Radiation induced trismus was demonstrated in various extent in NPC patients after a course of radical radiotherapy.

3. EXPERIENCED BENEFITS OF CYBERKNIFE® ROBOTIC RADIOSURGERY SYSTEM IN KUOPIO, FINLAND

Presenter: Heidi Niskanen, *Kuopio University Hospital, Finland*
Authors: Kati Tolonen, Aija Juutilainen, Heidi Niskanen

Introduction: In this poster we introduce the benefits of the CyberKnife® Robotic Radiosurgery System (Accuray Inc., Sunnyvale, USA) of our Cancer Center. CyberKnife® (CK) is a stereotactic radiotherapy system based on robotic technology. With CK it is possible to treat both benign and malignant tumours anywhere in the body. CK in Kuopio, Finland is the first and so far the only one in the Nordic countries. The majority of treatment targets treated with CK in our department are prostate, brain and lung tumours. Generally all the treatments are either radiosurgical (neurosurgical targets) or hypofractionated. Our Cancer Center works in close collaboration with the Kuopio NeuroCenter. Most of the cranial targets are treated radiosurgically with a single fraction. Prostate and lung cancers are treated with a hypofractionation scheme with five times 7.25 Gy and three times 18 Gy, respectively. CK unit is equipped with two orthogonal X-ray imaging devices for automated image guidance throughout radiotherapy treatment delivery. The tracking method is determined by the target: bony structures, tumour volume or fiducials. For example gold fiducials are utilised to track the prostate motion before and during the dose delivery. Targets moving with respiration are treated with Synchrony® system, in where the real time breathing pattern is recorded and the corresponding breathing cycle is accounted by the robot itself at time of treatment delivery. The online tracking methods allow reduction of treatment margins and high doses of radiation can be utilised safely. Equally important for reducing margins is the system's sub-millimetre accuracy being down to 0.3 mm.

Methods: Data for this poster were collected from patient databases, personnel experiences and on-going studies in Cancer Center and Kuopio NeuroCenter. This data covered all the patients treated with CK in Kuopio.

Results: With CyberKnife it is emphasised that treatments are comfortable for patients: there is no need for extracranial frames due to intrafractional online tracking. Use of hypofractionation makes the treatments more convenient for the patients reducing the total treatment course. For example, for prostate cancer patients the course is reduced from 38 fractions to 5 fractions. In conclusion CK is a cost effective method in treating patients non-invasively.

4. IMPROVING ACCURACY IN ADJUVANT RADIO THERAPY OF LEFT-SIDED BREAST CANCER ACCOMPLISHED WITH VOLUNTARY DEEP INSPIRATION BREATH HOLD TECHNIQUE

Presenter: Marko Laaksomaa, *TAUH Tampere University Hospital, Finland*

Authors: Marko Laaksomaa, Mikko Haltamo, Mika Kapanen, Seppo Peltola, Eeva Boman, Tanja Skyttä, Pirkko-Liisa Kellokumpu-Lehtinen, Simo Hyödynmaa

Introduction: Voluntary deep inspiration breath hold (vDIBH) is a technique to minimize dose to heart in adjuvant radiotherapy (RT) of left sided breast cancer (LSBC). With increasing knowledge of RT induced damage on cardiac myocytes and arteries the application of vDIBH has become more common. We routinely treat LSBC patients eligible for breath hold in 20-minute linac time. RPM (Varian



Helsinki, Finland Optimizing for Better Care
18th ISRRT World Congress 12.–15.6.2014

Medical Systems) is used with 1cm window for breath hold level (BHL). Breathing training was given before planning imaging and BHL is verified with image guidance. The system detects BHL indirectly from infrared reflector block placed on patient chest. In this study we aimed to improve the reproducibility of the BHL.

Methods: We investigated the reproducibility of BHL for 72 LSBC patients. The BHL guided by the RPM was verified using lateral kV image and the height of guided BHL window was adjusted when necessary. Sparing of heart was confirmed with daily image guidance.

Results: Mean error of the BHL was decreased 4.0 mm by the adjustment based on image guidance (n=9/30). The heart surface was confirmed to be outside treatment field in 60% of the vDIBH patients (n=72) while in non-vDIBH patients (n=28) it was spared in 4%. Large differences may occur between pre-recorded BHL in RPM and actual BHL in treatment situation. Reproducibility of BHL can be improved by adjusting the height of BHL window guided by the RPM based on onboard image guidance.

5. IMPLEMENTATION OF BREATHING ADAPTED STEREOTACTIC BODY RADIOTHERAPY FOR TREATMENT OF LIVER CANCER

Presenter: Ineta Nemiro, *Riga East Clinic University Hospital, Latvia*

Authors: Ineta Nemiro, Olga Utehina, Silvija Preinberga, Galina Boka, Viesturs Boka

Introduction: Aim of this study was to evaluate effects of internal tumor motion patterns on clinical implementation of Stereotactic Body Radiotherapy (SBRT) for treatment of liver cancer. Clinical Target Volume (CTV) was contoured on the basis of the MRI images co-registered with Maximum Intensity Projection (MIP) CT study. The Internal Target Volume (ITV) was contoured on MIP CT and on full inhale (0%) and full exhale phases (50%) 4DCT image sets. Planning Target Volume (PTV) was created by expansion of ITV by 3 to 5 mm. Dose delivery was performed using Image Guided Volumetric Modulated Arc Therapy (IGVMAT). Monitoring of patient breathing amplitude was done by means of recording of the position of external marker block placed on the patient's chest wall. Following parameters were evaluated in this study: absolute values of full internal tumor motion from inhale to exhale positions in Cranio-Caudal (CC), Anterior-Posterior (AP) and Left-Right (LR) directions estimated on 4DCT, relationship between CTV and ITV volume and correlation of these values with motion of External Marker Block (EMB).

Methods: 44 patients with malignant liver lesions were treated with SBRT between 2009 and 2013. For all patients treatment planning was performed on the basis of free breathing 4-dimensional Computed Tomography (4DCT).

Results: It was possible to define ITV on all of the 4DCT series. There were no treatment interruptions caused by patient breathing changes from 4DCT. Results of this study clearly demonstrate importance of creation of tailored ITV defined on 4DCT images for

each patient receiving SBRT for liver cancer. This method is easy to use clinically and it's suitable to all patients. Internal motion patterns can be precisely evaluated by use of direct tumor motion imaging, so avoiding excessive CTV – PTV margin.

A Search for Optimal Radiation Therapy Technique for Lung Tumours Stereotactic Body Radiation Therapy (SBRT): Dosimetric Comparison of 3D Conformal Radiotherapy, Static Gantry Intensity Modulated Radiotherapy (IMRT) and Volumetric-Modulated Arc Therapy (VMAT) with Flattening Filter (FF) or Flattening Filter-Free (FFF) Beams

6. A SEARCH FOR OPTIMAL RADIATION THERAPY TECHNIQUE FOR LUNG TUMOURS STEREOTACTIC BODY RADIATION THERAPY (SBRT): DOSIMETRIC COMPARISON OF 3D CONFORMAL RADIOTHERAPY, STATIC GANTRY INTENSITY MODULATED RADIOTHERAPY (IMRT) AND VOLUMETRIC-MODULATED ARC THERAPY (VMAT) WITH FLATTENING FILTER (FF) OR FLATTENING FILTER-FREE (FFF) BEAMS

Presenter: Gibson T.K. CHEUNG, Radiation Therapist II in *Department of Clinical Oncology, PWH (Hong Kong SAR)*

Authors: Murphy S.H. Chiu, Dora L.W. Kwong

Introduction: (1) To find out the optimal lung tumours Stereotactic Body Radiation Therapy (SBRT) delivery technique, through the dosimetric comparison of 3D conformal radiation therapy (3DCRT), Static Gantry Intensity Modulated Radiotherapy (IMRT) and Volumetric-Modulated Arc Therapy (VMAT), according to the dose specifications defined in RTOG 0813 protocol. (2) To assess the benefits and limitations of VMAT with flattening filter free (FFF) beams when compared with conventional VMAT with flattening filtered (FF) beams.

Methods: Ten patients who underwent thoracic SBRT (PTV diameter \leq 5cm) were selected. Four treatment plans: non-coplanar 3DCRT, coplanar static gantry IMRT, coplanar VMAT (FF) and VMAT (FFF) were generated and compared

Results: VMAT (FF and FFF) were found to be the more effective treatment techniques for lung tumours SBRT whilst maintaining IMRT plan qualities, and also simultaneously enhancing the delivery efficiency with shortened BOT than static gantry IMRT technique. Dosimetric performance for VMAT (FFF) was comparable with VMAT (FF) with further reduction of required MU/Gy, arcs number and BOT, significantly minimized the intra-fraction motions and is more tolerable to patients with long SBRT treatment duration.