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H

Scientific Sessions for Students

Friday, March 2, 14:00 - 15:30 **Studio 2012**

Student Session 1

H-1

The lady with the x-ray eyes

T.G. Teneva; *Varna/BG*

In half a century all physicians will be radiologists. Nowadays every medical specialisation (gynaecology, gastroenterology in particular) try to make all imaging decisions by themselves, but in the future there will be many subspecialisations within radiology, which will, by then, completely occupy medicine. The radiological work will not only consist of examination selection, protocol design, and interpretation of the imaging data set. Radiology will be more interventional (image guided surgery), more functional (functional neuroimaging in support of the Human Cognome Project), more molecular and genetic (not PET-CT, but GET-CT- gene evaluating tomography), more curative (expected progress in oncoradiology). Nevertheless there will be more scientific work. Many changes are expected in radiological education through social media – more eLearning possibilities like EDIPS, EURO-RAD, radiopaedia.org etc. More international exchange programmes for students, residents, specialists, and more European Schools of Radiology. All this will lead to the standardisation of radiological knowledge and experience throughout Europe and, hopefully, worldwide. This will also be possible through teleradiology, a part of telemedicine, using one specialist for many procedures in many countries at the same time (one lecturer for many medical universities in many countries at the same time). The last point to discuss is technological change. There will be x-ray vision (The lady with the X-Ray eyes by the Bulgarian fiction writer S. Minkov). The doctor will be able to see directly through the patient with some kind of high-tech glasses, or lenses for 3D-x-ray vision. As a result the physician will be able to immediately diagnose the pathological findings. I conclude, then, with two words: Quantum mutata (so much has changed) – the motto of the physician in 50 years.

H-2

The future of radiology

V. Kopitkovs; *Riga/LV*

Just like today, in the year 2052 radiology will remain one of the most rapidly developing medical specialties, which will continue to offer new research methods to other medical fields, giving them the capability to increase the accuracy of their diagnoses. The widespread usage of imaging methods will noticeably decrease their cost and provide job vacancies for radiologists. Radiological procedures will become significantly safer for both the patients and medical personnel. Hypoallergenic and non-nephrotoxic contrast materials will be produced. I can clearly imagine the future, where radiological equipment will become mobile, which will finally give us the option of taking crucial diagnostic examinations to the patients who are not able to reach medical facilities themselves. In acute cases, radiological imaging will be available at the site of various emergencies, battlefields and natural disasters. Routine full body scanning will even allow for prompt automatic diagnosis with any organ size and morphological changes or neoplasms in comparison to previous scans. A unified database of body scans will allow any physician in the world to access medical records. Automatic mass screening procedures will allow for the detection of diseases among populations and newly arrived tourists, giving us a chance to take preventive measures against the spread of disease. The person at risk will be detected and given medical treatment. There will be a compulsory radiology course for all other specialised physicians, in terms of their specific field. Doctors will be encouraged to carry out simple non-invasive diagnostic procedures on the spot and request a radiologist's assistance only if complex procedures are required. That is my view of the future of radiology.

H-3

Image reading simulator

K. Kovàc; *Debrecen/HU*

Introduction: Our aim is to design a system that will help master the daily diagnostic radiological routine. This, of course, will not replace consultation with the specialist, but should make it easier to recognise diseases. Discussion: The programme is basically a computer simulator for localising and identifying pathologies. After the evaluation of MRI, CT, US, or X-ray images, the device checks if the user's answer is correct. This would be based on predefined diagnoses by imaging specialists. Initially, it would be necessary to construct a large dataset of correct diagnoses and detailed, good quality patient records (request forms and images). Plain radiographs and particularly cross sectional CT and MRI images can be easily applied to this learning method, already there are tools available for this. We suggest an alternative, easy-to-use way to perform US scans, the acquisition and reconstruction of ultrasound. In order to allow for the computer-assisted simulation of a US scanning procedure, US scans should be performed with 3D-guidance: storing spatial information regarding the transducer's position and orientation. Using a 3D controller device in this virtual space, the user would be able to perform simulated US acquisitions. The database would be a result of international collaboration, but local radiology units could also create their own material based on their own patient database. The simulator suggests different training modes based on the imaging techniques and the disease's distribution. To encourage learning and review, scientific papers, or unified radiological eLearning material (such as eurorad.org) could be attached to cases. Conclusion: We assume that this simulator could revolutionise the training of radiological image recognition. It provides a supervised knowledge basis, especially for daily diagnostic routine.

H-4

Robotic science, a future medicine within

J.Y. Heu; *Seoul/KR*

X-ray, ultrasonography, CT, and MRI are radiological tools which physicians have used to diagnose diseases in patients. Back when diagnoses were made through surgery and dissection, a skilled physician would have made a diagnosis depending on symptoms, observations, and tactile perception. The development of other radiological technologies has emphasised the cost-benefit associated with the reliability of a diagnosis compared with the effects of the procedure. Numerous scientists have made considerable efforts to defeat cancer. In the future, nanomedicine combined with robotic science, i.e., nanobots, will be used in periodic health examinations to detect and automatically analyse or report microscopic problems in the human body. Nanobots will serve as a strategic monitoring system for those who are at high risk of developing a certain disease. After cancer patients achieve complete remission, more delicate nanobots will provide information about even infinitesimal cancerous lesions so as to preempt recurrence. Today, cancer patients suffer side-effects from the systemic cellular impact of anticancer drugs. However, in the future, anti-cancer drugs will be designed such that their effects are localised to the cancer without affecting healthy cells. Nanobots will provide extremely detailed anatomic information about a target lesion and will serve as a surveillance system for drug level and efficacy. It is fascinating to imagine what the evolution of medical devices and procedures could do to prevent patients from developing diseases such as cancer. Although nanobots will need to be extremely sensitive and specific, the road leading to the defeat of cancer will be unyielding with the help of robotic science.

H-5

Radiologist 2052

M.C. Bercea; *Cluj/RO*

Radiologist 2052: What will a radiologist's day-to-day work look like 40 years from now? After reading several essays by many noted radiology specialists of our time, on how they would like radiology to improve, I have assembled some of their ideas and I have come up with a view of the future of radiology. The radiologist of 2051 will be a sub-specialist and will manage the new information flow while keeping up with new discoveries in his sub-specialisation. He/she will supervise over the patient through a protective screen while calculating a personalised radiation dose for the procedure and patient. Once the image is obtained, the protective screen will turn into a widescreen touch panel where the radiologist can see the image in full size or even larger and can observe the abnormalities which he can then highlight. He/she will be able to upload the image to an enormous global image data base that analyses and compares his/hers with others that have the same pathology. Through a social network he/she will be able to get in touch with the current doctor who can answer all the questions he/she has about the patient's clinical past. Afterwards, proceeding towards the final diagnosis the doctor will be able to access all the radiologists on call at the time, who are online, and ask their opinion. These are a just few things which, if implemented, could make the future of radiology even brighter than it already is.

Friday, March 2, 16:00 - 17:30 **Studio 2012**

Student Session 2

H-6

Outlook of radiology 2052: risks, challenges, and opportunities

A. Arena; *Como/IT*

One potential radiology development by 2051 is further subspecialisation, not in techniques, but in systems and disease using the whole spectrum of imaging modalities. In this context, emergent areas could be cardiac, emergency, and oncological radiology. The challenge will be to keep the unity of radiology as a whole science and medical discipline. The risk is a dangerous imaging fragmentation caused by clinicians taking away the independent 'second opinion' supplied by radiologists. The further spread of interventional radiology (IR) will be a key point. Imaging-guided therapies will be the best option for an increasing number of diseases, especially small tumours incidentally detected by cross-sectional techniques, reducing the impact of overtreatment resulting from overdiagnosis. The amazing development of hybrid machines (CT-PET and MR-PET) will fuel the trend towards the fusion of radiology and nuclear medicine, also pushed by the increasing availability of techniques for cellular and molecular imaging. The distribution of electronic images in the context of open interdisciplinary cooperation will pose a challenge to radiologists in maintaining the prestigious role of interpreter. This will only be possible if radiologists outperform other physicians due to higher and higher technical and clinical expertise. Finally, future radiology may include new techniques we cannot foresee now. In 1895 X-rays were the future and the rise of MRI in the eighties was unexpected. Now, 30 years later, x-rays have evolved into multidetector CT while MRI has revolutionised the world of diagnostic imaging.

H-7

Subspecialties and unity of radiology

K. Khouri Chalouhi; *Settala/IT*

In 1895, W.C. Röntgen discovered x-rays, which gave birth to radiology as a science and medical discipline. For decades, x-rays were the only 'radiological' modality. Technological developments during and after World War II allowed for scintigraphy, ultrasound, angiography, CT, PET, and MRI as clinical tools. However, nuclear medicine was separated from radiology and radiology was subdivided according to technique. The radiologist became mainly a human appendix of a machine, a specialist of imaging, not of organs, systems, or body parts. About thirty years ago, radiologists began to understand the need for clinical knowledge across the different imaging modalities. Clinical fields became more important than imaging techniques. Radiological subspecialties such as neuro, paediatric, cardiovascular, breast, musculoskeletal, interventional, thoracic, and so on, were established. However, the human body still remains an entire entity. Thus, the unity of radiology must be conserved, at least when considering two main reasons. First, the borders between the subspecialties are not clearly defined (e.g., who has to study the peripheral nervous system? Neuroradiologists or musculoskeletal radiologists?). Second, when we look for an expected finding but we find more and more incidental findings, a trend increased by population aging, which results in co-morbidities. Every radiologist should have a transversal knowledge and a specialised skill in at least two main subspecialties. This is not only needed in order for radiology to survive the fragmentation of knowledge, but it is also the only way to do the best for our patients, and to be prepared for the future merger between radiology and nuclear medicine, which will result from the use of hybrid machines.

H-8

A view into the future of cancer treatment

M. Izotovs; *Jurmala/LV*

This topic is very important, because cancer is one of the most feared diseases in today's society. The initial idea is to predict how cancer treatment will change in the next few decades. Given modern knowledge of processes occurring in cancer-stricken cells and the ongoing research, it is possible to analyse what will happen in the near future. The causes of cancer are found on the cellular level. A cancer cell is a cell, that starts to proliferate uncontrollably, a cell whose division cycle is damaged and whose reparation system is damaged. This uncontrollable growth is caused by both genetic and environmental factors. Nowadays treatment is chemotherapy, radiotherapy, or surgery. Chemotherapy and radiotherapy are based on causing cancer cell apoptosis by blocking DNS synthesis. These methods are not perfect because they lack specificity. Not only cancer cells are destroyed, but also healthy cells are damaged, causing suppression of the immune system, fatigue, hair loss etc. Future methods however will be selective, targeting only cancer cells and leaving healthy cells alone. Developing pharmacogenetics will provide us with drugs, which will be able to repair the reparation system by restoring p53 activity, other drugs could reduce telomerase production in cancer cells causing cells to regain their Hayflick limit and lose immortality. Genetic testing will be widespread, finding people with hereditary cancer and curing them before cancer manifests. It will be possible to use adenoviruses as vectors to transport tumour suppressing genes into rapidly dividing cells. Nanotechnology will also play a role in cancer treatment. The future offers a lot of opportunities in cancer treatment; our duty is to use them. In my opinion, cancer, if not completely defeated, will at least cause less trouble to future generations.

H-9

Molecular imaging: a great chance for radiology

F. Seker; *Mannheim/DE*

For a long time high-tech radiological examination meant morphological imaging such as computer tomography or MRI. However, these technologies mainly allow for a diagnosis based on structural and anatomic information, whereas histopathology is still the gold standard when it comes to diagnosing neoplastic diseases. With the improvement of molecular techniques pathophysiological processes within cells are now better understood. In molecular imaging these molecular techniques are used for a new kind of imaging procedure. But why is this new technology so important for the future of radiology departments in modern hospitals? Molecular imaging, a young radiological discipline, is a product of advances in imaging technology. It uses modern molecular techniques in order to visualise cellular and molecular processes in living tissue. The imaging is based on physiological parameters like proliferative activity, blood flow, oxygen consumption etc. Molecules like biomarkers or nanoparticles are used to help image the area of interest. For this purpose these molecules connect with delivery agents in vivo and are transported to the pathological area where they accumulate. Thus diseases can be diagnosed in an early stage before morphological alterations can be seen. These molecular techniques can be used with existing imaging procedures like CT or MRI. Today the successful usage of PET-CT in lots of hospitals proves the benefit of this new technology. In summary it can be stated that molecular imaging assists in early detection, especially of neoplastic diseases. This new imaging technology will play a decisive role in the radiologist's field of work in 2051. It might even replace some histopathological analyses which require invasive procedures.

H-10

Delicate totality

A. Lice; *Riga/LV*

Today we are talking about chemical medicine, but the key word for the future of medicine will be biological. The purpose of this abstract is to give you a view of potential future methods of therapy. Prophylaxis: Medicine will cooperate with other disciplines of human study, for example, astrology. This will lead to better research of potential future diseases for a newborn, so every child will receive a prophylactic recommendation about diet, physical activities, the best environment and the best medicine to use. There will be a confluence of Eastern and traditional medicine: feng shui in psychiatry, colour therapy in oncology and aroma therapy in pulmonology. Dream registration and analysis by a dream psychologist will reveal traumas and complexes. Diagnostics: Every person will be measured not only as a combination of organs, tissues and cells, but in much more detail – at the molecular level. Methods will become less invasive: There will be devices which can detect every specific smell from the patient's body – mouth, sweat, urine, faeces, sputum – and offer a diagnosis. Research of water crystal changes after contact with a patient could detect microscopic changes in body liquids caused by different diseases. Treatment: Homeopathy will become more widely recognised. Specially modified plants will be used as their leaves will be full of medicine, so no pharmacies will be needed. Cell and tissue banks will become more developed and organ growing will emerge in the near future. Gene engineering will discover cures for otherwise incurable diseases. Conclusion: Doctors will analyse a patient in a much more delicate way; therapy will be based on energies and vibrations; mechanisms will become more elegant; Key words: Development of mechanisms, non-traditional medicine, body energies.

Saturday, March 3, 8:30–10:00 **Studio 2012**

Student Session 3

H-11

Development trends and future perspectives in vascular diagnostics
F. Rozikhodjaeva; *Tashkent/UZ*

I am a student at the Tashkent Paediatric Medical Institute and in the future I want to devote my life to radiology and to solving various problems in the diagnosis of vascular diseases. Why I am interested with this branch of medical science? I admire the achievements of radiological science over the last few years. The progress made in recent years in the area of medical devices, catheter technology, and contrast application has led to a general improvement in the diagnosis of vascular diseases. Today, through the advancement of other radiological procedures, computer tomography, magnetic resonance and ultrasonic diagnostics are available as alternative technologies for the identification of vascular diseases. Some of these procedures have already successfully been in use for a long time within vascular diagnostics. The progress of non-invasive procedures, above all in the area of magnetic resonance and ultrasound, will lead, in the next few, years to a considerable change in vascular diagnostics. Besides outlining some of the radiological procedures available today this abstract has also aimed to give an account of the developing trends and future perspectives of vascular disease diagnostics.

H-12

A letter to myself between science, technology and human beings
M. Brambati; *San Sonato Milanese/IT*

Dear Matteo, do you remember me? Well, I am you, twenty years in the future! As you can imagine it is hard to figure out what you might become in the next twenty years. I am writing to you in order to try and help you address some issues that will arise in your future profession. Do you remember your first radiology lesson? In the Seventies, computed tomography was considered to be the most innovative technique available and in 1979 Godfrey N. Hounsfield and Allan M. Cormack won the Nobel Prize in Medicine for that idea. Only two years later, Peter Mansfield started using nuclear magnetic resonance to identify pathological processes in the human body. In 2003, the Nobel Prize in Medicine was awarded to Peter Mansfield and Paul Lauterbur. In the next twenty years, you will see further improvements in diagnostic imaging, derived from future discoveries in physics. A new revolution in physics is going to occur with the discovery that neutrinos are faster than light. Despite these technological innovations, what should you always remember above all? The patient and his health are the core of your business. You must remember that although industrial research will produce more powerful machines and fantastic new images, the observation and rational assessment of a physician cannot be replaced. Contact with the patient must always be kept alive, as this kind of relationship could focus your attention on some specific signs that are undetectable with any exam. Even if you become a famous radiologist, never forget the importance of talking and listening to a patient. I know that all your dreams will become reality. Matteo

H-13

An illuminating blunder
I. Merli; *San Donato Milanese/IT*

Which one of these was my first x-ray? The first one I ever saw when I was in the ward of pulmonology or the one I saw during my first radiology lesson? Neither: it's the first one I actually felt was mine. My first x-ray was a brain CT scan; I was asked to report it as an exercise. I usually follow the radiologist as he/she reports images and every day I try to improve my skills in detecting findings. This opportunity to report like a real radiologist gave me the ability to check what I had learnt during the period I spent in the Unit of Neuroradiology. I understood that the saying 'you can only see what you know' is true. If you are sitting near the radiologist, everything seems to be easy to find. When you are alone with the image you can only count on your own knowledge. When I started looking at the images I was immediately impressed by an area of hyperdensity in the right temporal lobe. I was so excited by my discovery of the lesion that I was dazzled by it and I didn't see a small hyperdense area in the left cerebellar hemisphere. The correction of my report's proof showed me my mistake. Because of this experience, I now understand that it's important to focus on every centimetre of the image, without being influenced by previous findings. This approach to the radiological image is crucial in order to avoid making a blunder.

H-14

Radiology as seen by Romanian medical students: guidelines for the future
I.S. Margineanu; *Iasi/RO*

Background: The author's experience as a medical student and radiology professor has given him a unique ability to develop questions and search for solutions on how students view the radiological specialties and curriculum in Romania. Purposes: To determine the impact of exposing medical students to medical imaging during the second year of their clinical rotation on their perception of this specialty. To take the results and improve the current situation of radiology in Romania in order to offer medical students the best possible assistance for the future and also a comprehensive experience of what it means to be a radiologist. Materials and Methods: The study was divided in two phases. In phase one, a group of 65 students were given an essay-based questionnaire with 14 items concerning their knowledge of the field of radiology and the radiology module's impact on their clinical study and their future profession. The responses underwent qualitative analysis in order to develop the multiple-choice questions needed for phase two. This questionnaire will be given to all fifth and sixth year students and all radiology residents in Iasi, Romania. The results will be quantitatively analysed using SPSS. Phase one Results: Out of a total of 65 questionnaires, nine were incomplete. We performed a frequency analysis on the remaining 56 and eliminated all answers with a prevalence of less than three. We qualitatively analysed the answers and constructed a 23 multiple-choice item questionnaire. Phase Two: The questionnaires will be distributed to all fifth and sixth year students and all radiology residents in Iasi, Romania. The goal is to have at least 350 completed questionnaires in order to create a useful statistical analysis for developing solutions to the identified problems.

H-15

Imaging professionals of the future: how can tasks be distributed?
J. Lackó; *Debrecen/HU*

Purpose: The appearance of highly differentiated medical imaging devices demands the specialisation of those who work in radiology. Two types of experts are needed for acquiring images and diagnosing diseases properly: radiographers specialising in the operation of the devices and radiologists who evaluate the images. We aimed to compare both professions to each other emphasising, equally, their strengths and weaknesses. Methods and materials: Our research is based on the latest statistics available, studies on the training syllabi at our institution (University of Debrecen, Hungary), the experiences of our current and future colleagues and eventually, our own surveys. We found that radiographers obtain the necessary clinical practice and skills during their bachelor training, while r future radiologists mostly receive this during their postgraduate specialist training. The theoretical training makes a radiographer capable of understanding, deeply, the procedures of imaging, performing examinations independently, and operating the equipment securely. Radiologists are competent in evaluating the prepared images professionally and making a differential diagnosis. A radiographer's knowledge includes general physics and radiology, while a radiologist's includes a wide range of specialised topics in radiology and medicine. However it is important to broaden the radiographer's expertise in securely recognising pathologies. This could lead radiographers towards a new type of specialised imaging. The process of specialisation should consist of joint radiographer-radiologist image evaluation, unified educational materials, programme packages on computer-assisted learning methods and a standardised exam question bank. Problem-based learning can fit both bachelor and masters training. Conclusion: Training radiographers is a must and is gaining increasing acknowledgement. However their job requires close cooperation with their radiological colleagues and vice versa. These sister professions have a common purpose; treating patients in a specialised, appropriate and professional manner.

Saturday, March 3, 10:30–12:00, **Studio 2012**

Student Session 4

H-16

Radiologic diagnostics and surgical management tactics of craniosynostosis
U. Poznaka; *Riga/LV*

Purpose: The primary aims of the research were to identify the incidence of craniosynostosis in Latvia, as well as to compare it with data from other countries, to evaluate performed radiological examinations, and assess surgical strategy. Hypothesis: Use of multi-slice CT with 3D reconstructions for diagnosis of craniosynostosis noticeably improves early detection of this pathology and the possibility of surgical treatment planning. Materials and methods: The study was performed using medical reports from the Children's Clinical University Hospital within the period from January 2000 to December 2010. During the retrospective study 85 case histories of craniosynostosis patients were analysed, as well as the performed radiological examinations. Results: Overall, craniosynostosis was diagnosed in 85 patients. Incidence in Latvia is 1 per 2800 live births. Since 2005, with the application of multi-slice computed tomography with 3Dreconstructions the number of diagnosed patients increased noticeably from 2.7 to 12.7 patients yearly. Fifty-six nonsyndromic and 11 syndromic cases of craniosynostosis were detected. Nonsyndromic craniosynostoses consisted of sagittal synostosis - 46.6%, multisutural and metopic synostosis both comprised 16.4%, coronal synostosis 11%, lambdoid 6.8% and temporoparietal synostosis 2.7% of cases. Only in 3 of 11 syndromic synostosis cases was the diagnosis proven genetically. There was not a single case of craniosynostosis diagnosed prenatally. The most common age of patients' age at diagnosis was 4 months. Surgery was performed in 51 cases. Conclusion: The radiological diagnosis of craniosynostosis in Latvia is not comprehensive but rather qualitative. In all patients the diagnosis was based on the results of CT imaging. Since 2005, with the beginning of the application of multi-slice 3DCT, the number of diagnosed patients increased noticeably. The surgical management of craniostenosis in Latvia corresponds to the common concept.

H-17

MR image quality and correction methods

W. Alsharif; *Dublin/IE*

MRI is a major tool in the field of diagnostic imaging. However, there are several factors which could affect MR image quality and they appear for a variety reasons. Potential sources of which include hardware characteristics, intrinsic tissue properties, and sequence parameters. Therefore, it is essential to choose the pulse sequence with accurate imaging parameters, because those represent a vital factor in diagnostic techniques. Furthermore, optimum image is a compromise between the SNR, CNR, Spatial Resolution, and their own affected factors, and many artefacts could appear because of them. However, in some cases it could be corrected and mitigated to improve the image quality. Methodology: In this study we have quantitatively analysed the impact of alteration in the imaging parameters of image quality in T2W – FSE- axial plan MR imaging. In this case FSE was used as the baseline scan time for FSE was faster, because several sequences were acquired from the same volunteer during one session. 1) Acquire the baseline T2W FSE sequence – standard optimised parameters. 2) Run the sequence as per 1) above, except reduce the TR. 3) Run the sequence as per 1) above, except reduce the TE. 4) Run the sequence as per 1) above, except reduce the number of acquisitions. 5) Run the sequence as per 1) above, except reduce the slice thickness. 6) Run the sequence as per 1) above, except reduce the FOV. 7) Run the sequence as per 1) above, except reduce the matrix. Result: There are several factors which affect MR image quality. However, there are numerous correction methods which could improve the MR image resolution to facilitate evaluation and diagnosis of abnormalities. These methods include choosing sequences, scanning procedure, hardware, and parameters.

H-18

Flow phenomena – A case study of time of flight imaging

A. Rácz; *Budapest/HU*

Time of flight (TOF) Magnetic Resonance Angiography (MRA) is a non-invasive, non-radiation-based, non-contrast, high-resolution technique with high negative predictive value which is a widely used technique for visualising cerebral arteries. Despite its limitations it helps us a lot in daily practice.

TOF angiography is based on exploiting the flow phenomena of excited particles in the vessels. This movement of longitudinal magnetisation can be detected as signals. Thanks to the acquisition of thin slices and isotropic voxels TOF MRA gives us a 3D image. This enables high quality and better spatial resolution and post-processing options such as multi-planar reconstruction and volume rendering. In some clinical settings the gold standard digital subtraction angiography (DSA) can be replaced by 3D TOF MRA.

Through many cases we have shown how 3D TOF angiography is ideal for visualising the intracranial vessels and its anomalies. In everyday neuroradiology 3D TOF is used to diagnose aneurysms, cerebral artery anomalies, and developmental venous anomalies. On the other hand it sheds light on rare, but clinically important cases such as inflammatory and degenerative angiopathies, post-operational follow-up of aneurysms or patients who underwent carotid artery stenting, and also plays an important role in the cerebrovascular imaging of children.

3D TOF is a non-enhanced, high resolution MRA technique that enables the high quality imaging of cerebral arteries and many arterial anomalies, common ones as well as rare ones too. Because of its high negative predictive value it is very reliable in certain clinical cases and therefore can replace the gold standard DSA.

H-19

eReader usage in education

N. Zdanovskis; *Daugavpils/LV*

Technology develops so fast that we can't always keep up with it. Technological innovations enter into our life and it is important that we know how we use them. At present eReaders are becoming more and more popular. The advantages of eReaders are: 1. eReaders vs Books: Students who study medicine have to read a huge volume of books and, usually books take up a large amount of space on a desk. With an eReader it's not a problem – most only take up the same amount of space as one book. 2. The price of eReaders and eBooks: As the popularity of eReaders grows and competition between manufactures develops the prices should get lower. Now prices are between $69 to $300, depending on the specifications of the eReader. eBooks are 10% – 40% cheaper than conventional books. 3. Convenience: Instead of going to the bookstore or ordering books on the web, it's possible to get books in a few minutes using Wi-Fi and an online book store. 4. Access to eLearning systems: Many eReaders have internet browsers and thus the ability to access every eLearning system on the web. 5. Additional educational materials: Additional materials for education – presentations, documents, educational videos, and more – can be accessed easily and saved on an eReader. 6. Additional properties: Calendar- Develop sync software with eLearning systems in order to be informed of the latest updates. Dictionary: Problems understanding other languages? It's not a problem if you have an eReader. 3D atlases. Students can get a better understanding of many disciplines (anatomy, traumatology, radiology, endocrinology etc.) and many others. To sum up then, instead of handing out tonnes of books each year, a university could hand out one eReader to every student. In the long term it would pay off and could be a great educational innovation to improve the quality of education.

H-20

Impact of robust image processing to reduce errors in computational haemodynamics

A. Joao; *Lisbon/PT*

Purpose: Cardiovascular diseases are associated with a number of factors that include biochemistry, haemodynamics and genetic predisposition. These factors are specific to each individual and it is important to accurately represent patient-specific information in order to assess patient state at diagnosis and prognosis stages. Here we focus on the effects of uncertainty in clinically acquired medical imaging on variability in the reconstructed vessel geometry, and this error propagation in computed haemodynamics. Methods and materials: The effects of filtering, contrast enhancement and segmentation of medical images are examined with relation to changes in the reconstructed geometry. The images used include MRI and CT data sets, largely focused on the cerebral vasculature. Different image processing methods are chosen and tested, and the most suitable combination of approaches is discussed. Numerical simulations of haemodynamics are performed and the impact of variability in the vessel geometry is considered with respect to flow parameters commonly associated with disease: transport and stresses on the vessel wall. The discussion therefore has a clinical relevance. Results: Results indicate that image pre-processing can substantially alter the quality of the image and improve vessel extraction. This removes a certain level of uncertainty from the segmentation process. Nevertheless, care must be taken to choose appropriate and robust schemes. Results of computational haemodynamics are presented with error bars. Conclusions: Automatic procedures for medical image processing and geometry reconstruction are important for analysing clinical data. Robust schemes are proposed, reducing the effect of errors on subsequent analyses and post-processing.