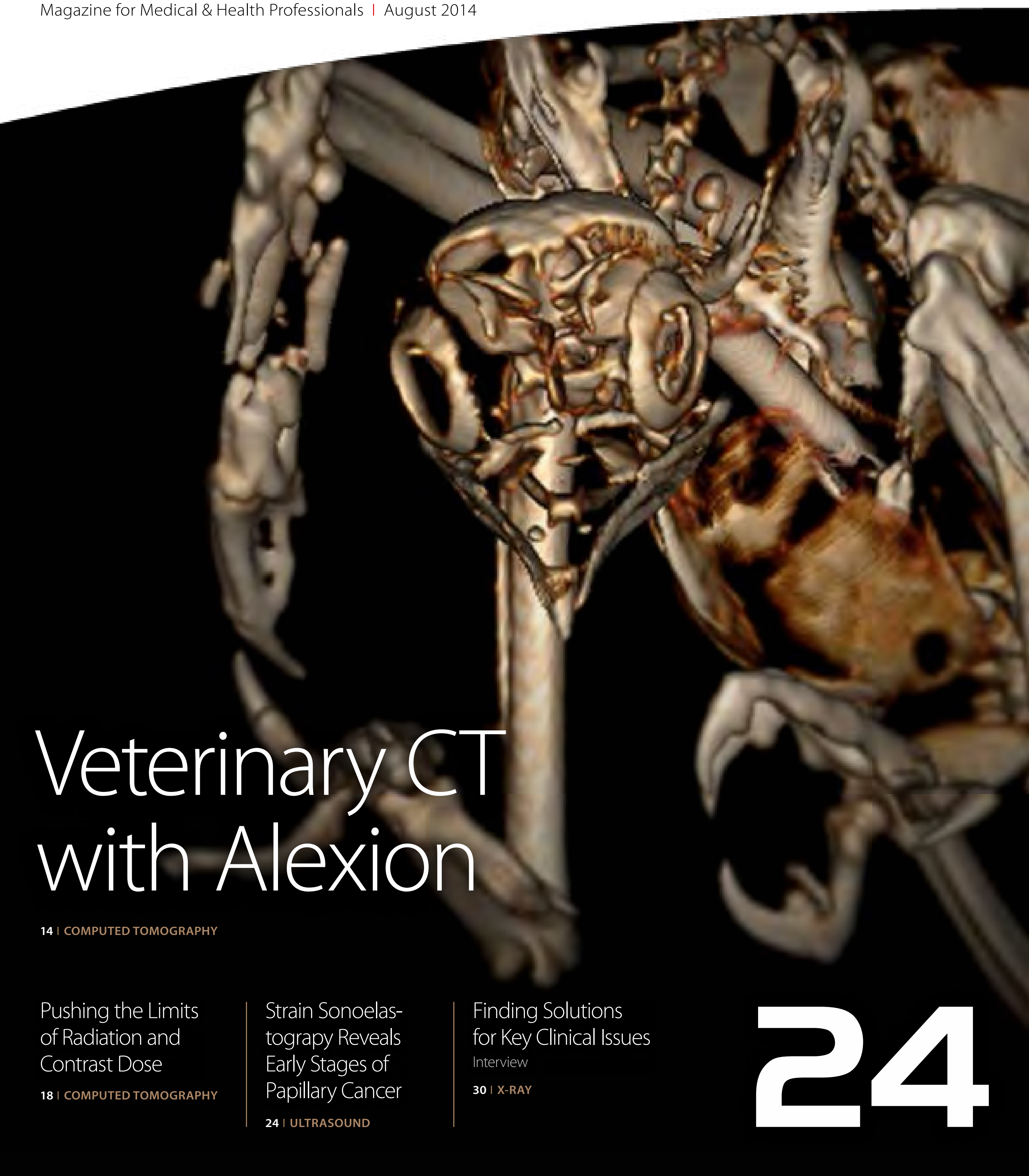
TOSHIBA
Leading Innovation >>>

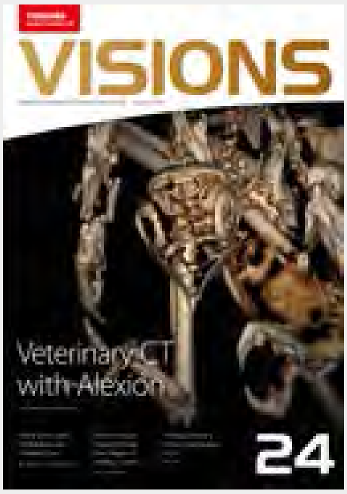
VISIONS

Magazine for Medical & Health Professionals | August 2014



Veterinary CT with Alexion

24



24

CT image of a wedge-tail eagle with fractures wing
(read more on page 14)

Imprint
VISIONS magazine is a publication of Toshiba Medical Systems Europe (Toshiba), and is offered free of charge to medical and health professionals. The magazine is published twice a year but is also available as an online portal. News items and articles are announced, pre-publication, via social media in dedicated groups. Toshiba stores data of readers and users, as far as known, of the online VISIONS portal. This data is used to send out the magazine and inform about new developments in the clinical market. Users can customize their preferences or opt-out in the online VISIONS profile at www.toshiba-medical.eu/visions.

Publisher
TOSHIBA Medical Systems Europe B.V.
Zilverstraat 1
NL-2718 RP Zoetermeer
Tel.: +31 79 368 92 22
Fax: +31 79 368 94 44
Web: www.toshiba-medical.eu
Email: info@tmse.nl

Editor-in-chief
Jack Hoogendoorn (jhoogendoorn@tmse.nl)

Modality coordinators
CT: Roy Irwan
UL: Joerg Schlegel
XR: Jaco Terlouw

Design & Layout
Boerma Reclame (www.boermareclame.com)

Printing
Quadraat Printmedia (www.quadraat.nl)

Text contributions
"Safety of Clinical Staff and Patients are our Top Priority"
by The Creative Practice (www.thecreativepractice.com)

Subscription Service
www.toshiba-medical.eu/visions

© 2014 by TOSHIBA Medical Systems Europe
All rights reserved

ISSN 1617-2876

FSC
www.fsc.org
MIX
Papier van verantwoorde herkomst
FSC® C020308

Follow us

Dear reader,

One morning in 1909, Henry Ford announced that he wanted to build a single model of car - the Model T - with a chassis that would be exactly replicated in all cars. In addition, he remarked: *"Any customer can have a car painted any color that he wants, so long as it is black."* [1] In the context of the subsequent emergence of the era of mass production, this would appear to have been a logical statement, but there has been a paradigm of change since then, and a quantum leap in terms of how we view our business activities and relationships today. Now, it is of paramount importance to explore customers' needs in detail and align how and what we provide to meet specific customer demands.This philosophy also permeates the automotive industry, judging by the increasing number of TV-commercials that promote the possibilities in customized or personalized cars.

At Toshiba Medical Systems, we have internalized the practice of continuously listen to the needs, desires and wishes of those working in the clinical environment. Combined with our *Made for Life* business philosophy, we strive to maintain lifetime partnerships; honoring our pervasive commitment to deliver customer-focused solutions all over the world.

It enables us to develop top quality CT, ultrasound, MRI, and X-Ray diagnostic imaging systems, as well as a myriad of associated services, in the closest collaboration with medical professionals and research institutions located across the globe. We also prioritize close partnership with many renowned experts and hospitals around the world in carrying out scientific studies. As seen, for example, in the CorE64 Multicenter Trial to assess Coronary Artery CT Angiography (CTA) performed with the Aquilion™64 CT scanner compared with conventional, catheter-based Coronary Angiography. This large study was completed by leading clinical professionals from nine leading medical centers located in seven different countries. You can read a summary of the results of the study and their clinical implications in this edition.

Simply said: Toshiba's advanced products, systems and technologies – with exceptional image quality, enhanced clinical safety and improved patient care – clearly reflect a direct translation of our customers' needs and the effectiveness of the partnerships already established between Toshiba's Engineering Team, our customers and other leading global specialists. Long-lasting business partnership shapes our core.

Kind regards,

Jack Hoogendoorn
Sr. Manager Marketing Communications
Toshiba Medical Systems Europe BV

[1] Autobiography Henry Ford:
"My Life and Work" (1922) Chapter IV, p. 71
http://tinyurl.com/ok9ghyj

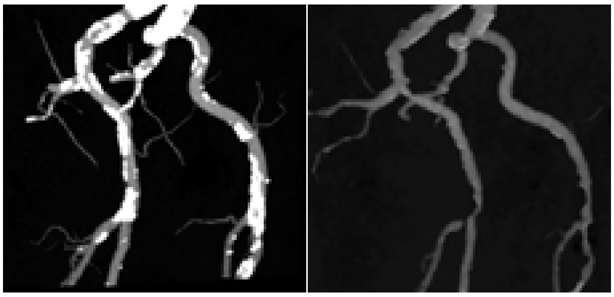
CONTENT

21 A reporter for VISIONS Magazine was allowed to see what goes on during medical checks at lotto-belisol.

30 How X-Ray offer provides solutions for current and future imaging needs through consistent groundbreaking innovations.

©2014 TOSHIBA MEDICAL SYSTEMS

46 Following from the work of the 2011 APEX 3 expedition, the APEX 4 study will improve understanding of fatal conditions



51 Toshiba has developed SURESubtraction™ Ortho software which uses a sophisticated deformable registration algorithm to remove not only bone in clinical images but calcifications and stents as well.

59 CorE64 summary of results and their clinical implications.

NEWS

The Science Picture Company Launches New Pregnancy App for iPad, 'Life in the Womb'

The Science Picture Company Developed a pregnancy app for iPad which enables expectant parents to follow their baby's journey from conception to birth. Life in the Womb is a stunning visual guide to pregnancy that explores the week-by-week progress of the developing baby using beautiful 3D generated imagery.

Long before a baby's first step, first word or even first smile they will experience a wealth of sensations from the safety of the womb. Using a combination of illustrations, animations and interactive 3D features, Life in the Womb beautifully illustrates these moments and milestones through the 40 weeks of pregnancy.

For mothers and fathers-to-be, the app brings this amazing journey closer than ever by illuminating key events including the baby's first time seeing, tasting, hearing, kicking and even the first heartbeat all with incredible clarity and beauty.




First Hospital in Austria to acquire the Toshiba Aquilion ONE™ / ViSION Edition

Krankenhaus der Elisabethinen, Linz is the first Hospital in Austria to acquire the Toshiba Aquilion ONE™ / ViSION Edition CT Scanner. The hospital exchanged an old Toshiba CT Scanner for the new state-of-the-art technology from Toshiba. The Aquilion ONE / ViSION Edition offers all patients a successful examination, with the lowest possible radiation exposure and the highest quality diagnostic outcomes.
The team of Prim. Dr. Manfred Gschwendtner is looking forward to working with the new Aquilion ONE / ViSION Edition CT Scanner, which represents a quantum leap in the quality of patient treatment.

©2014 TOSHIBA MEDICAL SYSTEMS

First relocatable MR ELAN system in the UK

Toshiba has taken all expertise, experience and passion for excellence and put them into the first self-loading relocatable MRI system in the UK. This innovative relocatable MR system will be used to ensure Toshiba's service levels are maintained as the highest in the industry. The unique unit is designed to make the scanning process easy, comfortable and quick with users and patients in mind and offers the patient and clinician almost 50% more space than conventional mobile MRI units.

The inspirational interior design aspects include; ambient lighting, visual displays on walls and ceiling, Freeview TV and sound system, as well as hot and cold running water. An MRI compatible wheelchair and patient transfer gurney/PAT slide are included with the unit.

Reinforcing Healthcare Systems & Services Businesses

Toshiba Corporation increases acceleration and expansion of its healthcare business by consolidating Toshiba Group's healthcare-related businesses in a new in-house company, the Healthcare Company. As the global population continues to rise and the developed economies continue to see the graying of society, the healthcare market is expected to show continuous growth in coming years. The Healthcare Company will position Toshiba to grow with the market.

The new company will integrate a wide array of know-how and technologies and deploy them to promote business in following key areas: *Diagnosis & Treatment*, which will explore new generations of diagnostic imaging in addition to current systems; *Prevention*, which will aim to reduce the risk of disease; and *Convalescence & Nursing Care*, which will aid people in recovering from disease and injury. On its establishment, the new in-house company will be around 9,000 people scale.

The Healthcare Company will integrate Toshiba's current Healthcare Business Development Division, the carbon iron radiotherapy system currently handled by the Power Systems Company, the Materials & Devices Division's DNA analysis system, and other healthcare businesses from across Toshiba Group.

Toshiba Medical Systems Corporation (TMSC), which develops and markets diagnostic imaging systems, including computed tomography, ultrasound, X-ray, magnetic resonance imaging systems, and medical IT systems, will be positioned as a subsidiary of the Healthcare Company. With global experience spanning more than 135 countries, TMSC will contribute a strong customer base and business assets that will support the new company in integrating and aligning its business operations.

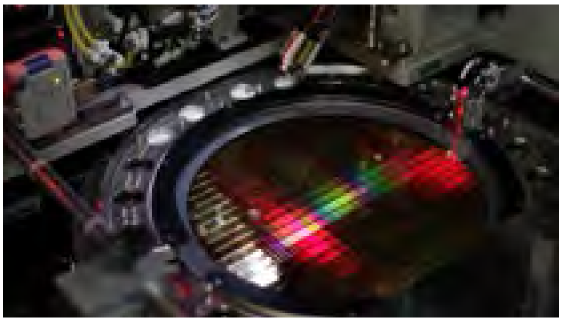
In July 2013, Toshiba defined Healthcare as third major pillar of business, alongside Energy and Storage, and in February 2014 the company announced its strategies for the healthcare business and a fiscal year 2015 sales target of 600 billion yen (approx. UD$6 billion). In keeping with this commitment, Toshiba has now decided to unify all of its healthcare businesses into the new in-house company. By promoting "New Concept Innovation," the Healthcare Company will bring together the wide-ranging technologies of Toshiba Group to create unique, innovative products and services, and to reinforce and expand its business via diverse sales channels.

NEWS

TOMODACHI Toshiba Science & Technology Leadership Academy

'Extremely welcoming' and 'Hot', first impressions from US high school students who arrived in Tokyo yesterday for the inaugural TOMODACHI Toshiba Science & Technology Leadership Academy. Over the next week, eight American students and eight high schoolers from Japan, supported by 4 teachers from the States and 5 Japanese teachers, will use their wits, knowledge and know-how to take on the challenge of envisaging a resilient smart community of the future.

High-performance storage



One of Toshiba's most globally renowned semiconductor products is the NAND flash memory. Since its invention in 1987, NAND technology has continued to be refined and improved over the years. NAND flash memory is a high-speed, high-performance storage device used in mobile phones and digital cameras.

Green Ozone Generator Produces Safe Water

Environmental pollutants called trihalomethane can affect the smell and taste of tap water. Public concern over these pollutants has also increased demand in the waterworks industry to produce safer and better tasting water. Toshiba offers multiple solutions to meet the needs of our waterworks customers in providing safe and secure water. Our Green Ozone Generator, TGOGS™, is a new entry in the field.

Toshiba partners to create a Real-World Smart Home

Toshiba, Sekisui House and Honda worked together to build an experimental two-household family home in Saitama, Japan. The house is being used as a field test of the newest technologies in IT, personal mobility, and sustainable energy management. In this test, a two-generation home has been set up where all energy usage by both households can be centrally controlled. We envisioned a home offering a lifetime of comfort and sustainability, along with the goal of zero carbon emissions by the year 2020. This model home is being used to test and verify technologies for future lifestyles by putting them into practical use. A video describes the project in more detail. http://tinyurl.com/n38uz4k

©2014 TOSHIBA MEDICAL SYSTEMS

Breath Analyzer for Medical Applications

A prototype of a compact breath analyzer has been developed by Toshiba that can detect a wide range of trace gases in exhaled breath. The analyzer has the potential to provide analysis that can be applied to health monitoring and diagnosis of disease.

Exhalations of breath carry trace amounts of gases that can be used in diagnostics. For instance, the presence of acetone may indicate diabetes, while methane provides clues as to the condition of the intestinal environment. Toshiba recognizes the analyzer as a promising tool along a continuum ranging from diet and exercise advice to disease diagnosis.

In order to develop the capabilities of the new analyzer, Toshiba has commissioned Waseda University, one of Japanís leading research universities, to undertake clinical measurements of acetone concentrations in exhaled breath and to correlate the results with fat metabolism, an approach that may advance understanding of how to develop diets and food supplements. The research has started on April 1st. See the YouTube video at: **http://tinyurl.com/pe9l2ob**

Follow us

for the latest news:

https://www.youtube.com/user/ToshibaMedicalEurope

https://plus.google.com/116571489645577418994

https://twitter.com/toshiba_med

https://www.facebook.com/ToshibaMedicalSystemsEurope

http://www.linkedin.com/company/toshiba-medical-systems-europe

http://www.slideshare.net/toshibamedical

Unlike conventional lithium-ion rechargeable batteries, SCiB™ (New rechargeable battery) use Toshiba's proprietary oxide material in the anode. This new type of storage battery not only features superior safety and quick-charging performance but also boasts longer life, low-temperature properties, high output and more energy that can be actually used.

NEWS

Artist impression of the new manufacturing facility in Malaysia

Toshiba Established Malaysia's First Manufacturing Base

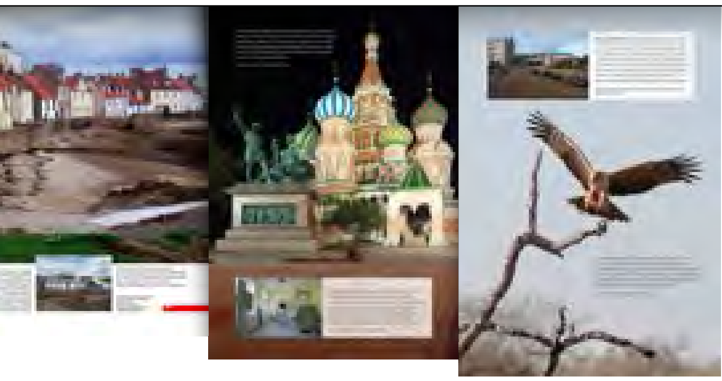
Toshiba established a new manufacturing company as a wholly owned subsidiary in Penang, Malaysia. This subsidiary will be Malaysia's first diagnostic imaging systems manufacturing base. It will be Toshiba's third manufacturing base outside Japan, following the bases in Dalian, China, and Campinas, Brazil. This new manufacturing base will be involved in the production of diagnostic ultrasound systems and printed wiring boards.

Toshiba to Commercialize Vegetable Production at New Plant Factory

Toshiba will add a new dimension to its healthcare business by starting production of pesticide-free, long-life vegetables in a closed-type plant factory that operates under almost aseptic conditions*. The company has begun construction of the plant factory at a facility in Yokosuka, Kanagawa prefecture, and will start shipping lettuce, baby leaf greens, spinach, mizuna and other vegetables in the second quarter of FY2014.

Building on its global presence in CT and other diagnostic imaging systems, Toshiba is promoting a healthcare business that combines technologies and know-how from across Toshiba Group to support the development of a society where people can lead healthier and happier lives. Promoting good health and a better living environment is integral to these efforts, and Toshiba is focusing its attention on improving food, water and air quality.

*An environment where germs on vegetables are about 1/1000th of the level typical for vegetables grown in soil.



The page on the right is part of the VISIONS Photo Page Series reflecting an eye for the beauty of our planet, the environment and the direct surroundings where Toshiba's systems are installed by Toshiba and its customers. Not the actual imaging products but photos of sceneries, cities, countries or other cultural aspects are highlighted on this photo page.
The Photo Page is based upon an idea of Prof. Edwin van Beek.
Every reader of VISIONS can participate and get their picture published. The submitted content should include: high resolution (300dpi) image, photo of the hospital and a brief text, name of photographer and Toshiba system(s) installed. The complete result is shown on the opposite page.

Send your pictures and texts to: jhoogendoorn@tmse.nl, Subject: Photo Page

©2014 TOSHIBA MEDICAL SYSTEMS

Bristol Royal Hospital for Children

The Bristol Royal Hospital for Children (BRHC) provides a local service for Bristol children and a referral service for specialist care for families across the South West and nationally. The hospital has a Toshiba Aquilion ONE and Ultimax-I Hybrid DRF in operation.

Text Source: www.uahbristol.nhs.uk - Photography: Jaco Terlouw

Bristol Harbour, United Kingdom, covers an area of 70 acres (28.3 ha). It has existed since the 13th century but was developed into its current form in the early 19th century. The harbour is a tourist attraction with museums, galleries, exhibitions, bars and nightclubs.

Text Source: Wikipedia – *Photography: Jaco Terlouw*

PRESIDENT'S MESSAGE

"We always keep our customers first."

It is a great honor to have been appointed as President and CEO of Toshiba Medical Systems Corporation.

I have been involved in the healthcare business of Toshiba Group since joining Toshiba Corporation in 1980. I began my career as an engineer, and have had experience in business planning, overseas operations, domestic sales and global marketing.

Additionally, I have dedicated myself to strengthening and expanding our medical systems business through corporate acquisitions and strategic alliances. Passionate about increasing Toshiba's presence in this market throughout the world, I know this is only possible with the help of our customers, who are equally passionate about improving patients' quality of life. This goal is shared with all employees in Toshiba Medical Systems Group and symbolized by our "Made for Life™" corporate philosophy.

In our CT business unit, providing solutions to our customers' clinical challenges has been the focus of our recent CT activities. Adaptive Diagnostics are a suite of technologies unique to Toshiba to improve patient care for our customers utilizing the registration algorithms developed at TMVS, subtraction applications remove bone, calcium and stents from CTA examinations and provide blood flow maps of the lung parenchyma. Single Energy Metal Artifact Reduction (SEMAR) improves visualization in patients with metal implants. The innovative vHP (variable Helical Pitch) and SURECardio Prospective scan modes makes complex examinations easier and allow diagnosis to be made in all patients. Volumetric dual energy provides an elegant solution for the classification of renal stones and gout. All these unique solutions improve workflow and reduce time to diagnosis for a wide range of patients.

Our X-ray business unit has introduced DTS (Dose Tracking System), which has been covered previously in VISIONS Magazine. This technology was introduced at RSNA 2013, and customers are showing strong interest in systems combined with DTS ever since. The number of Toshiba angiography systems with DTS is increasing globally, and they are being used to effectively monitor patients' cumulative X-ray dose.

Due to the increasing rates of cancer, there is rising demand for Angio-CT, and many customers are considering the option of installing such systems in their hospitals. We have more than 20 years of experience as a leader in the Angio-CT field and maintain a broad network among doctors. The new line-up, with the latest technology, was introduced as WIP at ITEM/JRC 2014 in Japan in April, and a workshop was held during APCCVIR2014 in Singapore in May.

In our MRI business, Vantage Elan™ has gained an excellent reputation in Japan with 14 sites fully operational in just three months since the first shipment. We are confident that Elan's small footprint and short installation time make it well suited for the European market as well, where installation conditions are similar to those in Japan. Our MRI business unit will continue to focus its efforts in the following areas: maximizing the lifetime value of the system by optimizing installation plans; reducing energy consumption; applying the latest technologies, such as "CardioLine", which assists in the positioning of six standard cardiac MRI planes to ensure that consistent results can be obtained by any operator without difficulty; and installing noise-reduction technology on all our MRI systems. In addition, we will fulfill our commitment to more patient-oriented healthcare by continuing to improve non-contrast imaging, a technology we are proud to have pioneered.

For Ultrasound, SMI (Superb Micro vascular Imaging) technology has been well accepted by the customer. Since our introduction of this technology in VISIONS Magazine, many lectures and discussions have been undertaken. We have featured SMI at ECR2014 in March, JRC2014 in April and many other ultrasound congresses and exhibitions globally. Customers are integrating SMI into their daily routines as a valuable tool. Here is a testimonial from one of our customers; "SMI has genuinely stunned us with its ability to show small low flow vessels at high resolution. We have found it immediately useful in such areas as characterization of liver lesions, evaluating uniformity of scrotal blood flood flow, and identifying segmental renal under perfusion. It is very likely to reduce the need for CEUS in some situations and it will become a routine clinical tool." (Robert N. Gibson, Professorial Fellow, Department of Radiology University of Melbourne, Royal Melbourne Hospital, Melbourne, Australia).

Finally, in our advanced visualization business, ever since the acquisition of ViTAL Images Inc., in 2011, we have focused on promoting healthcare informatics and advanced visualization businesses. In a recent activity, we combined ViTAL's office with the Headquarters of Toshiba Medical Systems Europe, located in Zoetermeer, Netherlands in January with the purpose of strengthening teamwork in order to improve customer satisfaction. We have also added a new item to the Vitrea family, Vitrea Extend. This is a workstation product which enables up to three concurrent users by adding a client to the host PC. This is an ideal workstation for multi-user and multimodality purposes, and is a perfect choice as an informatics solution for hospitals.

Toshio Takiguchi
President and Chief Executive Officer
Toshiba Medical Systems Corporation

Minimize. Visualize.

By focusing on low dose, high-quality imaging technologies for accurate diagnosis and treatment, Toshiba continues to improve the quality of life for all people.

Veterinary CT with Alexion

Elizabeth Davies [1)]

Elizabeth Davies

"You want to scan what? ... No worries!" This is what Mark, the veterinary radiographer has been able to say since the installation of his Toshiba Alexion™ CT scanner. The scanner was installed in the new Veterinary Clinical Centre at Charles Sturt University. I was lucky enough to provide CT Applications during the installation of the Alexion CT scanner and then return to support the installation of the Artec Equine table and Vital's VES thin client.

VETERINARY CLINICAL CENTRE

The CSU campus is located on the outskirts of Wagga Wagga, a small city in country Australia. It incorporates a small animal centre and the new equine centre. There are currently seven equine vets, four equine residents, six small animal vets, two small animal residents and four anaesthesiologists.

The imaging provided includes two small and one large animal x-ray room, the Alexion CT scanner, three ultrasound machines, three endoscopy stacks and a full RIS PACS environment. The team perform approximately 1000 horse imaging exams and an equivalent number of small animal exams annually.

The new Veterinary Clinical Centre at Charles Sturt University.

ALEXION CT INSTALLATION

The Toshiba Alexion 16 slice CT scanner was installed in 2012. This scanner has the same slice configuration as a standard 16 slice, remembering that all Toshiba systems have a 0.5mm detector; this is still the markets smallest detector and gives an isotropic voxel size of 0.35mm

The picture, top right, shows the Alexion in its new scanner room and there are some obvious differences between this and its human counterpart... The huge doors leading out into the stable yard, the Artec table and the aneasthetic machine which is a permanent fixure in the room.

SPECIAL ANIMAL MODIFICATIONS

My second trip to Wagga Wagga was to support the installation of the Artec Equine table. The designer of

Alexion CT room with special table and anaesthetic machine.

the table was also on hand as well as a plethora of vets, vet nurses and anaesthesiologists. This table attaches to the standard Toshiba couch using a magnet and special guide rails on the floor. The tug is an integral part of the CT procedure as horses do weigh a lot, as does the table! Some tricky manoeuvring is needed to line up the groove in the wheels with the floor guide.

The specially designed CT table for horses.

Once the table was assembled, complete with many cushions the anaesthetised horse was winched on. Horses are actually very fragile, also they cannot be recumbent for long and the limit of anaesthesia is 2 hours.

1) Toshiba Medical Systems, Australia

©2014 TOSHIBA MEDICAL SYSTEMS

The first patient was a 312kg horse which was placed supine on the table, which was then coupled to the scanner via the magnet - and it is surprising how small this is considering the weight being moved and the accuracy of table movement required, for both image quality and horse safety.

Once table and couch are connected the next job was centring the horse and ensuring the knees were not going to hit the gantry. We knew that scanning direction had to be out of the gantry and we learnt that one scanogram with a Vari Area (one slice to calculate DFOV) was best practice. We also discovered that the scanogram range had to be limited to 550mm or the table lost connection with the magnet.

CT PROTOCOL MODIFICATIONS AND THINKING IN THREE DIMENSIONS

Both installations were big learning curves for both myself and the vets. CT protocols, algorithms, and windowing all being adapted for small and large companion animals and horses. Mark and I made full use of the paediatric SUREIQ's available on the system... it is surprising how small a horse's brain is! Contrast protocols equally fall outside the box, with most access being arterial.

The vets are getting used to thinking in three dimensions. 3D imaging is aiding surgical planning, not only giving a definitive diagnoses, where ultrasound was inconclusive but also directly guiding treatment. Mark is making full use of the volume rendering techniques available both on console and on the VES.

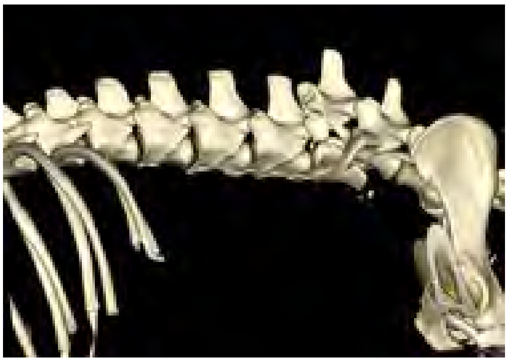
BIRDS, REPTILES AND MAMMALS...

This Pink Eared Duck was one of the first patients to be scanned. Brought into the centre by a WIRES carer with a suspected fractured pelvis. A decision was made to scan the duck, as a fractured pelvis would have led to an unhappy ending. Exquisite 3D images clearly shows there are no fractures and the duck continued to live a happy life.

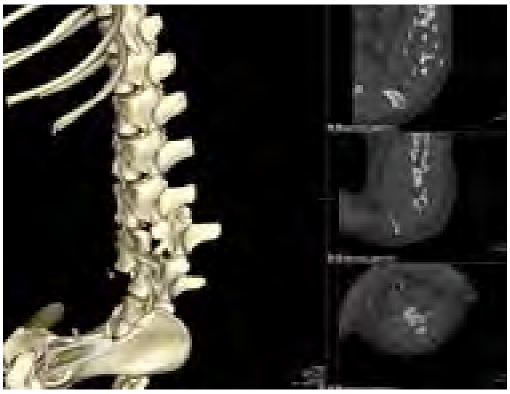
This wedge-tail eagle arrived in a box and was not too happy and with good reason. So it was decided to scan him rather than attempt an x-ray. They left him in the box, scanned on a fast pitch still achieving great image quality but... he has a fractured wing.

Curved MPRs are not just good for spines but tails as well. Here is a lace monitor's tail shown in exquisite detail.

The owner of this Blue tongue Lizard brought her in when it became apparent she was unwell... or actually with eggs...



Here we have Ben, the dog who had an altercation with a bull and the owner got caught up in the foray as well, but had minor injuries, unlike Ben.

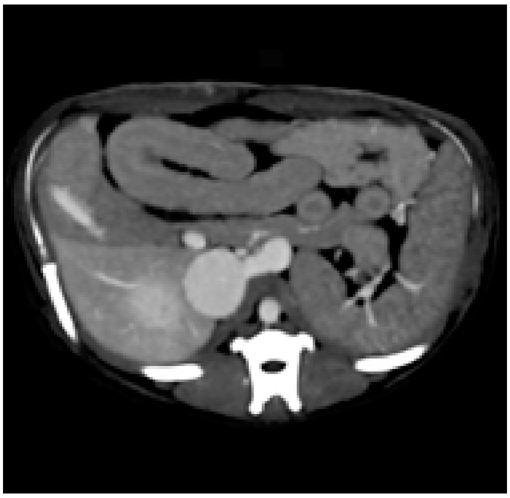


When the vet saw the 3D images of Ben's broken vertebrae on the VES, he decided a different type of plating would have been preferable. However the first plating was a success, as Ben has since been seen leaping a fence! These images will change surgical planning-for the better.

FAMILIAR PATHOLOGY, UNUSUAL PATIENT

Porto-Systemic Shunts

This is Ruby the dog. Porto systemic shunts are an abnormal communication between the portal circulation and other venous vascular systems. This is a common pathology in dogs, causing hepatic encephalopathy, raised bile acids and other abnormalities. Prior to the scanner install ultrasound was used. The vets are now CT scanning dogs with suspected shunts due to the benefits of surgical planning.



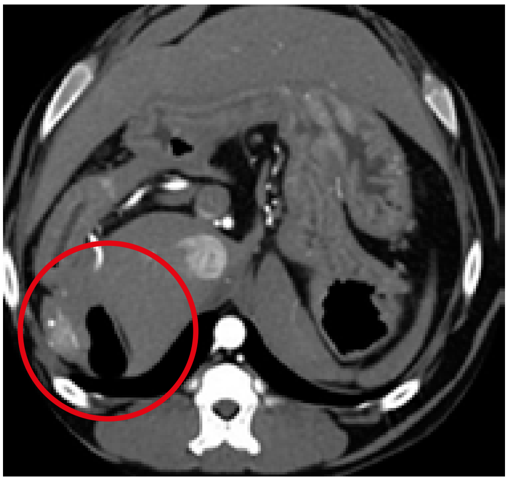
Dogs do not have a SVC and their caudal vena cave is the equivalent to our IVC. This axial and 3D image shows a portocaval shunt and an aneurysmal caudal vena cava. Shunts can be intrahepatic, extrahepatic, single or multiple. Dual phase CTs are performed via a cephalic or jugular vein contrast injection. Timing is difficult with peak arterial enhancement varying considerably between

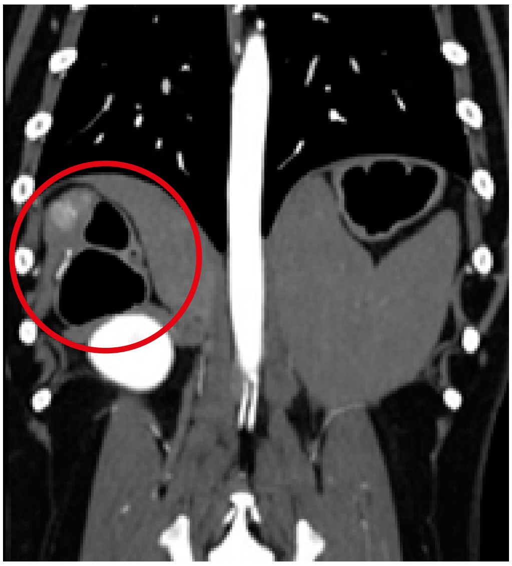
©2014 TOSHIBA MEDICAL SYSTEMS

5-15 seconds post start of injection and portal and caval phases lasting between 25-60 seconds. Mark is experimenting with both SureStart and test bolus technique to gauge timing. Treatment is to clip off the shunt and restore normal circulation.

Insulinoma

This dog presented with a possible insulinoma. Ultrasound was inconclusive, so a three phase liver CT was performed and as we can see the insulinoma was clearly demonstrated.





CONCLUSION

CT imaging in a veterinary hospital is a challenging and rewarding experience. Techniques learned in imaging humans must be adapted for size, both small and large; injection timing must also be adapted for different circulatory systems. Finally the CT scanner must be modified to allow large, heavy animals to be accurately scanned – a new take on bariatric scanning. The Alexion has proven to be more than capable at handling the infinite variety of the animal kingdom from the very small to the very large.

ACKNOWLEDGEMENT

A big thank you to Mark Murray, Veterinary radiographer and the team at CSU Veterinary clinical centre.

Pushing the Limits of Radiation and Contrast Dose with Aquilion ONE Next Generation

Dr. R. Bull [1)]

Dr. R. Bull

The first generation Aquilion ONE™ was installed at the Royal Bournemouth Hospital, UK in May 2009. This revolutionized the service we provided to our patients. It was now possible to scan an entire organ such as a heart or a brain in a single gantry rotation, allowing low dose isophasic imaging for the first time. Subsequent development of advanced iterative reconstruction technologies (AIDR 3D) led to further dramatic reduction in radiation doses with improved image quality for all clinical applications. The first clinical Aquilion ONE™ Next Generation was installed at our institution in November 2013. This new machine has a wider bore (78cm diameter) and substantially improved dose efficiency. This new machine builds on the success of the first generation Aquilion ONE and is now allowing us to routinely scan patients with exceptional image quality using very low doses of radiation and contrast.

ULTRA-LOW RADIATION DOSE

The ultra-efficient detector system in conjunction with AIDR 3D is now allowing us to routinely produce ultra-high resolution, artifact free cardiac and chest images at exceptionally low radiation doses.

In March 2014, data was collected from 59 unselected consecutive cardiac CT studies (including all heart rates and rhythms and all patient sizes with a BMI range of 20-44 and a median BMI of 27.3). Median DLP was 77 mGy.cm equating to an effective radiation dose of 1.1 mSv (k=0.014).

The dose efficiency of the Aquilion ONE Next Generation now also allows the whole chest to be scanned at similar, exceptionally low radiation doses. This has extended the application of CT to young patients as an alternative to more conventional techniques such as catheter coronary angiography and is even starting to replace the conventional chest X-Ray as a first-line test for those with suspected cardiothoracic disease.

CARDIAC

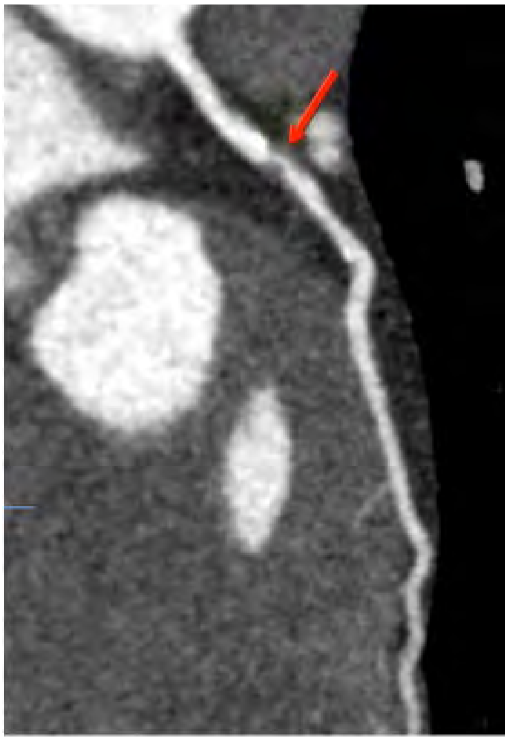


Figure 1: Coronary Artery Assessment BMI 29, Chest Pain. Significant stenosis of the proximal LAD. 0.6 mSv total dose (k =0.014).

[1)] *Royal Bournemouth Hospital Bournemouth, United Kingdom*

©2014 TOSHIBA MEDICAL SYSTEMS

Figure 2: Coronary Stent Assessment. BMI 30, Patent LAD stent. 1.3 mSv total dose (k=0.014).

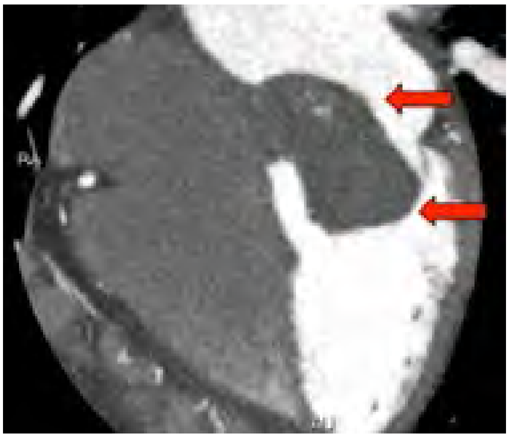


Figure 3: Assessment of Cardiac Mass
BMI 24, Large left atrial myxoma (arrows) seen prolapsing through mitral valve. Total dose 1 mSv (k=0.014).

CHEST

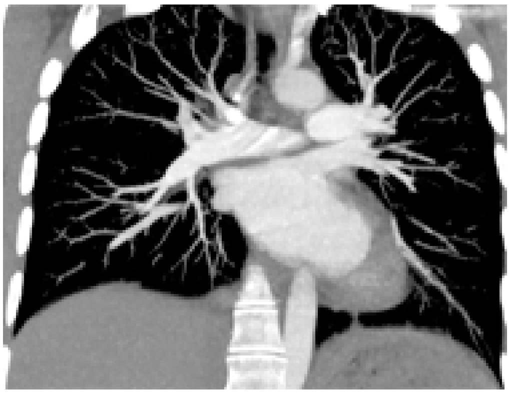


Figure 4: CT Pulmonary Angiogram
Age 19. Chest pain. Normal CTPA, 0.6 mSv total dose (k=0.014).

Figure 5: Ultra Low Dose Chest
Age 25. Chest CT showing excellent lung detail. 0.09 mSv total dose (k=0.014).

ULTRA-LOW CONTRAST DOSE

Scanning patients at 80kVp leads to much more intense contrast enhancement due to the fact that the photon absorption of iodine is much greater at low photon energies ('k-edge' effect). This allows contrast doses to be reduced by 30-40% whilst still maintaining equivalent organ enhancement. Previously 80kVp scanning was not practical in routine practice due to image noise and artifacts. The amazing low-dose performance of the Aquilion ONE Next Generation is now allowing us to routinely scan patients at contrast doses of 40ml or less for angiographic examinations and 60ml or less for portal phase examinations. This substantial reduction in contrast dose also allows IV contrast to be used more safely in patients with impaired renal function and can potentially result in cost savings.

Figure 6: CT Chest to exclude oesophageal leak
Age 25. 80kVp. Post Oral + IV contrast. No leak. Total dose 0.6 mSv (k=0.014).

Figure 7: 80 kVp Abdomen/Pelvis
BMI 26. 80kVp. 60ml Niopam 370 IV. Portal phase abdo/pelvis showing excellent liver enhancement with no artifacts. Area of dense calcification seen with pancreatic head (arrow) consistent with focal area of chronic pancreatitis.

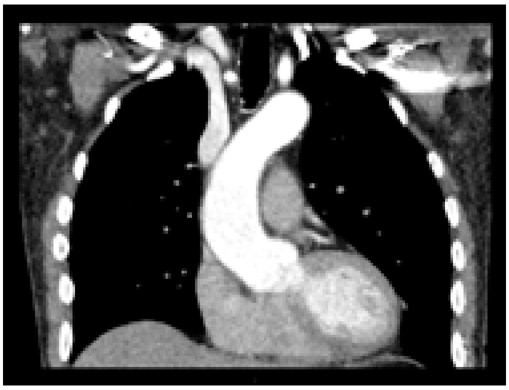


Figure 8: 80kVp Chest to exclude Thoracic Aortic Dissection 30ml Niopam 370 @ 2.5ml/s. Good opacification of thoracic aorta. No dissection. 0.4 mSv total dose (k=0.014).

CONCLUSION

The first generation Aquilion ONE revolutionized our practice in 2009. Based on our initial experiences, the Aquilion ONE Next Generation represents another huge leap forward in CT technology allowing us to produce excellent images using doses of radiation and contrast that would have been inconceivable even just a few years ago. Using 80kVp techniques, contrast volumes are very low, substantially reducing the risk of contrast induced nephropathy, particularly in patients with renal impairement. For cardiothoracic examinations, radiation doses are now so low that they are approaching those of plain film. This truly is a game-changer and has the potential to fundamentally change the role of CT within imaging departments, allowing CT to move from a 'specialised' low volume examination to a 'general' high volume examination. The challenge for us as radiologists is to integrate this revolutionary technology as a first-line test into new clinical pathways, even if this meets with some initial resistance from traditionalists who still view plain-film as the 'gatekeeper' for CT.

©2014 TOSHIBA MEDICAL SYSTEMS

MoT for professional riders

Original Text: Yves Brokken / Photos: Cor Vos, Irmo Keizer

Before the new cycle racing season begins, all professional riders are given medical checks. That happens at lotto-belisol as well. A reporter for VISIONS Magazine was allowed to see what goes on during these checks.

The riders from the Lotto-Belisol WorldTour team undergo their initial check measurements of core stability and muscle strengthening in the radiology department of the CHC Clinique St.-Joseph in Liège (Belgium). Tests are also conducted in the Académie Robert Louis-Dreyfus, the training centre of the Standard Liège football club, and in the Centre Cardiologique Orban. "Our winter programme consists of various elements", explains Lotto-Belisol team doctor Jan Mathieu. "First of all core stability and muscle strengthening. Injury prevention concentrates mainly on the stability of the neck, back, knees, pelvis and abdomen. It's very important to take up the correct posture on the bike, on racing bikes as well as time trial models.

DIFFERENCE IN STRENGTH

We look at two levels in strength training. On the one hand is the muscle mass. Here we check how many muscle fibres are present in the body, what types of muscle there are and whether fat infiltration has to be removed. On the other hand there is the strength of the muscles. We measure this using an isokinetic test in order to get an idea of the difference in strength between the muscles for the same joint in the left and right legs. Furthermore, we look at the response of those joints under the influence of forces. The test data are recorded in the computer by the dynamometer and by means of graphs and calculations give a reliable and repeatable picture of the strength of the muscles and the joints.

We perform initial measurements of all riders in November, and take those measurements as the baseline. There is dissimilarity in nearly all riders at that stage, especially where the leg muscles are concerned. One leg is more developed than the other. In the case of Jurgen Van Den Broeck we saw a considerable difference between his left and right leg after his knee operation. If you don't deal with that loss of volume, you automatically

compensate and you get injuries in the longer term. The physiotherapists therefore give all riders a programme that they have to follow for three months. In the meantime they get together every week to perform exercises, to see how their bodies are evolving, and to make adjustments where necessary. Then there are medical tests at the end of January to see whether their bodies are better balanced." The connection between core stability and muscle strengthening is not unimportant. Doctor Mathieu explains: "A pedalling motion has to be regarded as a lever action. It is therefore very important for your lower back to be stable. If that isn't the case, then you can't apply maximum force. Compare it with a barrier at a level crossing. If the arm is unsecured, the barrier can't close."

Then there is the cardiological test, which is required by the UCI. "Professional riders' heart muscles are subjected to very heavy loads", acknowledges Mathieu. "The UCI requires an exertion test - during which a cardiogram is made - or an ultrasound test of the heart, to check that all the valves are working properly. We do both. We can't take risks. It would be terrible if a rider fell of his bike because of a heart abnormality."

CT scan in operation.

The results of a CT scan.

MOST HEAVILY-STRESSED MUSCLE

Current team leader Mario Aerts had to give up cycle racing in 2011 because of cardiac arrhythmia. "It doesn't occur often, but you have to act upon it every time there is a signal. Unfortunately, performing preventive checks is the only thing we can do. In the case of major abnormalities we can only recommend stopping. You certainly don't become a professional rider in order to lead a healthy life, that much is clear. The heart is a rider's most heavily-stressed muscle."

A fourth test is the calcium measurement. "At Lotto-Belisol we have a lot of riders with broken bones", Mathieu points out. "That's often caused by a lack of calcium in the body. There has been research into the possible cause of this, and it turns out that riders' sustained riding motion causes calcium to be deposited in their muscles and to remain there, instead of going into the bones. You can achieve the desired calcium level by walking a lot, but that's not something for riders. We therefore give them dietary supplements such as vitamin D."

Finally, a blood test is also part of the medical testing. "We check whether all the parameters in the blood are correct, such as for the liver and kidneys."

KNEES AND LOWER BACK

"Because we have little influence on traumatological problems, we concentrate mainly on chronic complaints", says physiotherapist Tim Aerts. "Studies show that 50 percent of all professional riders suffer with their lumbar region, and one in three with their knees. We as a team are therefore focussing on those places, because limited time and budgets mean you can't investigate everything. By tackling those two areas we can increase the riders' capacities quite a lot. It is important that we find the weak spots preventively and improve them in a subsequent phase. This can be done by screening the riders individually in clinical tests. Our medical think tank then examines all the results. As the physiotherapist I look after the static dynamic evaluations (SDE). The series of weak links we find in the knees or the lumbar region determines each rider's preventive programme. A lower back complaint can be caused by, for example, a less than optimal cycling posture as well as by an underdeveloped gluteus or a hip bending muscle that is too short. The last situation occurs because riders lean forward when sitting on their bikes, which in time can shorten the muscle. The cause of a back complaint can also be a slipped disc or the after-effects of a fall that occurred years ago. The tests therefore serve to discover the cause of the complaint.

As far as the knees are concerned it's mainly about differences between muscles. If you have a pain in one knee you use more force in the other knee. This leads to a

©2014 TOSHIBA MEDICAL SYSTEMS

Maxime Montfort goes through the Aquilion ONE CT scanner.

significant imbalance, which can continue to increase if it is not noticed and treated. It's often a case of the quadriceps being too strong and the hamstring too weak. One explanation could be that there is much more pushing than pulling. Hamstrings are in any case less strong than quadriceps, but the 2/3 ratio does have to be respected, otherwise the imbalance causes injuries. To measure the difference between the quadriceps and the hamstring, and also between the left and right legs, we sit the rider on a Cybex, a seat for measuring strength, where he can move only his lower legs backwards and forwards.

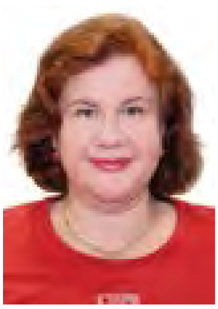
FAT INFILTRATION

"What we also look at very closely are fat infiltration and muscle structure", says Aerts subsequently. "Fat infiltration means that there is too much fat around the muscle, as a result of which it doesn't develop fully and therefore cannot apply maximum force. Increasing muscle training is the only remedy for this. We look at the musculature mainly when there are problems. The result is that some muscles have to be trained more and some muscles less. What is important here is knowing the relevant muscles. Too much attention was paid in the past to passive solutions such as changing the posture on the bike. Now we intervene actively by training the muscles. The number of complaints has fallen sharply as a result. We also try to investigate whether there is a link between the SDE and the Cybex tests on the one hand and the imagery (in which the condition of the muscles is investigated, for example too much or too little fat infiltration, Ed.) on the other. The multifidus and the abdominis transversus are very important muscles for a cyclist's lower back. In everyday language these are the small muscles deep in the abdomen and the back. In the past there was too much training of superficial muscles, for example by doing sit-ups. These can make you better, but can cause even greater imbalance. A lot more muscles have to be optimised for the knees. In general terms we can talk about stabilising muscles. These are possibly even more important than the motion muscles. Thanks to these preventive measures and the training, riders can pedal at higher wattages than previously, and they can withstand the loads required in modern cycle racing. If your body is not fully balanced, you can never achieve a peak pedalling power of 2000 watts, such as Greipel managed recently In Australia. If he'd had a weak back he would have been completely destabilised."

WWW FIETS.NL - APRIL 2014

Use of strain sonoelastography for differential diagnosis of thyroid papillary carcinoma

V.A. Serdyuk [1)]



V.A. Serdyuk

At the present time thyroid gland (TG) diseases take a leading position among all endocrine pathology and show constant upward trend. Morbidity rate of nodular lesions of the thyroid gland in the last 30 years has grown from 4-9% to 5-22%, herewith thyroid cancer has become 3-fold more frequent and causes death in up to 2% of oncological patients [7]. Among all histological types of thyroid cancer more than 90% accrue to papillary carcinoma (PC). Prognosis in case of thyroid papillary carcinoma to a large extent depends on stage of tumor progress, revealed during initial examination. In case of small-size highly differentiated carcinoma without metastasis, the survival rate after surgical treatment exceeds 90%. In this regard the early diagnostic of cancer on the background of many other focal lesions in TG is an acute problem[3].

Ultrasound diagnostics is of great significance for revealing and differential diagnosis of nodules in the thyroid gland. Nevertheless, often ultrasound examination does not allow to do reliable conclusion concerning the character of pathological process, which could be consistent with histological examination[1].

In recent years a new branch of ultrasound diagnostics, sonoelastography, is extensively developed. The technique of strain sonoelastography is based on assessment of differences of elastic properties (elasticity, compressibility and deformability) of normal and pathologically changed tissues[2,6].

Objective of the study was to analyze the potentialities of strain sonoelastography, one of modern ultrasound techniques, in differential diagnosis of thyroid nodules and to investigate the sonographic signs of thyroid lesions of different etiology in gray scale mode and with Doppler mode. Following problems were posed in the course of the work:

1. To systematize and assess elastographic values (color mapping and coefficient of deformation) in groups of patient with different masses in TG and with papillary carcinoma.
2. To assess sonographic signs, which are most characteristic for papillary carcinoma and different groups of nodules in gray scale mode and using Doppler mode.
3. To set criteria for choosing patients for fine needle aspiration biopsy (FNAB) in order to confirm diagnosis and to choose further management strategy.

MATERIALS AND METHODS

Study was performed in Kyiv City Clinical Endocrinology Center. During period from January 2012 to July 2013 we have examined 312 patients with nodular pathology of thyroid gland, 245 of them females and 67 males. Age of patients varied from 15 to 73 years. Ultrasound examination was done using expert-class device Toshiba AplioXG with multi-frequency transducer 5-14 MHz. Sonographic picture in gray scale mode and during Doppler mapping was assessed and strain sonoelastography was performed.

It should be mentioned that thanks to abilities of expert-class device Toshiba AplioXG, especially Precision and ApliPure™ modes, it was possible to get images with highest quality during examination of thyroid gland, which considerably increased accuracy and specificity of diagnostics.

Such parameters as echogenicity of lesions, their, shape, borders, margins, and the presence of «vertical alignment» or «taller-than-wide» sign were assessed in gray scale mode.

Concerning echogenicity hyper- and isoechoic, moderately hypoechoic lesions and lesions with extremely decreased echogenicity were specified. In describing the border terms smooth/unsmooth were used, and the margin was described as distinct/indistinct. On grounds of shape revealed lesions were divided on nodules with regular (oval or oval-round) and irregular shape.

[1)] *Kyiv City Clinical Endocrinology Center*

©2014 TOSHIBA MEDICAL SYSTEMS

In Doppler mode on the basis of blood flow characteristics nodules were classified on 5 types:
1st type - lesions do not have signs of blood flow or with solitary vascular signals, avascular;
2nd type - lesions with angioarchitecture by kind «penetrating vessels»/«nourishing pedicle», with afferent blood flow;
3rd type - lesions with low or moderate peripheral blood flow;
4th type - lesions with significant peripheral (with/without central) blood flow;
5th type - lesions with significant central (with/without peripheral) blood flow.

Data of strain elastography were assessed according to character of color mapping and to coefficient of deformation (CD). Previously conducted research, which used this technique showed that CD exceeding 4 is typical for malignant pathology[4,5].

In cases when sonographic and elastographic characteristics of visualizes lesion allowed to suggest benign character of pathology patients underwent fine needle biopsy with cytological verification for confirmation of diagnosis.

Patients with masses, where malignant nature could not be excluded, also underwent fine needle biopsy and in case of confirmation of malignant growth they also underwent further surgical intervention.

Patient with sonographic and elastographic characteristics of microcarcinomas were sent for surgical treatment without previous biopsy, due to risk of false-negative results, but intraoperativ express biopsy was performed. Morphological and pathohistological examination of specimens was performed after surgical intervention.

RESULTS AND DISCUSSION.

According to data of cytological and pathohistological examination all patients were divided into 5 groups. The first group was composed of patients (n - 103) with nodular goiter (different its varieties were revealed: colloid goiter, nodes with adenomatous hyperplasia, with B-cell metaplasia, with cystic degeneration). Patients with follicular adenomas were included into second group (n - 39), with follicular carcinomas – into third group (n - 12). Fourth group was composed of patients with papillary carcinomas (n - 121). Fifth group included patients with foci of thyroiditis (n - 37).

Medullar and anaplastic carcinomas with low morbidity rate were not included in the study.

Examination of focal lesions in grey scale mode showed that regular shape (oval or oval-round), distinct smooth contours, and absence of «vertical alignment» sign were typical for the first three groups of nodular structures. Echogenicity of lesions was different, but majority of pathological structures from the first three groups referred to isoechoic masses or to structures with moderately decreased echogenicity (Fig. 1).
Character of blood flow for lesions on these groups corresponded to 3rd and 4th type: peripheral from low to significant, with or without central blood flow. It should be noted that among adenomas and follicular carcinomas were mostly hypervascular lesions (with 4th type of blood flow) and in group with nodular goiter the 3rd type prevailed.

Kiev Clinical Endocrinology City Center (KCECC) is a leading healthcare setting in Kiev established to deliver highly skilled and approachable help for patients with endocrine disease. The Center has 390 stationary beds and a number of departments, i.e., diabetes, constitutional endocrine pathology, rehabilitation in endocrine disorders, endocrine gynecology and endocrine surgery. Besides, KCECC has a clinic with 100 visits per day, diagnostics unit, functional diagnostics unit and clinical and pathologic laboratory. The diagnostics department is equipped with 6 ultrasound units. The most modern of these units is Toshiba Aplio XG that contains compression sonoelastography and ASQ. All together 35.879 examinations have been carried out in 2013 including 20.913 thyroid testings (of them, 1.157 with sonoelastography), as well as 4.770 needle biopsies. 2.218 patients underwent surgery in the surgery department (1.386 of them on thyroids and parathyroids). Mrs. V.A. Serdyuk is the head of diagnostics department. She carries out expert US examinations of thyroid, sonoelastography and needle biopsy, as well as exercises scientific analysis.

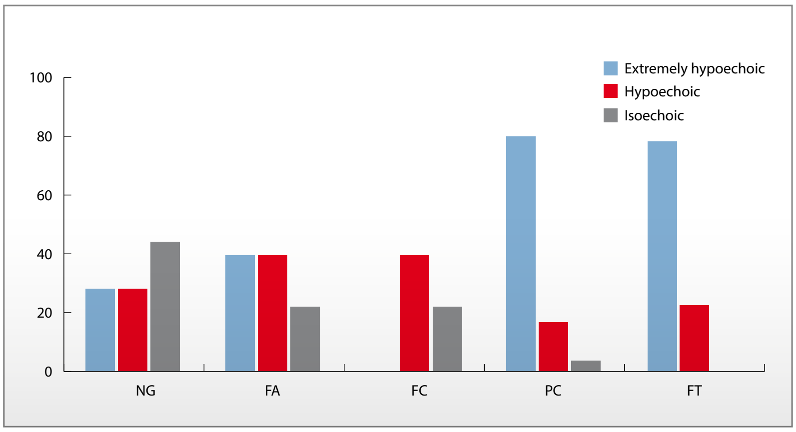


Figure 1: The variants of thyroid nodular lesions echogenicity (NG - nodular goiter, FA - follicular adenomas, FC - follicular carcinomas, PC - papillary carcinomas, FT - foci of thyroiditis.

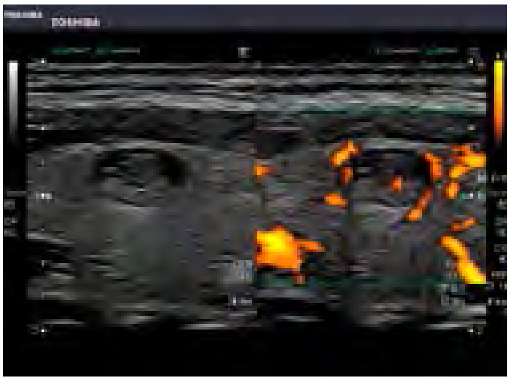


Figure 2A: Sonogramma of the isoechoic nodular goiter with cystic degeneration in gray scale mode and using energy Doppler mode (3rd type - moderate peripheral blood flow).

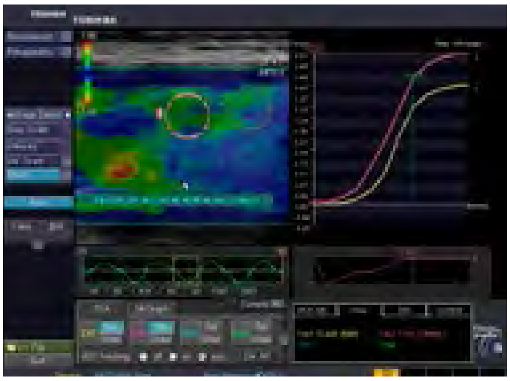


Figure 2B: The same case. Elastographic color mapping is almost green, CD – 0.8.

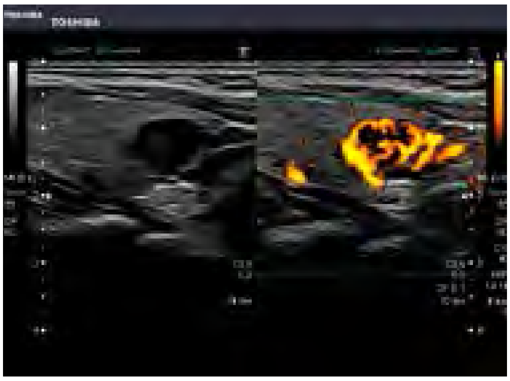


Figure 3A: Sonogramma of the hypoechoic follicular adenoma in gray scale mode and using energy Doppler mode (4th type – significant peripheral and central blood flow).

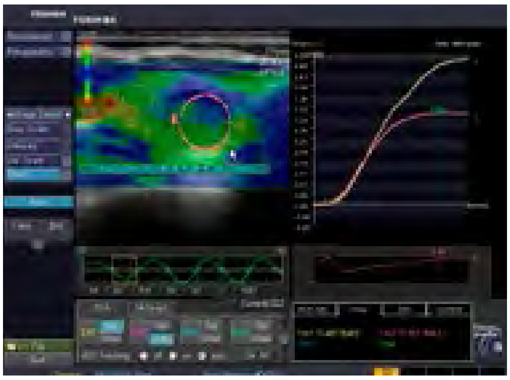


Figure 3B: The same case. Elastographic color mapping is green and blue, CD – 1.5.

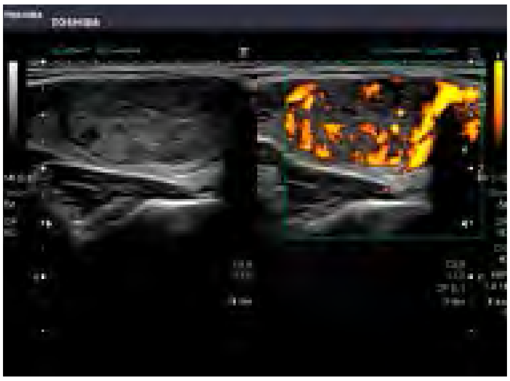


Figure 4A: Sonogramma of the isoechoic follicular carcinoma in gray scale mode and using energy Doppler mode (4th type – significant peripheral and central blood flow).

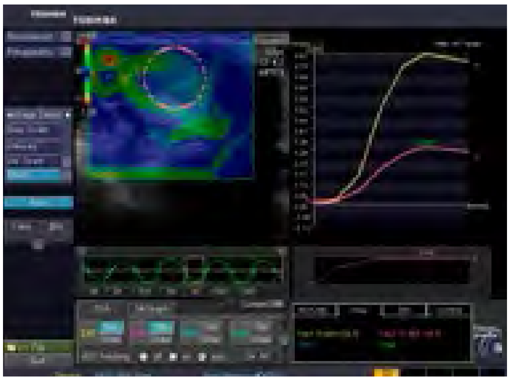


Figure 4B: The same case. Elastographic color mapping is green and blue, CD – 2.0.

Results analysis of strain elastography showed that overwhelming majority (95.6%) of lesions in the first three groups was mapped with different combinations of green and blue colors. Mean value of coefficient of deformation in the first group was 2.3 (0.8 – 3.5), in the second group 2.1 (0.9 – 2.7), and in the third group 1.9 (0.9 – 2.0) (Fig. 2,3,4). As it can be seen from presented data, such different in etiology, morphology and prognosis lesions as hyperplastic nodes, adenomas and follicular cancer have considerably similar sonographic picture and, unfortunately, do not have significant differences according to results of compression elastography.

©2014 TOSHIBA MEDICAL SYSTEMS

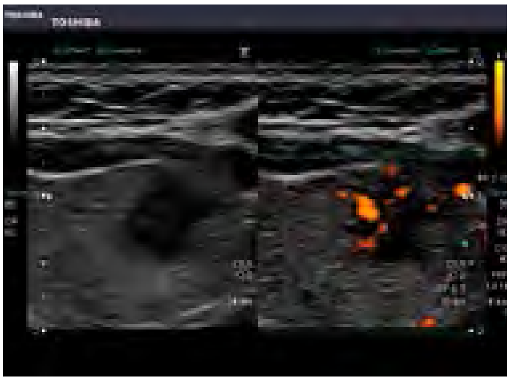


Figure 5A: Sonogramma of the papillary carcinoma with extremely decreased echogenicity and irregular shape in gray scale mode and using energy Doppler mode (2nd type – afferent blood flow like «penetrating vessels»).

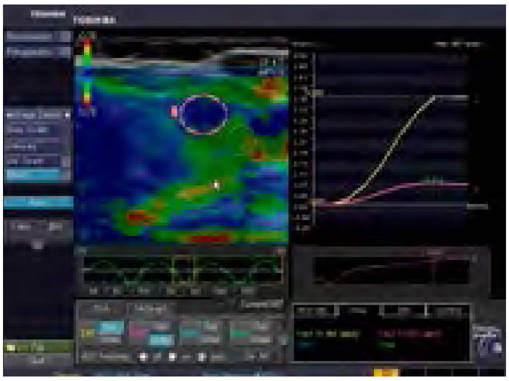


Figure 5B: The same case. Elastographic color mapping is dark blue, CD – 4.9.

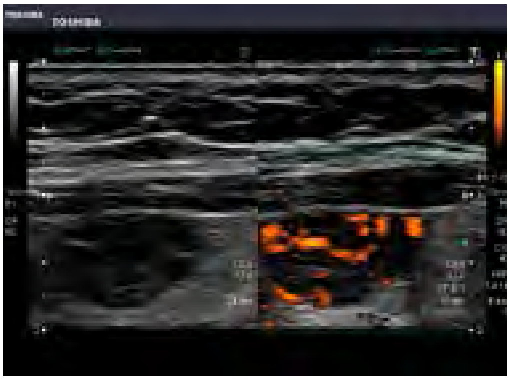


Figure 6A: Sonogramma of the papillary carcinoma with extremely decreased echogenicity and regular shape in gray scale mode and using energy Doppler mode (5th type – significant central and moderate peripheral blood flow).

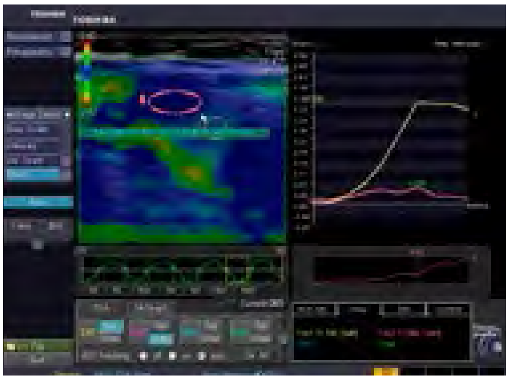


Figure 6B: The same case. Elastographic color mapping is dark blue, CD – 6.0.

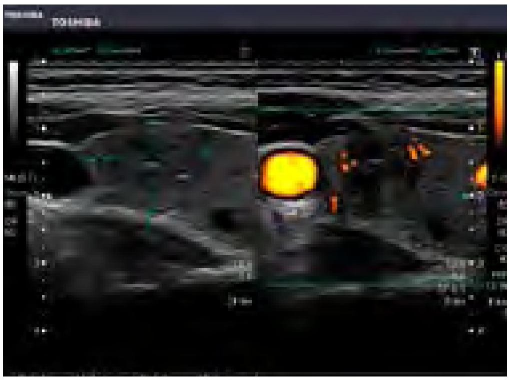


Figure 7A: Sonogramma of the isoechoic papillary carcinoma with irregular shape in gray scale mode and using energy Doppler mode (1st type – solitary vascular signals, avascular).

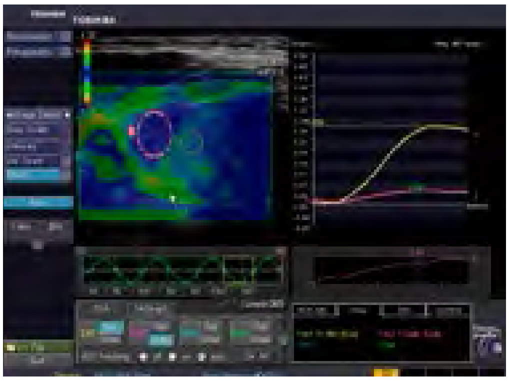


Figure 7B: The same case. Elastographic color mapping is dark blue, CD – 5.5.

Further analysis of obtained results demonstrated that majority of papillary cancers have irregular shape (73.77%), vertical alignment (62.3%) and indistinct margins (70.49%). Extremely decreased echogenicity of lesions is also typical for this pathology (80.33%). More than a half of PC have 1st and 2nd types of blood flow (avascular and with afferent type of blood flow) and approximately a quarter of cases were of 5th type (hypervascular with prevailing central blood flow).

Elastographic characteristics of papillary cancer were the following: color mapping in overwhelming majority of cases was dark-blue (98.3%), and coefficient of deformation varied from 3.4 to 12.4 (mean value 5.73) (Fig. 5-7).

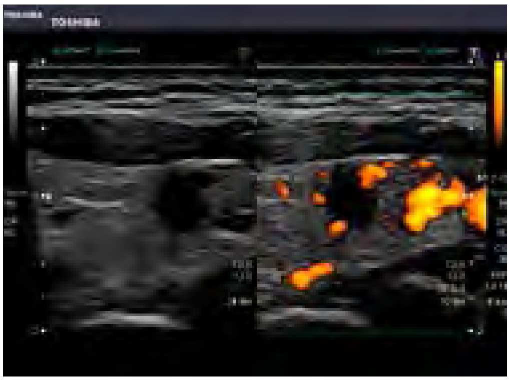


Figure 8A: Sonogramma of the papillary microcarcinoma (6.1x7.9mm) with extremely decreased echogenicity and irregular shape in gray scale mode and using energy Doppler mode (2nd type – afferent blood flow like «penetrating vessels»).

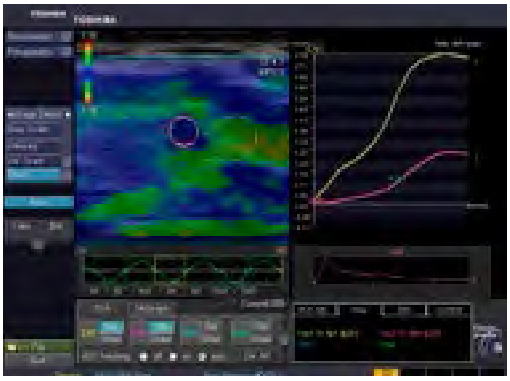


Figure 8B: The same case. Elastographic color mapping is dark blue, CD – 4.9.

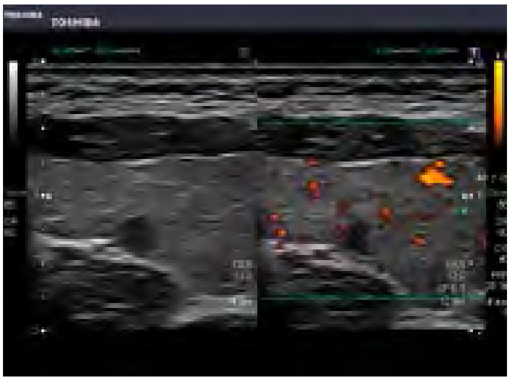


Figure 9A: Sonogramma of the papillary microcarcinoma (3.7x5.6mm) with extremely decreased echogenicity and regular shape in gray scale mode and using energy Doppler mode (2nd type – afferent blood flow like «penetrating vessels»).

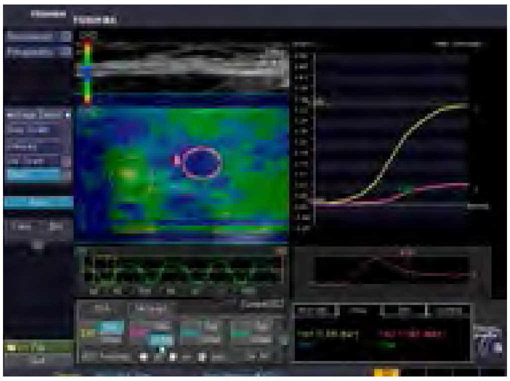


Figure 9B: The same case. Elastographic color mapping is dark blue, CD – 6.2.

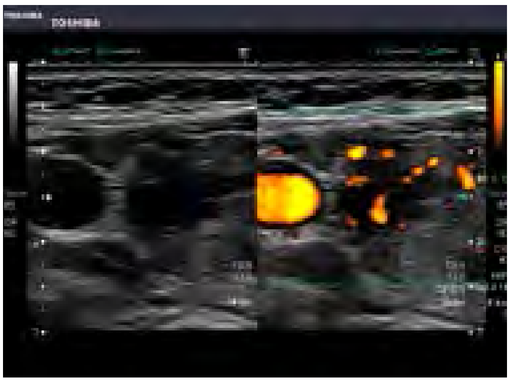


Figure 10A: Sonogramma of the hypoechoic foci of thyroiditis with irregular shape in gray scale mode and using energy Doppler mode (2nd type – afferent blood flow like «penetrating vessels»).

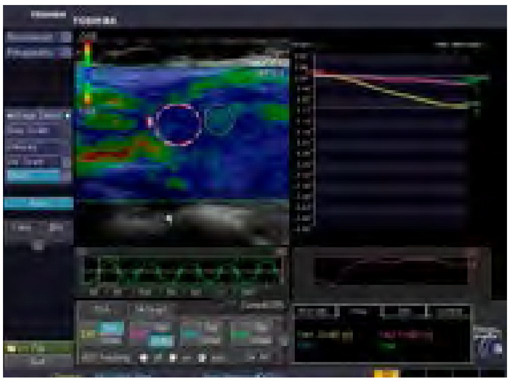


Figure 10B: The same case. Elastographic color mapping is blue, CD – 3.7.

©2014 TOSHIBA MEDICAL SYSTEMS

It should be pointed out, that all specified signs are as well typical for microcarcinomas (less than 1 cm), which is useful for early detection of papillary cancer (Fig.8,9).

In the fifth group (patients with foci of thyroiditis) visualization of lesions in grey scale mode and data of Doppler mode often were similar to such in patients with PC. Thus, more than 70% of foci of thyroiditis had extremely decreased echogenicity, irregular shape and vertical alignment. Blood flow in 46.7% of cases was referred to the 1st type, and in 32.5% of cases to the 5th. Color elastographic mapping was characterized with green-blue array with prevailing of blue color, but it does not reach dark-blue color. CD varied from 2.7 to 3.8 with mean value 3.0. We are of the opinion that thyroiditis may be characterized as the «great mystifier», because differential diagnosis of this pathology with PC causes the greatest difficulties (Fig. 10).

In summary, elastographic signs of papillary cancer are steady dark-blue color and CD exceeding 4. Green or blue-green color and CD less than 3 is typical for benign lesions. It should be kept in mind that follicular carcinomas, which do not have elastographic signs of malignancy, are also included in this group. Lesions with CD from 3 to 4 compose a «risk group» or «underdetermined group» and are subject to puncture biopsy with cytological verification.

CONCLUSIONS:

1. Strain sonoelastography is noninvasive and high-informative ultrasound technique, which allows to reveal papillary cancer, specifically on early stages of progression (microcarcinomas).
2. Elastographic signs of benign lesions give possibility to scale back the number of unreasonable biopsies.
3. Lesions with CD from 3 to 4 compose a «risk group» and require cytological verification

References:

1. Borodina N. B. Комплексное ультразвуковое исследование с применением эластографии как метода для обнаружения опухолевых узлов в щитовидной железе и лимфатических узлах шеи. Московский научно-исследовательский онкологический институт им. П.А. Герцена Минздрава России, Москва, Россия. Онкохирургия:2012, № 2, с. 98-104.
2. Zubarjev A. V., Gazhonova V.E., Hohlova E.A., Panfilova E.A., Churkina S.O. Эластография - новый метод поиска рака различных локализаций. Радиология-практика: 2008, № 6, с. 6-18.
3. Zubarjev A.R., Fedorova V.N., Demydova A.K. и др. Ультразвуковая эластография как новая ступень в дифференциальной диагностике узловых образований щитовидной железы. Медицинская визуализация: 2010, №1, с. 16.

René Degros, Business Unit Manager X-Ray Europe

©2014 TOSHIBA MEDICAL SYSTEMS

VISIONS spoke with René Degros, Toshiba's Business Unit Manager X-Ray Europe, about how its X-Ray offer provides solutions for current and future imaging needs through consistent ground-breaking innovations.

"Safety of Clinical Staff and Patients are our Top Priority"

Exactly one hundred years since it first started research on X-Ray tubes, Toshiba is continuously discovering new possibilities in X-Ray imaging that consolidate its value in diagnostic imaging and treatment. As the oldest medical imaging modality, X-Ray has saved the lives of millions, enhanced medical knowledge and benefitted healthcare professionals all over the world.

Consistent development of unique, high value innovation has ensured that Toshiba continues to retain market leadership in X-Ray, as it has done already for many decades. Its offer expands to not only include X-Ray systems and additional devices, but also tailor-made solutions for specific clinical situations. The product spectrum comprises a complete range of powerful diagnostic systems and technologies, headed by the powerful and versatile Infinix-i™ Toshiba's continual R&D efforts in this modality have resulted in many market firsts.

René Degros was appointed as Toshiba's X-Ray Business Unit Manager one year ago. He led a major restructure of the Business Unit to align it more closely with evolution of the global clinical landscape and launch a plethora of new innovations for the X-Ray modality.

"Toshiba has always produced high quality X-Ray solutions, but our innovation is being driven at an accelerated pace by the needs and demands of our customers, changes in healthcare, rapid development of new treatments, techniques and practices, as well as the continual growth of our expertise and knowledge," he said. "Currently, the greatest opportunities for further development of our X-Ray offer are in interventional radiology - cardiology, oncology and hybrid procedures, although bucky- and remote systems hold sustained clinical value. Alongside ongoing efforts to enhance image quality, we are focused on expanding the utility of X-Ray systems, from diagnostics to treatment that plays a major role in the interventional environment, in response to advances in clinical practice. We are finding solutions for key clinical issues through brand new treatment-oriented options, further dose reduction, and fusion of modalities, as well as cost reduction."

CLINICAL FREEDOM

Optimal patient access has become crucial. Increasingly complex procedures can increase the risk of emergencies and difficult interventions are now frequently performed under anesthesia. In addition, the use of hybrid procedures is growing with widespread introduction of new techniques. Unlimited patient access without angulation restrictions has become key in interventional imaging.

Clinical Freedom
Clinical staff can access the patient readily and comfortably. Flexible design, optimal angle, with focus on patient comfort.

"Toshiba's Infinix-I's C-Arm has the highest flexibility on the market," confirmed René. "Its multi-access, floor- and ceiling mounted C-Arm positioners give optimal patient access from all sides without moving the patient. This benefits patients' and health care professionals alike and is well appreciated by our customers. It is valued across the entire interventional spectrum and easily supports the uptake of new techniques and procedures."

It facilitates, for example, the use of the 'radial approach', in which catheterization occurs through the radial artery, as opposed to the femoral artery. Many customers prefer this method. The superficial location of the radial artery allows easy access and significantly reduces the risk of bleeding and complications. Mechanical compression devices safely obtain hemostasis, and personnel use is minimized. Patients are ambulatory immediately after the procedure and the length of stay in hospital is significantly reduced. Compared to the femoral approach, there is substantial economic benefit because of reduced vascular complications and shorter hospital stay.

Modality fusion providing image fusion of other modalities within the Infinix-i platform creates new opportunities to enhance Clinical Freedom. Toshiba is developing several products that combine various modalities.

IMAGE QUALITY

Toshiba's unique Advanced Image Processing (AIP) provides outstanding image quality for visualization of vessels and devices in the interventional environment by combining: Stable Imaging Technology, Dose Reduction Technology and Noise Reduction Technology. Constant advances in interventional treatments within the rapidly evolving clinical landscape form an important driver in Toshiba's continual commitment to improve Image Quality further.

"DTS enables us to measure in real time the skin dose of radiation that patients are exposed to for the first time in history."

Oncology is a key therapeutic area that continues to grow significantly. In February 2014, the World Health Organisation (WHO) reported that there are approximately 14 million new cancer cases globally each year. And the trend is only worsening. WHO predicts that the global burden of cancer will grow by 70 percent over the next two decades with an estimated 22 million new cases and 13 million deaths each year by 2032[1].

The healthcare industry is responding with growing reliance on increasingly sophisticated technologies and procedures in diagnosis and treatment. Targeted and personalized medicine is becoming widespread. For example, Transarterial Chemo Embolization (TACE) therapy, which involves administration of chemotherapy directly to the liver tumor via a catheter to 'kill' blood supply to tumor with the expectation of eventually killing the tumor. With this technique, the chemotherapy targets the tumor, while sparing the patient many side effects of traditional chemotherapy that is administered to the whole body. An even newer technology developed to treat cancer is Selective Internal Radiation Therapy (SIRT) - a form of radiation therapy used in interventional radiology for selected patients with unresectable cancers (those that cannot be treated surgically), especially hepatic cell carcinoma or metastasis to the liver. The treatment involves injecting tiny microspheres of radioactive material into the arteries that supply the tumor to target it directly and reduce the impact of chemotherapy on surrounding healthy tissue.

"Advanced features of the Infinix not only enable better diagnosis, but also open the doors to better treatment options and monitoring of the patients' response to treatment," said René. "For example, as well as superior imaging quality, Toshiba's Infinix-i features a catheter that enables live treatment."

Image Quality

One of our basic principles is that what you see is all there is to make critical decisions easier and interventions safer with absolute accuracy.

Toshiba just launched Metal Artefact Reduction (MAR) on the Infinix™ platform – a feature that reduces the size and intensity of susceptibility artefacts originating from coils during CT-like imaging, for example. This is anticipated to provide enhanced Image Quality in support of a wider range of interventional treatment procedures.

In addition to growing complexity of methods of treatment and procedures, products for treatment are becoming more complex.

"New generation stents are a prime example. The development towards the new generation and more cost effective stents, supports widespread uptake, but provides more challenge in visualizing in a correct way with imaging equipment, for placement, assessment, removal and avoidance," explained René. "Ongoing R&D into how to improve image quality with these kinds of devices is a high priority for Toshiba. We developed a new generation of 'CT-like' imaging technology using a special 3D acquisition software that clearly shows the positioning of a wider range of stents. Constant collaboration with other manufacturers also helps to find new solutions for the long term: in this case, development of new stents that are easier to detect with imaging."

Toshiba will also soon launch Parametric Imaging, which applies color mapping of physiologic parameters, such as blood flow, for neuro applications. The technique is based on subtraction of images. It looks promising as it will provide more additional information about the impact of treatments that would not otherwise be available with normal subtraction.

©2014 TOSHIBA MEDICAL SYSTEMS

While cost cutting is a continual focus across the global healthcare industry, the demand for high Image Quality and increased Dose Reduction has not lessened. Toshiba is innovative with design of its systems and can adjust its hardware to offer cost effective solutions, but never compromises on Dose Reduction or Image Quality.

Dose Reduction
Our innovative dose control tools enable clinicians to minimize radiation exposure to patients and staff, significantly, with one touch.

DOSE REDUCTION

While X-Ray generally involves lower radiological dose compared to other modalities, the biggest focus in X-Ray for interventional procedures remains, nevertheless, on dose reduction, not only for the benefit of patients, but increasingly for medical staff exposed to equipment daily and who spend day-in, day-out in a potentially-radiated environment. One of Toshiba's latest innovations is **Spot Fluoroscopy** – a unique new feature that can reduce dose by up to 62%. Spot Fluoroscopy is based on unique Asymmetric Collimation that allows a free definition of any desired collimation based on Last Image Hold (LIH), superimposition of LIH information to keep anatomical or device relevant reference information visible during Fluoroscopy and novel Automatic Brightness Control (ABC) technique that avoids a dose increase regardless of collimation. Spot Fluoroscopy can be used for any anatomical area, and in any interventional discipline. The feature, which has been available for Toshiba Infinix-i systems since 2012, has been found to reduce dose by up to 62%[2]. A dose reduction of 45% was achieved using Spot Fluoroscopy to perform various neurointerventions on the Infinix VFi Biplane by Dr. Ljubisa Borota, MD, PhD at the Department of Neuroradiology, University Hospital of Uppsala, Sweden. His findings were presented in the last issue of VISIONS[3] and have been presented at high profile academic conferences in Europe. Several high profile interventional doctors heralded Spot Fluoroscopy as the 'biggest innovation in interventional world in the last ten years.'

DOSE DETECTION

Enhanced dose detection provides a key to managing procedures in the X-Ray room to reduce dose further. The Dose Tracking System (DTS) is a unique new feature that enables the skin radiation dose of the patient under examination or treatment to be measured and monitored in real time. This is particularly important as the length of interventional procedures increases, particularly with adoption of advanced and more complex techniques.

CASE STUDY

We examined the dose reduction effects of Spot Fluoroscopy in atrial fibrillation ablation (Fig.1). The subjects were divided into a Spot Fluoroscopy group consisting of 10 cases and a non-Spot Fluoroscopy group consisting of 31 cases, and comparisons were made between the two groups for fluoroscopy time and dose area product. As a result, there were no significant differences observed in ablation fluoroscopy times for the left pulmonary vein, right pulmonary vein, or cavotricuspid isthmus between the Spot Fluoroscopy and non-Spot Fluoroscopy groups. On the other hand, dose area product significantly decreased to 181.4 cGy•cm² in the Spot Fluoroscopy group in contrast to 683.3 cGy•cm² in the non-Spot Fluoroscopy group during ablation of the left pulmonary vein (Fig.2). Dose area product also decreased significantly, from 414.6 cGy•cm² to 92.15 cGy•cm² for the right pulmonary vein, and from 819.7 cGy•cm² to 211.2 cGy•cm² for the cavotricuspid isthmus. On the basis of these findings, Spot Fluoroscopy is considered to be extremely useful for reducing exposure with respect to atrial fibrillation ablation.

Figure 1: Spot fluoroscopy image in atrial fibrillation ablation.

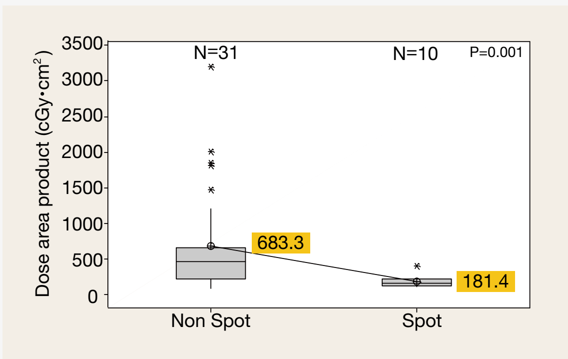


Figure 2: Comparison of Dose Area Products for Left Pulmonary Vein Ablation.

"We are proud to take X-Ray forward."

"DTS enables us to measure in real time the skin dose of radiation that patients are exposed to for the first time in history," said René. "Acceptable thresholds of dose exposure are discussed and agreed with the hospital in advance. They are defined by customer and EU regulations. Once the system is set to these thresholds, it uses a color coding to indicate skin dose. Blue indicates minimal dose and then the scale increases from green, to yellow, to orange, to red, with red indicating a high and potentially problematic dose. A screen which is visible to all health professionals present displays the results clearly. The system creates enhanced awareness of in situ dose exposure and health professionals can then act to reduce skin dose to the patient. While they do not have to stop the procedure, they can change angulation or reduce frame rate for example. DTS doesn't directly reduce dose, but provides the information to then take appropriate action and to create awareness. The market has been eagerly anticipating this functionality for a long time."

As well as working in close collaboration with its customers, leading healthcare professionals and academic hospitals, Toshiba also joins forces with other commercial companies to develop groundbreaking solutions for key market issues like dose reduction. For example, with Fluke Biomedical to offer a new dose monitoring and management tool for Infinix-i cardiovascular X-Ray systems. RaySafe™ i2, a state-of-the-art, real-time, dose-monitoring solution developed by RaySafe, allows medical staff to monitor their exposure while in the X-Ray room, thus helping to make examinations safer. With the system, each staff member is assigned a digital, real-time dosimeter, which is wirelessly connected to an in-room-mounted screen displaying radiation exposure. The dosimeters are small, unobtrusive badges that transfer received dose exposure for each individual. The RaySafe i2 system not only helps staff view radiation exposure level during procedures, but also archives dose exposure history for future analysis.

"Clinical staff safety is a top priority for us, and making the RaySafe i2 technology available on Infinix-i systems further expands our comprehensive set of dose management tools," said René. "With increasingly complex interventional procedures, the ability to accurately monitor radiation exposure in real time will enable hospitals to identify protocols and educate clinical staff members on ways to make procedures safer."

STRENGTHENED TEAM

Toshiba's innovations are derived with input from its own experts, customers, medical professionals and commercial companies from all over the world. Over the past year, the X-Ray Business Unit has undergone a radical redevelopment to reflect its alignment with tackling key healthcare issues.

"We developed a stronger and more focused strategy that prioritizes the wide reaching functionality of our products and services," remarked René. "It incorporates: Clinical Freedom, Optimized Workflow, Image Quality, Dose Reduction, Patient Safety, Connectivity, Clinical Applications, Service and Education. This not only helps focus our own development and promote understanding of the value and quality of Toshiba's unique X-Ray offer amongst customers, but helps focus the whole industry on addressing key healthcare challenges."

In addition to the existing high quality features and groundbreaking new functionality, which will be available on the Infinix platform shortly, the system itself has a new, contemporary design to accommodate the wide range of new features and improved ergonomics. And to implement its holistic approach to continual improvement and innovation, the Business Unit has not only expanded the size of its staff, but has reorganized the specialist talent to ensure that it 'speaks the language of its increasingly specialized customers' at every level.

"After one hundred years of dedicated focus on this modality, we are proud to take X-Ray forward, extending its major and long-lasting contribution to saving lives and meeting the global healthcare challenges of the future." concluded René.

References:

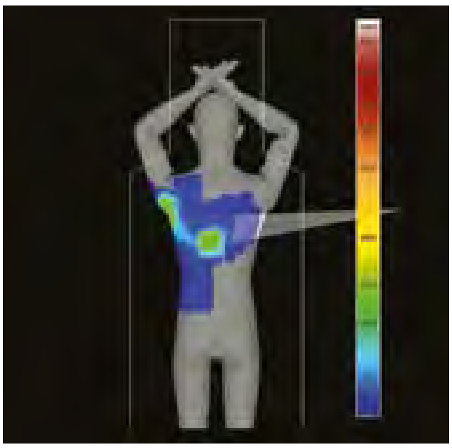
1. http://www.iarc.fr/en/publications/books/wcr/index.php
2. Study done during ablation procedures in Yokusuka Hospital, Japan.
3. Spot Fluoro – A Novel Promising Approach to Reduce the Dose in Interventional Procedures – Dr. Ljubisa Borota[1], MD, PhD., Andreas Patz[2], Takuya Sakaguchi[3]. 1. Unit of Neurointervention, Center for Imaging, University Hospital, Uppsala, Sweden. 2. Toshiba Medical Systems Europe, Zoetermeer, The Netherlands. 3. Toshiba Medical Systems Corporation, Otawara, Japan.

©2014 TOSHIBA MEDICAL SYSTEMS

TOSHIBA

Leading Innovation

Are you aware of the peak skin dose of your patient?



Skin dose is shown in real-time on an easy to understand colour map.

Toshiba's DTS (Dose Tracking System) is a unique feature that enables real-time visualisation of skin radiation dose of patients that are under examination or treatment. Knowing skin dose is particularly important as the length of interventional procedure increases, especially with adoption of advanced and more complex techniques. For the first time in history skin dose is presented real-time on a clear and easy to understand colour map visible to all health care professionals. DTS makes people-friendly care available to everyone involved in medical practice, including patients, doctors and other medical-care providers. DTS: A new era in dose management has arrived.

Toshiba: Made for Life.

Minimize. Visualize.

By focusing on low dose, high-quality imaging technologies for accurate diagnosis and treatment, Toshiba continues to improve the quality of life for all people.

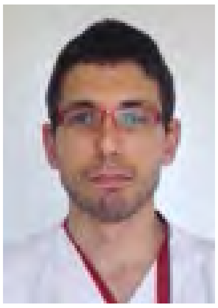
www.toshiba-medical.eu

ULTRASOUND CT MRI X-RAY SERVICES

Robust and accurate coronary CT Subtraction algorithm

M. Razeto PhD [1], D. Viladés-Medel MD [2,3], R. Leta MD PhD [2,3], A. Hidalgo MD [2,3], F. Carreras MD PhD [2,3], G. Pons-Lladó MD PhD [2,3], X. Alomar MD [2]

M. Razeto PhD



D. Viladés-Medel MD

Using coronary CT angiography to detect significant luminal stenosis is well-established yet challenging in the presence of calcium. Due to blooming artifacts, the amount of calcium is frequently overestimated leading to an increased number of false positive results and more unnecessary diagnostic tests downstream with risks by e.g. invasive procedure[1].

Therefore, a subtraction technique such as Coronary CT Subtraction may be used to improve reader confidence when evaluating calcified arteries[1,2]. The workflow includes scanning the patient before and after contrast injection. The two datasets are subsequently registered and the pre-contrast scan is subtracted from the post-contrast one. The result is a 3D volume in which coronary calcifications have been removed, leaving the contrast enhanced blood in the lumen as the only high intensity material.

Accordingly, optimal conditions to measure coronary stenosis are obtained. However, to achieve such circumstances, perfect registration is essential, a point which will be discussed in the next section.

The introduction of the world's first wide area detector scanners about a decade ago, i.e. Aquilion ONE™, and its ViSION Edition with 275ms rotation time and z-coverage of up to 16cm simplify the use of this imaging technique. Fig. 1 depicts a 320-row ViSION Edition CT scanner at our institute. The imaging technique can be simplified because Coronary CT Subtraction software requires identical location in both pre- and post- contrast scans[3]. A large z-coverage allows one to acquire the whole heart in a single non-helical rotation with uniform temporal

Figure 1: 320-row ViSION Edition CT scanner at Clinica Creu Blanca, Barcelona.

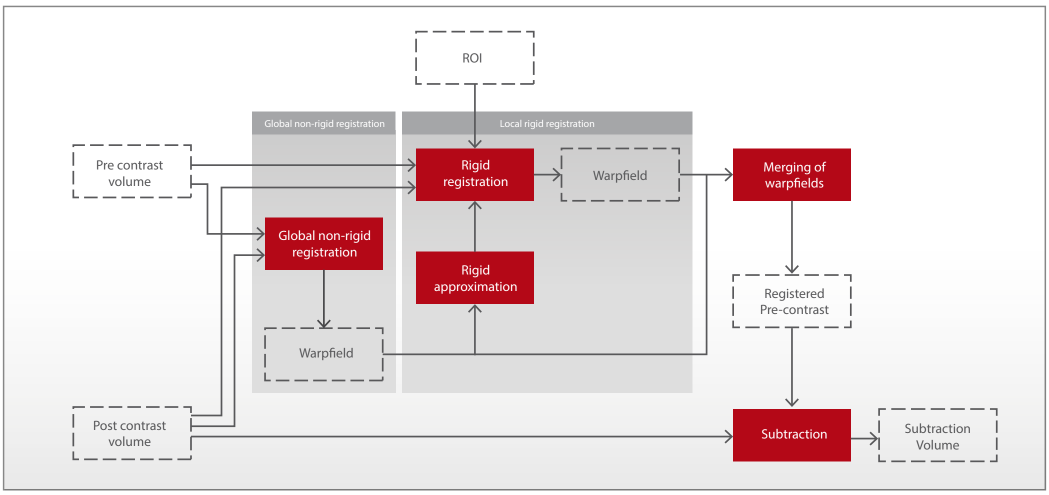


Figure 2: Inputs are in dashed boxes, results in dotted boxes, and algorithmic operation in line boxes. The thin boxes shows the operations constituting the Global non-rigid and Local rigid registration steps[3].

1) Toshiba Medical Visualization Systems Europe, Ltd., Edinburgh, United Kingdom

2) Clinica Creu Blanca, Barcelona

3) Unitat d'Imatge Cardíaca Hospital de Sant Creu i Sant Pau Spain

©2014 TOSHIBA MEDICAL SYSTEMS

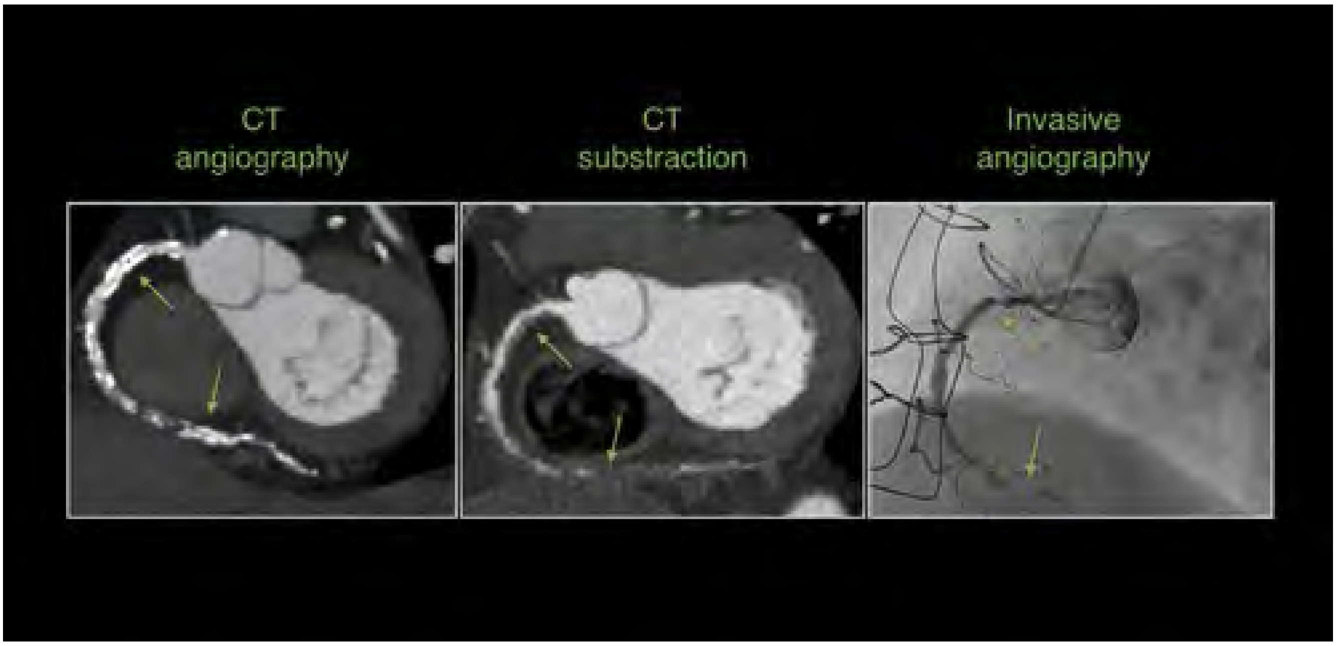


Figure 3: CTA image of highly calcified coronary artery (left), result of coronary subtraction volume on a heavily calcified RCA (middle), and its correlation with the invasive coronary angiography (right) as shown by green arrows.

resolution of 137.5ms in all views as opposed to that of the high-pitch scanner which produces best temporal resolution only in axial view.

TECHNICAL OVERVIEW

To ensure a fast workflow of daily clinical routine, the software should require minimal user interaction and simultaneously deliver accurate results. In this paper we discuss the registration method based on a global non-rigid step, followed by local rigid refinement (Fig. 2).

Global Non-Rigid Registration Phase

The effect of the Global Non-Rigid Registration phase of the algorithm is to bring the input volumes into alignment in most of the heart. We can normally observe a certain amount of residual displacement in those areas where the motion between the two acquisitions was particularly large. This often corresponds to the proximal region of the coronary arteries.

Local Rigid Registration Phase

The local refinement phase uses a local rigid registration. The reason for using rigid registration is that the calcifications are small, rigid objects, and their movement between scans should also be rigid. Rigid registration is also normally simpler and faster than non-rigid, giving a clear advantage when it comes to user interaction.

In order for the assumption of local rigidity to hold, the Local Rigid Registration must be applied to the original, unregistered data, as the application of a non-rigid warp-field to the original data would invalidate the initial hypothesis of rigidity.

Fig. 3 demonstrates a clinical case of CTA, the final result of Coronary subtraction volume as described in Fig. 2, and its high correlation with the invasive coronary angiography, respectively. The green arrows show proximal (upper part) and distal (lower part) segments of Right Coronary Artery (RCA).

CONCLUSION

In this paper we have presented the algorithm of robust Coronary CT Subtraction volume software. We have presented a fast, effective method to register coronaries with very high accuracy ensuring a fast workflow in a daily clinical routine.

We have shown how the combination of a global non-rigid registration and a number of local rigid refinements can achieve a high degree of accuracy, in a time frame suitable for interactive applications.

Finally, a clinical result was shown to demonstrate a high correlation between subtraction volume and the invasive coronary angiography in the same patient.

References:

1. R. Tanaka, K. Yoshioka, K. Muranaka, T. Shiba, T. Ueda, T. Sasaki, T. Fusazaki, S. Ehara, "Improved evaluation of calcified segments on coronary CTA: a feasibility study of coronary calcium subtraction", Int J Cardiovasc Imaging, Oct 2013.
2. A. Fuchs, T. Kuhl, K. Kofoed, "Coronary CT Subtraction: clinical results", Toshiba Medical Systems Journal VISIONS Vol. 22, pp. 28-29, 2013.
3. Marco Razeto, Brian Mohr, Kazumasa Arakita, J. D. D. Schuijf, Andreas Fuchs M.D., Jørgen Tobias Kühl M.D., Marcus Chen M.D., K. F. F. Kofoed M.D., "Accurate, fully-automated registration of coronary arteries for volumetric CT digital subtraction angiography", in Medical Imaging 2014: Image Processing, Sebastien Ourselin; Martin A. Styner, Editors, Proceedings of SPIE Vol. 9034 (SPIE, Bellingham, WA 2014), 90343F.

CT imaging before Transcatheter Aortic Valve Implantation (TAVI) or transcatheter aortic valve replacement (TAVR)

M.-Y. Jeung MD [1)]

M.-Y. Jeung MD

Second generation 320-detector row CT (Aquilion ONE™/ ViSION Edition) provides an excellent image quality across a wide range of heart rates and allows the complete workup for TAVI/ TAVR with one single intravenous bolus injection of the contrast media and single breath-hold. It permits also to use lesser volume of contrast media and lower radiation exposure.

Aortic valve stenosis is the third most prevalent form of cardiovascular disease, after hypertension and coronary atherosclerosis. It frequently affects patients of older age. Aortic valve replacement is indicated for symptomatic patients with severe aortic stenosis, because the prognosis is poor[1]. Surgical valve replacement can be performed at relatively low risk. However, as many as 30% of patients with aortic stenosis are not considered surgical candidates because of comorbidities and estimated extreme surgical mortality risk[2]. Transcatheter aortic valve implantation (TAVI) or transcatheter aortic valve replacement (TAVR) is an emerging therapeutic option for patients who are not eligible for surgical treatment. As opposed to conventional aortic valve replacement, direct visualization of the valve and annulus is lacking during the TAVI/TAVR procedure. So, imaging is necessary to allow for appropriate valve sizing and also necessary to evaluate the best access pathway (transfemoral vs apical, subclavian or aortic). Computed tomography (CT) can provide the other information such as the extent of aortic valve calcification and appropriate fluoroscopic projection angles that permits exactly orthogonal views onto the valve. CT imaging is a highly valuable diagnostic tool in the workup of patients who are being considered for TAVI/TAVR.

Image acquisition remains challenging. A large imaging volume needs to be covered from the aortic arch (and potentially subclavian arteries), and iliac, as well as common femoral arteries (Fig. 1). Spatial resolution must be high to provide adequate imaging, especially of the aortic root and the iliofemoral arteries. It is desirable to choose an acquisition protocol that obtains a reconstructed slice width of ≤ 1.0 mm throughout the entire imaging volume. The aortic root must be imaged with retrospective electrocardiogram (ECG) gating or prospective ECG triggering to allow for adequate motion-free imaging at specific time-points within the cardiac cycle and to compensate for tachyarrhythmia such as atrial fibrillation. Imaging acquisition protocol must consider minimizing the volume of contrast media in the clinical setting of impaired renal function. So, two separate acquisitions (ECG-synchronized for the aortic root and non gated for the aorta and peripheral vessels) may be preferable over an ECG-synchronized acquisition of the entire volume to reduce the amount of contrast amount and radiation exposure (Fig 1). Recent data indicate that imaging of the aortic root and annulus in systole may be preferable over diastole because of the dynamic changes of the annulus and slightly larger annular sizes are noted in systole[3].

Figure 1: Scan plan.
Single- shot one volume scan (blue box) with retrospective ECG-gating for the evaluation of the aortic root including from the carina to cardiac apex, followed by non gated second helical scan (orange box) from base of the neck to the groin with one bolus intravenous injection of the contrast media and one breath hold.

[1)] Department of Radiology B, Nouvel Hôpital Civil, University Hospital of Strasbourg, France

©2014 TOSHIBA MEDICAL SYSTEMS

Choosing the appropriate prosthesis size requires accurate measurement of the dimension of the aortic annulus to reduce the complications during and after TAVR deployment. For measurement of aortic annulus dimensions, an imaging plane must be created which is exactly aligned with the most caudal insertion points of the aortic cusps (hinge points) (Fig 2, images 2A, 2B, 2C). Three derived mean diameters should be obtained from small and large diameter, circumference and area (Fig 2, images 2D, 2E). CT provides additional data such as the distance of the coronary ostia to the annulus, leaflet length, and width of the aortic sinus and the sinotubular junction as well as the ascending aorta (Fig 3). These measurements are important to avoid potentially catastrophic complications such as coronary occlusion and root injury. While the Edwards Sapien prostheses are between 15 and 19 mm in height and do not extend beyond the aortic sinus, the self-expandable CoreValve is between 52 and 55mm in length and, when implanted, extends beyond the sinotubular junction into the ascending aorta (Fig 4).

In addition to annular sizing, CT can provide information about the aortic root orientation in relation to the body axis. The aortic root orientation can be easily extracted from CT data sets to predict an appropriate angle implantation and to reduce the need for repeat aortograms. Pre-TAVI CT data may give information about anatomic details predisposing to paravalvular regurgitation and adverse post-TAVI outcome. Severe valvular calcification may impair complete apposition of the sealing skirt to the native commissures, requiring subsequent transcatheter heart valve (THV) postdilatation to mitigate paravalvular regurgitation[2].

The iliofemoral axis is the most common access for TAVI/TAVR. There have been ongoing refinements resulting in progressive reduction of the profile of the delivery system for transfemoral TAVI/TAVR. Vascular complications have emerged as a main cause of mortality and morbidity in transfemoral TAVR[3]. Risk factors for vascular complications of and potential contraindications to transfemoral TAVI are external sheath diameters exceeding the minimal artery diameter, moderate to severe calcifications, peripheral vascular disease, and potentially substantial vascular tortuosity[3]. CT provides thin-section isotropic volume data of the iliofemoral arteries and can easily identify the presence of all these risk factors, allowing for a more definitive assessment of the access route. CT is also helpful for the evaluation of the other access route for TAVI with similar anatomic detail. In the case of unfavorable vascular anatomy of iliofemoral axis, a transapical, subclavian, or transaortic approach may be selected. Qualitative assessment of CT imaging for TAVI access usually includes 3D volume rendered image display, curved multiplanar reformats, and maximum intensity projections (Fig 5). Multiple measurements are taken along the entire course of iliofemoral arteries with minimum luminal measurement.

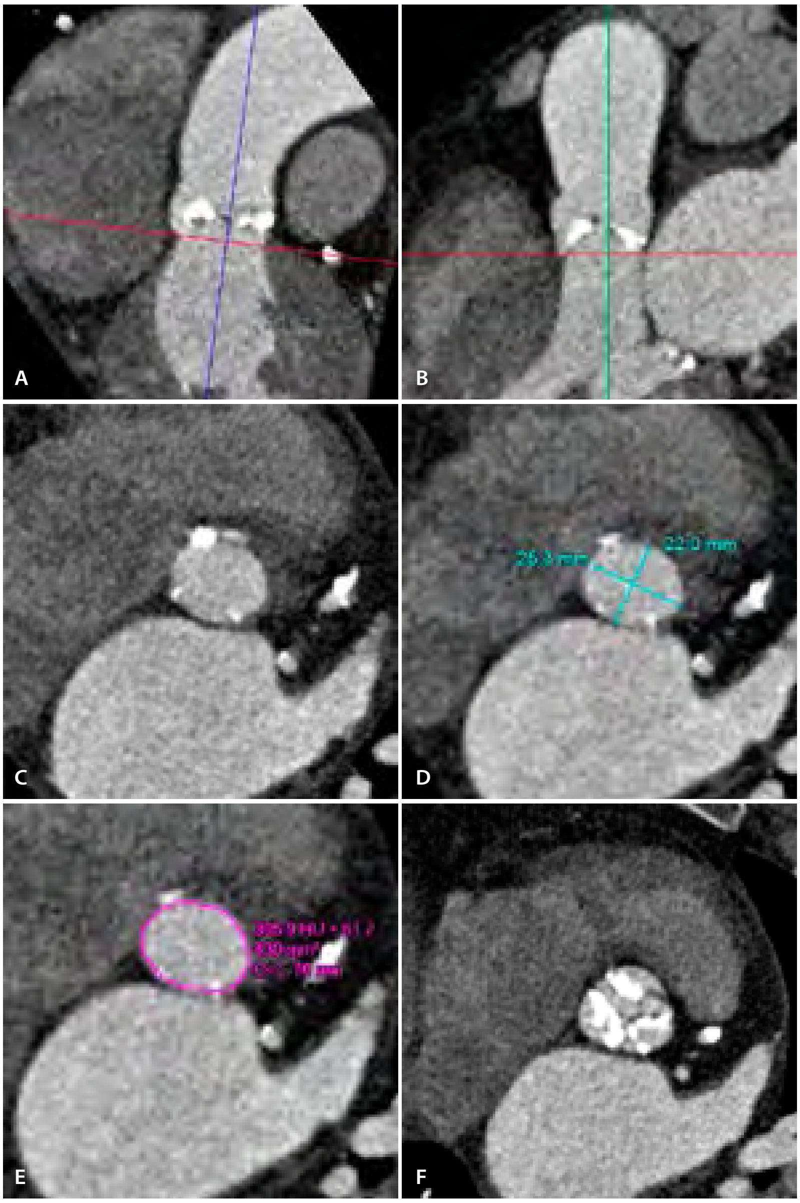
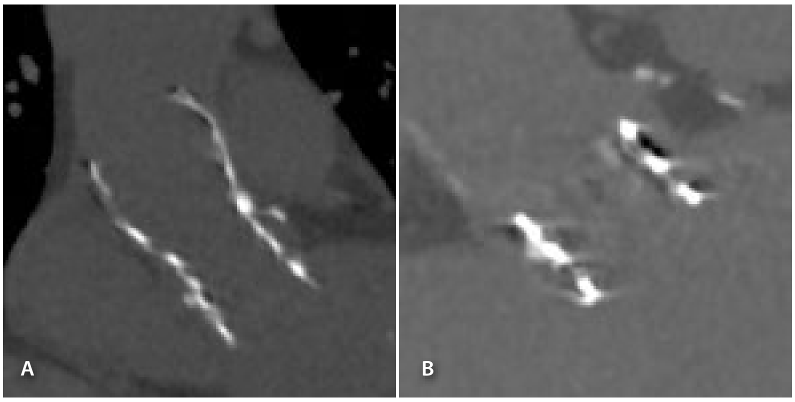


Figure 2: Contrast enhanced CT imaging set for the aortic annulus evaluation.
***A**. Coronal oblique view. **B**. Sagittal oblique view. **C**. Double-oblique transaxial view of true annulus plane (virtual ring) through the most basal attachment point of all three cusps. **D**. Annulus dimension by averaging the maximum and minimum diameter. **E**. Derived diameter from planimetrically based on circumference (diameter=perimeter/ π) and from cross sectional area followed by calculation (diameter=2x √area/π). **F**. Evaluation of aortic valve calcification burden.*

Since April 2013, we have performed CT imaging workup for TAVI/TAVR in more than 65 consecutive patients in our institution with the second generation of 320-detector row CT (Aquilion ONE / ViSION Edition). We are doing two separate acquisitions (retrospective ECG gated single-shot volume scan for the aortic root and non gated helical acquisition for the aorta and peripheral vessel including subclavian arteries) with the same contrast bolus injection and single breath hold. We use almost always 100kV, except for patients with BMI >40, with SUREExposure 3D and novel iterative reconstruction algorithm AIDR 3D.

Figure 3: Assessment of the distance of coronary ostia to annulus.
***A**. Distance from the simultaneously encompassed aortic valve cusp hinge point to the ostium of the left main coronary artery. **B**. Distance to right coronary artery.*



CONCLUSION

TAVR/TAVI is a new emerging technique to treat patients with symptomatic, severe aortic stenosis who have a high surgical risk. CT plays an important role in the workup of patients. Its 3D imaging capabilities provide accurate dimension and morphology of aortic root, annulus and severity of peripheral vascular disease. Second generation 320-detector row CT provides an excellent image quality across a wider range of heart rates and allows the complete workup of aortic root and simultaneous assessment of peripheral vascular access route with one single intravenous injection of the contrast media. It permits also to use lesser volume of contrast media and lower radiation exposure than the first generation 320-detector row CT or other 64-detector row CT.

*Figure 4: Postdeployment of transcatheter heart valve. **A**. Coronal oblique view of CoreValve. **B**. Coronal oblique view of Edwards Sapien valve.*

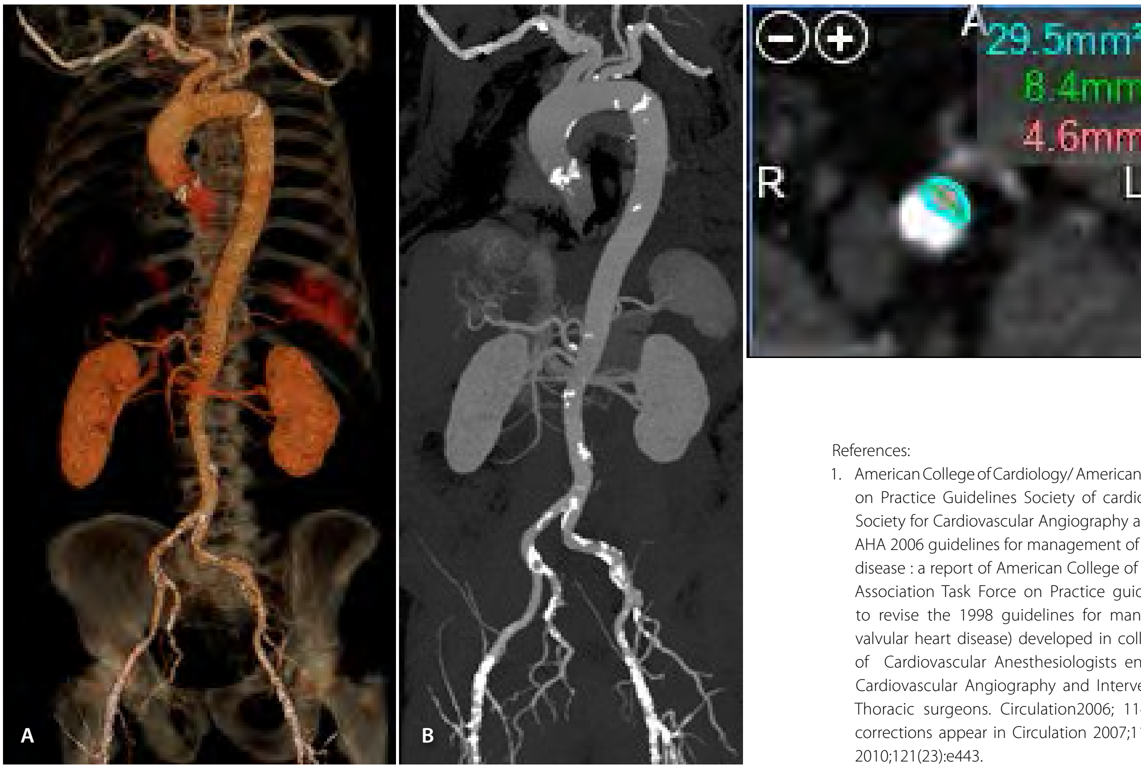


*Figure 5: Contrast enhanced CT angiography of the aortoiliofemoral arteries for the evaluation of peripheral vascular access for TAVR deployment. A 74-year-old man with extensive calcification of iliac arteries and small artery caliber. **A**. 3D volume-rendered image display. **B**. Maximum intensity projection (MIP) and orthogonal section to the centerline (blue box) in curved MIP.*

References:

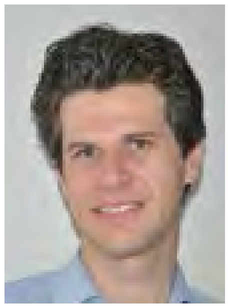
1. American College of Cardiology/ American Heart Association Task Force on Practice Guidelines Society of cardiovascular Anesthesiologists Society for Cardiovascular Angiography and Interventions et al. ACC/AHA 2006 guidelines for management of patients with valvular heart disease : a report of American College of Cardiology/American Heart Association Task Force on Practice guidelines (writing committee to revise the 1998 guidelines for management of patients with valvular heart disease) developed in collaboration with the Society of Cardiovascular Anesthesiologists endorsed by the Society for Cardiovascular Angiography and Interventions and the Society of Thoracic surgeons. Circulation2006; 114(5): e84-e231. [Published corrections appear in Circulation 2007;115(15):e409 and Circulation 2010;121(23):e443.
2. Blanke P, Schoepf U.J, Leipsic J. CT in Transcatheter Aortic Valve Replacement. Radiology 2013;269:650-669.
3. Achenbach S, Delgado V, Hausleiter J et al. SCCT expert consensus document on computed tomography imaging before transatheter aortic valve implantation (TAVI)/transcatheter aortic valve replacement (TAVR). J Cardiovasc Comput Tomogr. 2012;6:366-380.

©2014 TOSHIBA MEDICAL SYSTEMS

Low Dose and Low Amount of contrast for cardiac applications with Aquilion ONE / ViSION Edition

Dr. O. Ghekiere [1)]

With faster gantry rotation time of 275 msec and wide volume coverage up to 16 cm, the new second-generation 320-detector row CT scanner (Aquilion ONE™ / ViSION Edition) enables single-heart-beat coronary CT angiography (CCTA) in heart rates (HR) of up to 75 beats per minute (bpm) and two-heart-beats CCTA in HR of up to 100 bpm. These technical advances combined with the iterative reconstruction AIDR 3D, an automated exposure control (SUREExposure 3D Adaptive) and a larger X-ray power generator, provides excellent image quality while reducing the radiation dose over a wide range of body sizes and HR.



Dr. O. Ghekiere

LOW DOSE CCTA

Since the installation of the Aquilion ONE ViSION in CHC Cliniques St-Joseph, Liège, Belgium, we performed about 750 CCTA examinations between June and December 2013. In a study of 202 consecutive unselected patients, at least 18 years old and referred for clinical purposes and with different heart rates, the mean radiation dose was 1.5 mSv (k = 0,014), which represents a reduction of up to 50% in comparison with our previous 64-slices scanner equipped with prospective gating and iterative reconstruction. The mean body mass index (BMI) was 27.09 kg/m^2, however 131 patients (64,9%) were obese, or morbidly obese. The mean standard deviation (SD) for all patients was 40.5 A SD of 50 was preset for patients with zero or very low calcium score. For patients with a coronary stent or severe calcifications, we used a SD of 33, and for all other patients, a SD of 40. More than one heart beat scanner was performed in 25 (12,4%) patients, including one three-heart-beats scanner in a patient with a HR of 110 bpm *(clinical case)*. All studies were of diagnostic quality without significant blurring artefacts.

The radiation dose was ≤ 1 mSv in almost half of all patients, and more than 4 mSv in only 12 patients, including 6 patients with arrhythmia *(clinical case)*, one morbidly obese patient (BMI > 35) and 5 obese patients with 2-heartbeat scan.

REDUCED CONTRAST VOLUMES

Contrast protocol selection is complex but very important for diagnostic image quality in CCTA. With a gantry rotation time of 0.275 seconds of the Aquillion ONE ViSION Edition, only a very short window of coronary opacification is required. The main indication for CCTA in our institution is to exclude obstructive coronary artery disease.

To avoid streak artifacts generated by high iodine concentration accumulation in the right cardiac cavities, we used a reduced contrast volume with a biphasic injection protocol to obtain good attenuation of the coronary arteries *(table)*.

For single-heartbeat scan, the injection protocol contains 100% of iodine (Iomeron 400, Bracco Diagnostics, Milan, Italy; 400 mg of iodine per milliliter) during 9 seconds, followed by 30 ml saline. For two- and three-heartbeats scan, the 100% of iodine contrast administration is prolonged with respectively 1 and 2 seconds.

In order to achieve a homogeneous and high attenuation of the coronary arteries for all patients (between 400 and 500 UH), we adjust the contrast medium volume and injection rate in function of the BMI, the body surface area (BSA), and the kVp and mA in function of the automated exposure control (SUREExposure 3D Adaptive).

For patients with BMI < 23 and 80 kVp protocol, we use an injection rate of 3.5 ml/sec. If the automated exposure control estimates a radiation dose of 100 kVp and mA < 450, or mA > 450, an injection rate of respectively 4 or 5 ml/sec is proposed. If SUREExposure 3D adaptive proposes 100 kVp and 900 mA, 120 kVp scanning protocol is used with an injection rate of 6 ml/sec.

The delay to CT acquisition is determined using automated contrast bolus tracking, with a region

[1)] *Department of Radiology, Cliniques CHC St-Joseph, Liège, Belgium*

of interest placed in the descending aorta, and automatically triggered at 300 Hounsfield units (HU). The breath-hold command is given 12 seconds after contrast delivery, while SUREStart begins after a delay of 14 seconds. This injection protocol represents a reduction in IV contrast volumes of up to 50% compared with our contrast volume injected using a 64-slices CT scanner.

PEDIATRIC CARDIAC CT AT DOSES COMPARABLE TO A CHEST X-RAY

Echocardiography remains the primary noninvasive imaging tool for pediatric congenital heart disease. For diagnostic additional anatomic information, invasive cardiac catheterization was often required. However, using a dedicated prospective CT pediatric mode (target CTA) the second generation 320-detector row CT-scanner can represent a noninvasive alternative with a dramatic reduction of the radiation dose for visualization of the anatomy of the heart and the coronary arteries. Target CTA consists of the same dose reduction technologies, while the different parameters are fully set manually. Since the installation of the Aquilion ONE ViSION Edition, it is now possible for us to have diagnostic image quality of the coronary arteries in this pediatric population with radiation doses comparable to a chest X-ray and a very small amount of contrast volume (clinical cases).

CONCLUSION

With the technological advances of the second-generation 320-detector row CT scanner, very low dose coronary CTA with reduced contrast volumes can be obtained with excellent image quality, even at higher heart rates and for pediatric cardiac applications.

Phase 1	100% iodine / 0% saline
Phase 2	0% iodine / 100% saline

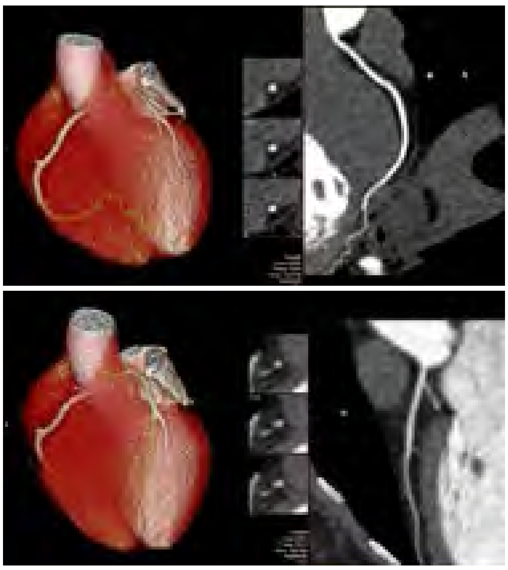
			One Beat	Two Beats
		Flow rate	Quantity	Quantity
80 kV and BMI < 23	Phase 1 Phase 2	3.5 cc/s 3.5 cc/s	32 cc 30 cc	35 cc 30 cc
100 kV and BMI < 450	Phase 1 Phase 2	4 cc/s 4 cc/s	36 cc 30 cc	40 cc 30 cc
100 kV and BMI > 450	Phase 1 Phase 2	5 cc/s 5 cc/s	45 cc 30 cc	50 cc 30 cc
120 kV	Phase 1 Phase 2	6 cc/s 6 cc/s	54 cc 30 cc	60 cc 30 cc

Clinical case 0.16 mSv

A 44-year-old woman presented with retrosternal pain. The cardiovascular risk factors included smoking. The patient presented an infero- lateral ST segment depression at a bicycle stress test. CTA showed no coronary artery disease.

The radiation dose was 0.16 mSv (k = 0,014), DLP 11,2 mGy.cm. 36 ml Iomeron 400 at 4 cc/sec was administered for this examination.

Heart rate during the acquisition was 68 bpm.



©2014 TOSHIBA MEDICAL SYSTEMS

Clinical case 110 BPM

A 40-year-old man presented with angina pectoris and dyspnoea at exercise. The cardiovascular risk factors included dyslipidemia and smoking in the past. The patient presented a lateral ST segment depression at a bicycle stress test. CTA showed no coronary artery disease.

The radiation dose was 2.17 mSv (k = 0,014), DLP 155 mGy.cm. 36 ml Iomeron 400 at 4 cc/sec was administered for this examination.

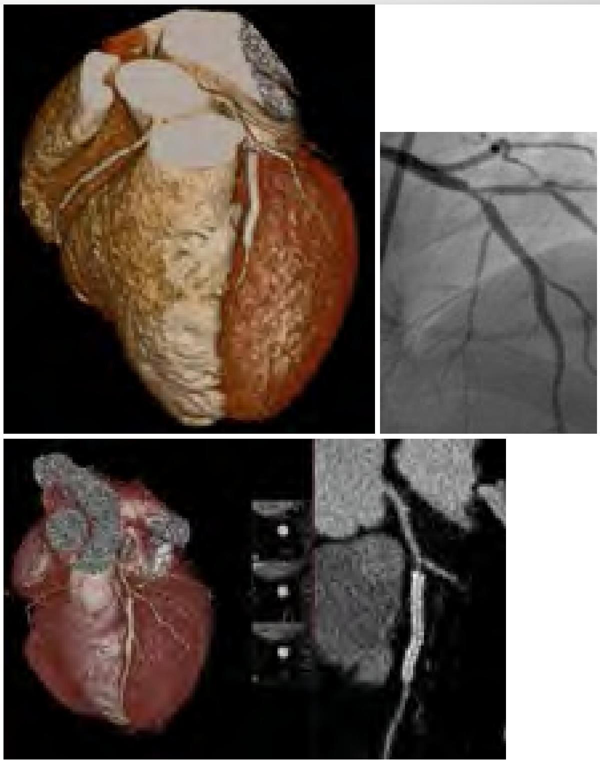
Heart rate during the acquisition was 109,5 bpm.

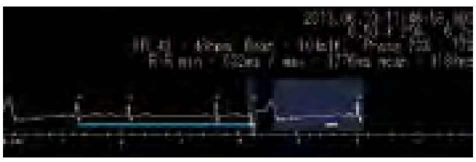
Clinical case arrhythmia

A 60-year-old female with a history of angioplasty of the LAD and anterior infarct, was seen by the cardiologist for follow-up. Cardiovascular risk factors include smoking stopped 6 months ago. Rest-ECG showed multiples supraventricular extasystolies. CTA shows normal permeability of the stent in the LAD, but a moderate stenosis just before the stent, confirmed by catheter coronary angiography.

The radiation dose was 4.05 mSv (k = 0,014), DLP 289 mGy.cm. 36 ml Iomeron 400 at 4 cc/sec was administered for this examination.

Heart rate during the acquisition was 71,3 bpm.





PEDIATRIC CASES

Clinical case 1

An asymptomatic 4-year-old boy presented with a history of anomalous origin of the right coronary artery at transesophageal ultrasonography. There was no familial history of sudden death. Clinical investigation revealed no abnormalities and rest-ECG was normal.

Using CT an abnormal origin of the RCA from the left sinus of Valsalva with an interarterial course was seen between the aorta and the pulmonary trunk (arrows).

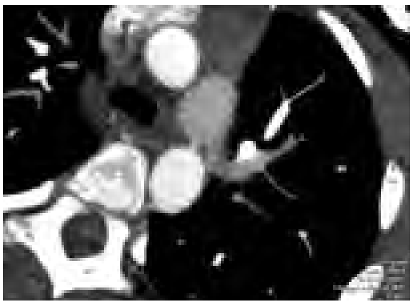
A specific prospective CT paediatric mode has been used with a standard deviation of 50. The acquisition was performed in one heart beat and scan length was 60 mm. The radiation dose was 0.12 mSv (k = 0,0319), DLP 3.7 mGy.cm. Only 14 ml (patient of 20 kg) Iomeron at 2 ml/s was administrated for this examination.

Technical parameters: 80 kVp ; 17 mAs ; rotation time of 0.275s ; standard deviation of 50.
Heart rate during the acquisition was 76 bpm.

Clinical case 2

A 5-year-old boy presented with heart murmur and a suspicion of an aortic coarctation on cardiac ultra-sonography. Low dose cardiac CT of the heart and the aortic arch showed a persistant ductus arteriosus, a shunt between the proximal descending aorta and the left pulmonary artery (arrow).

A specific prospective CT paediatric mode has been used with a standard deviation of 50. The acquisition was performed in one heart beat and scan length was 160 mm to cover the thoracic aorta. The radiation dose was 0,46 mSv (k = 0,0319), DLP 14,4 mGy.cm. 14 ml Iomeron 400 (patient of 20 kg) at 2 ml/s was administered for this examination.



Technical parameters: 80 kVp ; 17 mAs ; rotation time of 0.275s ; standard deviation of 50.
Heart rate during the acquisition was 89 bpm.

©2014 TOSHIBA MEDICAL SYSTEMS

Clinical case 3

A 14-year-old boy presented with syncope during sports practice. There was no familial history of sudden death. Clinical investigation revealed no abnormalities and rest-ECG was normal. Low dose cardiac CT was performed to exclude abnormal origin of the coronary arteries.

A specific prospective CT paediatric mode has been used with a standard deviation of 55. The acquisition was performed in one heart beat and scan length was 60 mm. Total radiation dose was 0.08 mSv (k = 0.014), 5,7 mGy.cm. Only 20 ml Iomeron 400 (patient of 52 kg) at 3 ml/s was administered for this examination.

Technical parameters: *80 kVp ; 17 mAs ; rotation time of 0.275s ; standard deviation of 55.*
Heart rate during the acquisition was 51 bpm.

University of Edinburgh partners with Toshiba in high altitude research project APEX 4

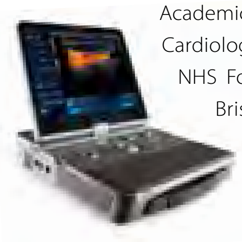
Following from the work of the 2011 APEX 3 expedition, the APEX 4 study will improve understanding of fatal conditions including High Altitude Pulmonary Oedema (HAPE) and and High Altitude Cerebral Oedema (HACE). The results are set to improve management of the sickest and most vulnerable patients in intensive care units around the world.

Thirty students and alumni from the University of Edinburgh are to undertake an ambitious expedition to Bolivia where they will study the effects of altitude and low-oxygen environments on the human body high up in the Bolivian Andes.

The APEX 4 (Altitude Physiology Expeditions) team will conduct experiments at more than 5,300m in order to shed new light on potentially fatal conditions that appear to strike randomly at high altitudes. The study could improve the safety and wellbeing of millions of climbers and skiers who ascend to high altitude each year. It could also help patients in hospital intensive care units who suffer from very low blood oxygen levels.

The team will research High Altitude Pulmonary Oedema (HAPE) - an illness characterised by fluid build-up in the lungs - and High Altitude Cerebral Oedema (HACE), which is characterised by a build-up of fluid in the brain. Both conditions are potentially fatal.

Mr Wayne Pringle, Sonographer, Royal Devon and Exeter NHS Foundation Trust and Dr Guido Pieles, Academic Clinical Lecturer in Paediatric Cardiology, University Hospitals Bristol NHS Foundation Trust / University of Bristol will join the expedition, working with the team using ultra-portable, lightweight



©2014 TOSHIBA MEDICAL SYSTEMS

Viamo™ ultrasound scanner technology from Toshiba Medical Systems, which combines all the advantages of a portable ultrasound system with the diagnostic precision, productivity and comfort of a premium cart-based machine.

Dr Pieles will perform cardiac ultrasound studies at high altitude to investigate the effect of low oxygen levels and pressure on the heart, as well as defining the effects of exercise at high altitude on heart function. This will help understand heart dysfunction in newborns and children with congential heart disease who often have to live with low blood oxygen levels before corrective surgery is undertaken. A novelty of this expeditions approach will be to correlate cardiac ultrasound findings with the individuals genetic make up and the search for predrictive blood biomarkers for cardiac dysfunction at high altitude.

The battery-powered Viamo scanner's high performance imaging function will allow the medical team to continue research from the 2011 APEX 3 expedition, in which Toshiba technology was also used, by measuring fluid in the lungs of members of the party at altitude. The team will also examine whether a person's genetic make-up can influence their susceptibility to HAPE and altitude sickness.

The students will also research acute mountain sickness (AMS), a condition that results in headache, nausea and fatigue. It is often a sign that a person is at risk of HAPE and HACE.

The two week-long trip is the fourth such research trip to Bolivia by students from Edinburgh, following the inception of APEX in 2000.

Expedition leader Shona Main, a fourth year medical student, said: "This expedition will provide an invaluable opportunity to improve our understanding of these potentially fatal conditions. It will also help us to improve management of the sickest and most vulnerable patients in intensive care units around the world."

APEX founder Dr Kenneth Baillie, who led a previous trip to Bolivia, said: "It is a privilege to work with such a driven and inspiring group of students. The research they have planned at high altitude will help us to understand why patients' lungs fill up with fluid during critical illness back home at sea level. Ultimately their research could lead to important advances in the ways we treat patients on life support with severe lung problems."

Toshiba Medical Systems UK Managing Director, Mark Hitchman comments: "We are proud to support this groundbreaking research. Toshiba's heritage in applied research has allowed us to develop the technology with the capability to be easily used for this kind of study. As ever, Toshiba's participation in special projects takes into consideration the benefits for wider swathes of the population. With the potential to realise immediate benefits for climbers and skiers operating at high altitude, the ability to achieve healthcare management benefits for acutely ill patients in intensive care units around the world is a significant objective for the group."

If you'd like to find out more, you can visit the APEX 4 website: www.altitude.org/apex4. You can also follow them on Facebook www.facebook.com/apex4expedition or tweeting @apex4expedition.

Expedition ultrasonographer Wayne Pringle performing an ultrasound scan of the eye. He is using the Viamo portable ultrasound machine kindly provided by Toshiba Medical Systems.

Some of the members of the expedition team at the media event held at the CSE gym, Edinburgh.

Dinosaur vertebra detected using a Toshiba CT scanner

A. S. Issever, M.D. [1)]

A. S. Issever, M.D.

Berlin radiologists have used a Toshiba CT scanner to produce a lifelike digital image of a dinosaur fossil – and copied this for the first time using a 3-D printer.

Figure 1: Digitized image of original excavation field map from Halberstadt, 1923. Inset is magnification of fossilized vertebra.

The Aquilion ONE™ appears to be capable of (almost) anything: it has even almost brought to life a 210 million-year old plateosaurus. You at least get a realistic idea, for example, of its hand-sized vertebrae if you visit the radiologists Ahi Sema Issever and Rene Schilling in their doctor's surgery at Charité Universitätsmedizin Berlin. In cooperation with the Naturkundemusuem Berlin (Berlin Museum of Natural History) and the Technische Universität Berlin, they recently carried out an unusual research project in the Radiology Department – causing an international sensation both on the scientific scene and in the media. The researchers published their results in the renowned US trade journal Radiology. They even received calls and questions from Russia and Australia following this.

The Berlin radiologists discovered several dinosaur bones with the help of a Toshiba computer tomographist. "We can see a bone in stone, virtually reconstruct this and generate a 3-D impression without touching the fossil at all," says Issever. Taxidermists normally require weeks or months to excavate bones from sediment. There is always the danger of the preparations getting broken or destroyed. Computer tomography on the other hand enables precise recognition of the original bone in the sediment. "We are able to create the digital visualization at the press of a button – without destroying anything," rejoice the paper's authors. They proudly showed on the workstation how impressive the scans have become that the Aquilion One had created of the prehistoric dinosaur: a body of vertebra in large format permeated with the finest fractures".

It all started with a request from the Naturkunde-museum. It was here in the Second World War that a bomb explosion led to the collapse of a cellar together with several excavation finds. Fossilized dinosaur bones

[1)] Charité – Universitätsmedizin Berlin X-rays dinosaur fossils

©2014 TOSHIBA MEDICAL SYSTEMS

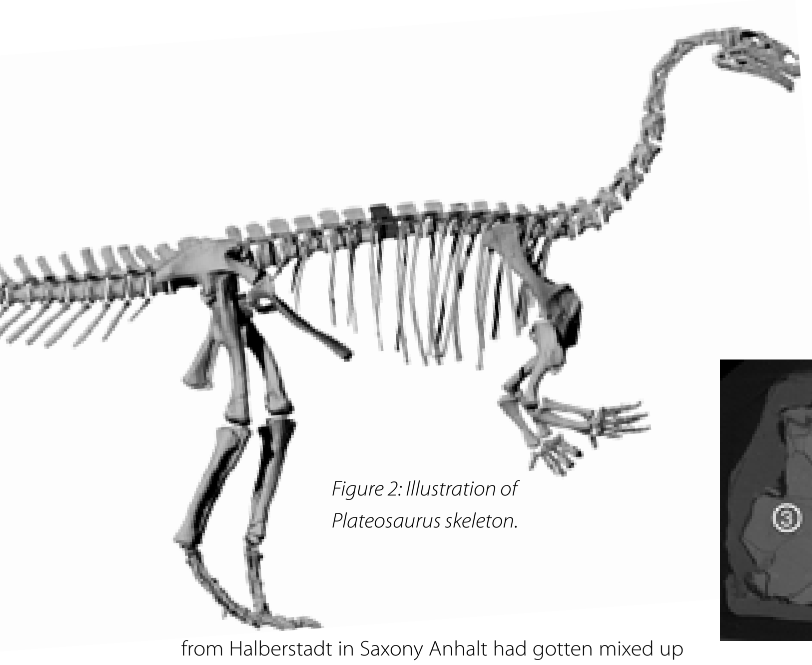


Figure 2: Illustration of Plateosaurus skeleton.

from Halberstadt in Saxony Anhalt had gotten mixed up with dinosaur bones from Tendaguru in Africa – a world-renowned dinosaur fossil site in Tanzania. Some finds in the cellar of the Naturkundemuseum have still not been explained to this day. The dinosaur researchers asked their scientific colleagues at Charité for assistance so they would not have to open each object.

It was not the first time in radiology that dusty boxes were delivered with unknown contents. Palaeontologists have being using CT technology for a long time for x-raying preparations. This saves time and money. This therefore meant that the Aquilion ONE could be used more often. The Berlin researchers are however among the first to create a 3-D impression using scanning data from unprepared bones. Researchers from the Technische Universität Berlin then created a cheap, faithful synthetic copy on the 3-D printer using the data from the Aquilion One and the resulting virtually-constructed models.

The scientists at Charité scanned a total of 20 preparations. Some of the chunks of rock with matrix were tiny, others were as a big as a medium-sized boulder.
As x-rays no longer affect the prehistoric fossils, Issever and Schilling were able to disregard the otherwise impressive dose reduction of the Aquilion ONE. "We were able to make any number of cuts from a horizontal and coronary perspective." The sketch of the excavation shows that the vertebra comes from a plateosaurus that was excavated more than 80 years ago in Halberstadt. The radiologists were also able to use the CT to establish exactly which fractures must be as old as the dinosaur itself – and which ones must have occurred at the same time as the bomb explosion.

Issever is convinced that there will be more assignments in the future from the Naturkundemuseum, which is only a few hundred metres away and that the 3-D synthetic copies may soon be standard." There are still many fossils of which the origin is unclear," she says. Issever therefore feels that this makes for excellent infrastructure and cooperation between the colleagues at Charité, Toshiba, the Naturkundemuseum and the TU. "We even enjoy carrying out research projects outside working hours when the environment is so scientifically creative," says Issever.

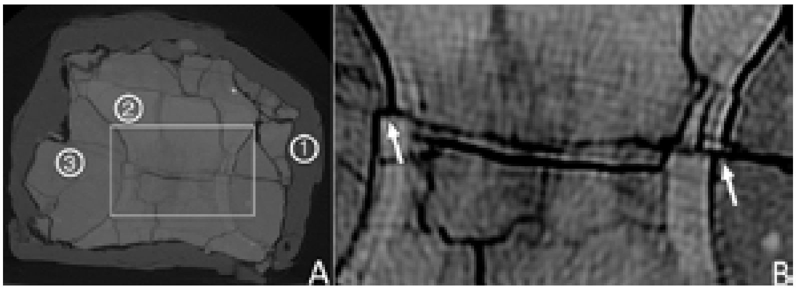


Figure 3: Axial CT scans of fossil. A, CT scan covers full scale of attenuation and depicts entire inner structure of scanned object, including surrounding plaster jacket, sediment matrix, and fossilized vertebral body. To obtain representative attenuation measurements, circular ROIs were placed in surrounding protective plaster (1), body of vertebra (2), and surrounding fossil¬ized sediment matrix (3). B, To increase contrast between fossilized vertebral body and fossilized surrounding sediment matrix, a section—square in A—is depicted. Arrows in B indicate displacement of ventral and dorsal halves of vertebra (see arrows in Fig 6, F).

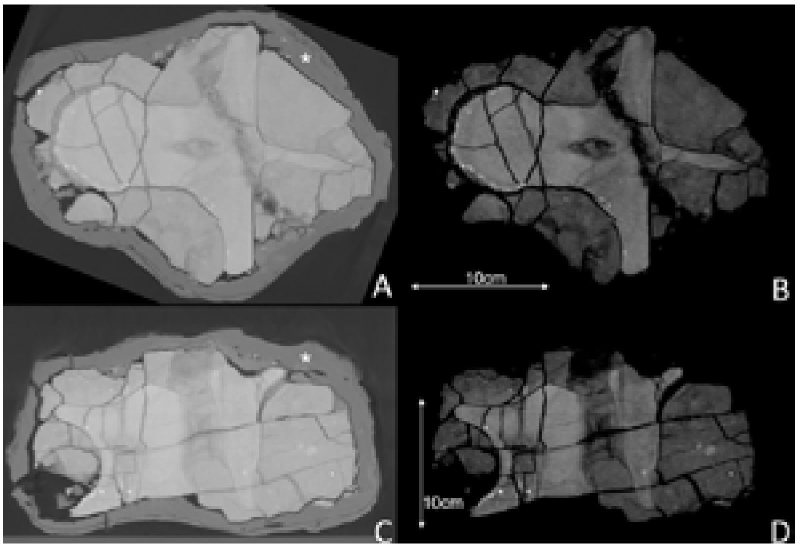


Figure 4: A, B, Coronal and, C, D, sagittal reconstructions of fossil with different window levels and widths.

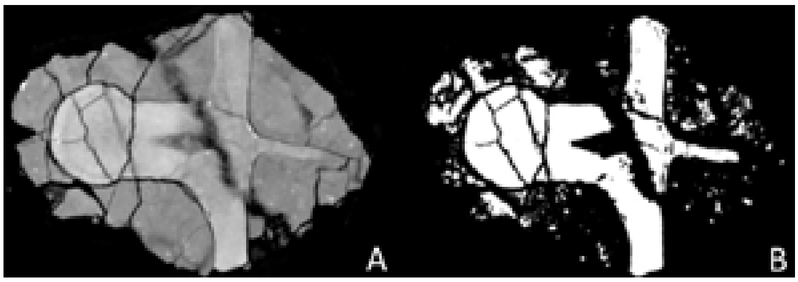


Figure 5. Coronal views of fossil. A, To segment the dataset for the 3D print and to improve visual differentiation, attenuation values were first remapped into a smaller range. B, Recalibration of brightness and contrast values further improves differentiation between fossilized vertebral body and its surrounding sediment matrix.

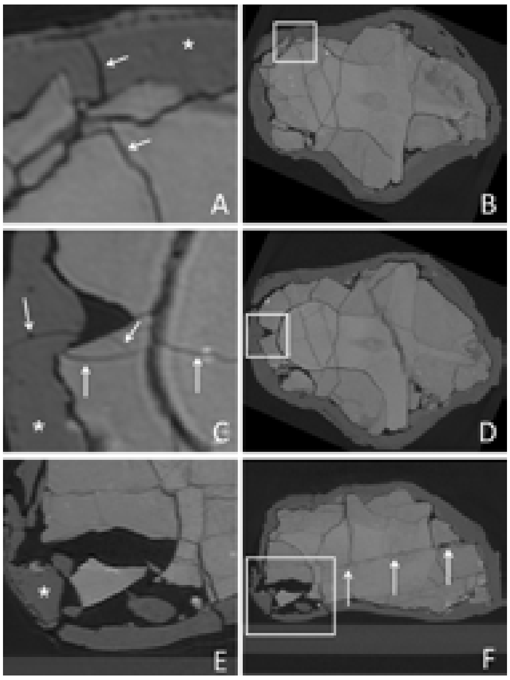


Figure 6: A, C, E, Enlarged sections of squares in B, D, and F, respectively. In coronal views (A and C), fracture lines (arrows) pass through surrounding plaster jacket (*) and extend into fossil. Arrows on sagittal view (F) mark major fracture zone that goes through entire fossil, causing displacement of ventral and dorsal halves as marked by arrows in Figure 3, B. In enlarged section of image (E), a void between the surrounding plaster (*) and the underlying—apparently destroyed—anterior part of fossil is clearly visible. Multiple small fragments can be identified within the void.
* indicates surrounding hard plaster. Numerous fracture lines passing through fossil are clearly visible.

Figure 7: Virtual 3D reconstructions of fossilized vertebral body after surrounding sediment matrix and protective plaster have been digitally removed through segmentation of CT dataset. Multiple fracture lines and dislocated fragment from anterior rim of vertebral body are clearly visible.

Figure 8: 3D print of vertebral body.

Figure 9: 3D print next to the original unprepared and erroneously labeled plaster jacket.

©2014 TOSHIBA MEDICAL SYSTEMS

SURESubtraction Ortho: Clinical Application for Aorta and Peripheral Arterial Occlusive Disease

Pr. C. Roy [1], Dr. M. Ohana [2]

CT Angiography has become a routine examination for the assessment of vascular diseases. It is the imaging modality of choice for the pre operative evaluation of aortic aneurysms and the planning of their endovascular treatment. Calcified plaques can hinder the evaluation of the lumen and is therefore one of the greatest limitation of CTA today. To overcome this challenge Toshiba has developed SURESubtraction™ Ortho software which uses a sophisticated deformable registration algorithm to remove not only bone but calcifications and stents as well. This article describes our initial experience with this software to evaluate the aorta and lower limb vessels.

Pr. C. Roy

Dr. M. Ohana

BACKGROUND

CTA (Computed Tomography Angiography) is now a mature and robust imaging examination and is considered to be the gold standard to evaluate the aorta and peripheral arterial occlusive disease. Although image interpretation relies on axial slices and curved multiplanar reconstructions (MPR), a quick overview of the whole arterial vasculature can be obtained with maximum intensity projection (MIP) and volume rendering (VR) reconstructions. Even though CTA is suitable to evaluate atherosclerosis, it is less useful for assessing the degree of stenosis in cases with extensive calcified plaques or in presence of stents. These high density structures can appear larger on CT than they actually are due to blooming artifacts, leading to an overestimation of the degree of stenosis or even a false positive diagnosis of occlusion. Automatic bone segmentation algorithms are available on most workstations, however these algorithms are generally only useful to remove the bones and are quite unreliable when it comes to removing florid vessel calcifications or small caliber stents. Removing these structures manually is very time consuming and user dependent and therefore is not applicable for routine clinical use.

To improve lumen visualization even in highly calcified vessels, subtraction techniques developed for conventional and digital angiography have been adapted for CTA examinations and were first published by Gorzer in 1994[1]. Subtraction techniques use an unenhanced acquisition to create a mask, which is then subtracted from the post contrast arterial acquisition, providing a clear depiction of the lumen free from overlying bones, calcifications and stents. This process can be fully automated, requiring almost no user interaction.

Initially, subtraction algorithms used a rigid registration technique which shifts the mask volume in the x and y directions. Good results can be obtained in body regions where there is little to no motion, such as the brain. In body regions such as the abdomen, motion is often in x, y and z directions as well as rotational motion. In these cases more sophisticated registration techniques are required when performing subtraction. Deformable registration algorithms 'warp' the bony structures and calcified plaque from the mask volume to match the corresponding structures in the post contrast volume.

SURESubtraction Ortho utilizes a super high resolution deformable registration algorithm that has been optimized for accurate subtraction of skeletal structures and calcified plaque.

In combination with iterative reconstruction (AIDR 3D), it provides fast and robust low radiation dose subtracted CTA for almost all patients with negligible impact on reconstruction time and daily workflow.

With SURESubtraction Ortho, blooming artifacts are significantly reduced, thus increasing reader confidence when assessing the lumen size and degree of stenosis. Potential streak artifacts induced by stents or surgical clips are also removed, making in-stent restenosis easier to assess and endoleaks more clearly visible. Finally, high-quality MIP and VR reconstructions are immediately obtained, without painful and time consuming post processing.

[1-2] Department of Radiology B, University Hospital of Strasbourg

IN PRACTICE

Step 1: Data Acquisition

A low dose pre contrast acquisition is performed followed by a post contrast arterial acquisition. Both acquisitions are performed with the same scan range, FOV, kV and rotation speed. The mA is reduced in the pre contrast scan, in many cases allowing the examination to be performed with less radiation dose than a routine CTA performed without AIDR 3D. Table 1 shows the scan parameters for an Aorta CTA with Subtraction.

Table 1: Scan & Reconstruction Parameters for Aorta

	Slice Thickness	Pitch	kV	mAs	Rotation Speed	FOV	Scan Time	Reconstruction Slice Thickness/ Interval
Pre Contrast	0.5mm x 80	0.813	100	SUREExposure 3D (SD 18.5)	0.75s	350-380mm	30-40s	1mm/0.8
Post Contrast				SUREExposure 3D (SD 9)				

Contrast material (350 or 400 mgI/ml) is injected with the appropriate individual scan delay for contrast arrival using a dual-head power injector. The average contrast volume is 80 mL with a flow rate of 4 mL/s, followed by 50 ml of saline injected at the same rate. The CTA scan is triggered using SUREStart with a ROI in the supra renal aorta and a threshold at 250HU.

Step 2: Subtraction Processing

The reconstructed volumes are loaded by the technologist into the subtraction software, which performs registration and subtraction. A subtracted volume is then saved. Total processing time for an aorta is 5 minutes and around 10 minutes for a lower-limb CTA.

Step 3: Viewing

The subtracted volume is transferred to the Vitrea workstation for routine post processing and any type of reconstructions including MIP, VR, curved reformations and stenosis evaluation.

OUR INITIAL EXPERIENCE

The quality of the resulting subtracted volume data is generally excellent for the aorta (Figs 1, 2, 4), with some bone remnants occasionally visible without compromising the evaluation of the vascular structures. We have observed good results for the evaluation of the lower limb arteries (Fig 3).

The additional time required for the subtraction process does not have any significant impact on the workflow, as no user interaction is necessary during the subtraction process and the CTA dataset is available for evaluation in the meantime. We consider this to be acceptable, even in an emergency situation.

Our referring clinicians receive both datasets: post-processed images with bone segmentation containing arterial calcifications and post-processed images using subtraction without arterial calcifications. The subtracted images are greatly favored.

The additional radiation dose for the subtraction protocol was between 25 - 33% more than our routine CTA examination, however we consider this to be acceptable in the clinical context of usually, elderly patients.

Another advantage of using subtraction techniques in CTA is that the concentration of contrast agent may be reduced.

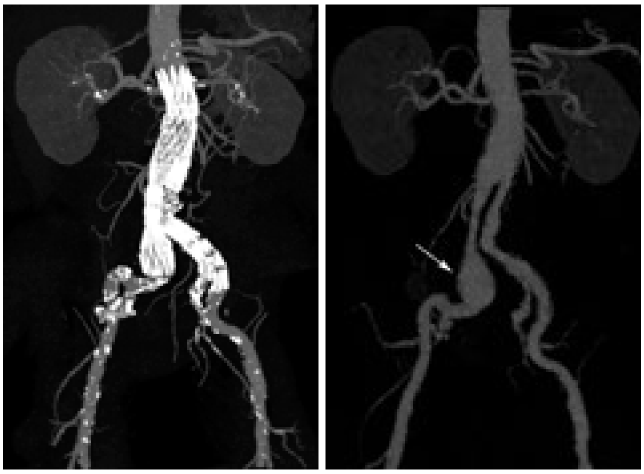
However, some limitations should be noted. Subtraction CTA requires a high level of patient cooperation which may limit its use in critically ill and uncooperative patients. Also, this method generates twice the number of images than routine CTA, which can result in PACS overload.

CONCLUSION

SURESubtraction Ortho is a robust and accurate technique to remove calcification, stents and bone from CTA examinations. The automation of the subtraction process has allowed us to seamlessly integrate it into our routine workflow, with clear benefit for the evaluation of highly calcified distal arteries and the detection of in-stent restenosis.

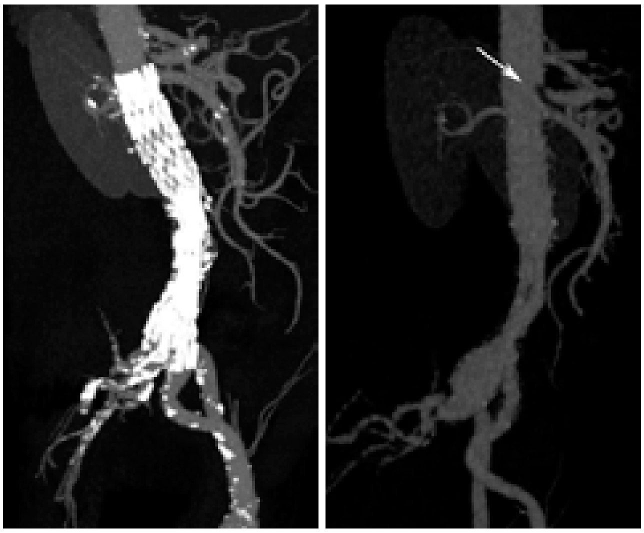
1. Gorzer H, Heimberger K, Schindler E. Spiral CT angiography with digital subtraction of extra- and intracranial vessels. J Comput Assist Tomogr 1994;18:839–41

©2014 TOSHIBA MEDICAL SYSTEMS



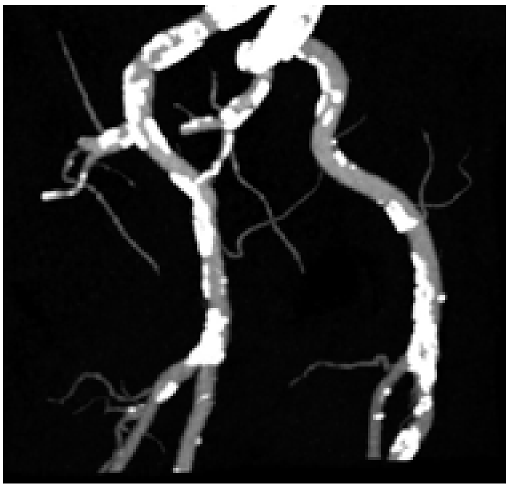
A

B

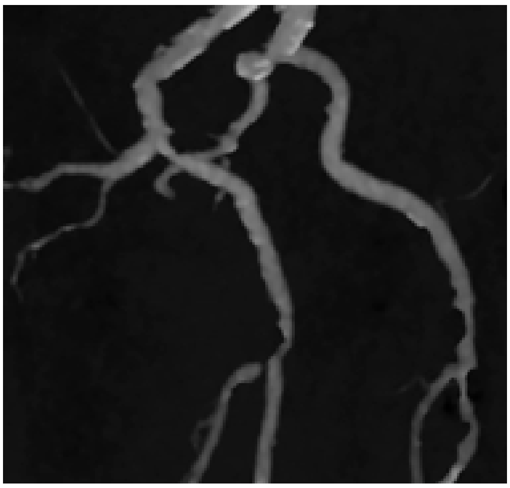


C

Figure1: Aorta CTA following EVAR Contrast enhanced MIP reconstructions in coronal (a), oblique (b) and lateral (c) views: aortic endograft and arterial wall calcifications obscure the lumen. Subtracted MIP reconstructions: true lumen with narrowing of iliac vessel and ectasia at the distal end of the right iliac graft. Note the improved visualization of the occluded coeliac trunk (↑) and of the ectasia of the right iliac (↑).



A

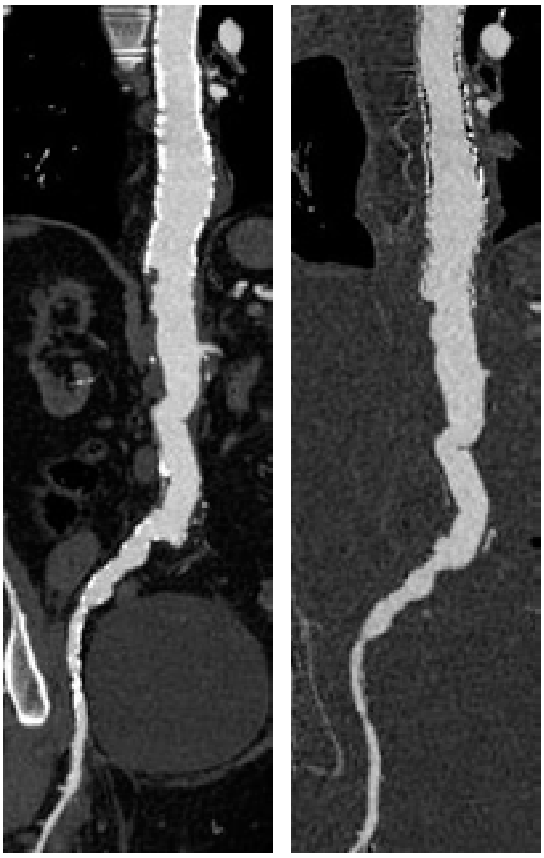


B

Figure 2: Severe calcifications of the external iliac and femoral arteries: contrast-enhanced MIP oblique view (a) and subtracted MIP (b): the arterial patency is clearly demonstrated in the subtracted image.

A B C

Figure 3: Runoff CTA. Contrast-enhanced MIP in oblique view (a) and subtracted MIP (b): more detailed evaluation of the distal arteries, especially on inverted MIP (c) is possible using the subtracted images.



A B

Figure 4: Aortic endograft. Contrast-enhanced curved MPR (a) and subtracted curved MPR (b): improved visualization of the lumen, particularly the right iliac artery, is possible in the subtracted image.

©2014 TOSHIBA MEDICAL SYSTEMS

TOSHIBA
Leading Innovation

Register online for **VISIONS**

And stay up-to-date with the latest innovations in medical imaging

Subscribe for VISIONS and have digital access to the latest edition of VISIONS magazine and all other articles that have been published in previous editions of VISIONS.

Just visit our website at www.toshiba-medical.eu/eu/visions-magazine

Do you also want to receive a paper copy of VISIONS magazine at home or at work? Please tell us so during registration and we will send you VISIONS magazine twice a year! Registration is easy and absolutely free.

www.toshiba-medical.eu   ULTRASOUND CT MRI X-RAY SERVICES

The TAVI scan protocol in the LUMC

J.J.H. Roelofs [1)]

J.J.H. Roelofs

Transcatheter aortic valve implantation (TAVI) has emerged as an attractive alternative to surgical aortic valve replacement. At the Leiden University Medical Center (LUMC, Leiden, the Netherlands) the procedure is performed, by the cardiology department, at an average of three times a week.

The TAVI procedure is mainly applied in patients who cannot undergo open heart surgery due to the presence of significant co-morbidities. Most of these patients are elderly fragile patients, above the age of seventy years. CT imaging plays an important role in the workup for the procedure. Therefore all TAVI candidates undergo a pre-procedural CT scan (using the pre-TAVI scan protocol) on the Toshiba Aquilion ONE CT scanner. This scanner is uniquely suited to capture all required details in a single examination with Toshiba's default protocol I where a volumetric acquisition is combined with a ultra helical scan.

The pre-TAVI scan protocol consists of a calcium scoring scan, a CTA/CFA of the heart, followed by a CTA of the entire aorta and peripheral arteries, including the iliac arteries.

Because of the advanced age and existing co-morbidities of the patients the radiation dose of this examination is of less importance. More important is to reduce the amount of contrast volume given the risk of contrast induced nephropathy for this group of patients; therefore we created a scan protocol with a slightly higher but acceptable radiation dose, but with a single contrast injection of limited volume.

PREPARATIONS

Three hours prior to the examination the patient is only allowed to drink clear liquids (no coffee or food). No additional beta-blocker or other pre-medication is indicated for this examination.

THE PRE-TAVI-SCAN PROTOCOL

First a dual scanogram of chest and abdomen is performed. This dual scanogram is used both for planning and dose modulation.

The calcium scoring scan is performed in every patient, including patients with stents, metal clips or wires, to measure the amount of calcifications of the aortic valve. The scan is not intended to quantify the amount of calcium in the coronary arteries. The calcium scoring scan is a volumetrical scan with a scan range of 140mm.

For the sure IQ (Image Quality) settings of this scan a standard deviation value of 50 is used based on a 0.5mm slice thickness and FC03 reconstruction kernel. The maximum mA level is put on 230mA to limit the maximum dose, and a tube voltage of 120kVp is used.

Next, prospectively ECG-triggered imaging of the aortic root and the heart is performed (Fig. 1). This volumetric scan can be performed as a target CTA at either end-diastolic or end-systolic phase to minimize radiation dose. If more information is needed, this protocol can easily be changed into a prospective volumetric ECG-triggered CTA/CFA scan with dose modulation at the cost of a slightly higher radiation dose. Using this protocol, both end-systolic and end-diastolic phases can be obtained, allowing more accurate evaluation of the aortic root as well as functional analysis of the heart.

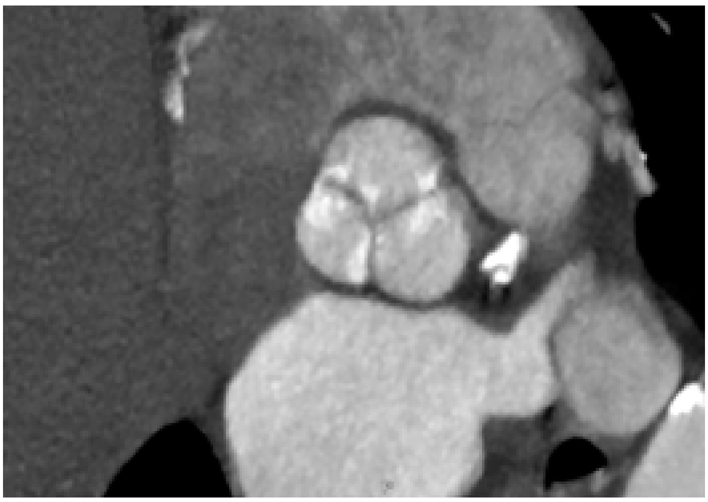


Figure 1: Showing the calcified aortic valve using a single beat volumetric scan.

1) Radiology Department, LUMC, The Netherlands

©2014 TOSHIBA MEDICAL SYSTEMS

A tube voltage of 100kVp is used, in combination with modulated tube current. The sure IQ setting of this scan has a standard deviation value of 40 based on a 0.5mm slice thickness and FC05 reconstruction kernel.

This volume scan is followed as fast as possible by an ultra helical acquisition of the aorta. The scan range of this ultra-helical scan is from the scull base, including the subclavian arteries, all the way down to the pubic symphysis, including the iliac arteries (Fig. 2). The ultra helical is scanned in a 80 row mode, with a helical pitch of 95.

A tube voltage of 100kVp is used. The sure IQ setting of this scan has a standard deviation value of 15 based on a 5.0mm slice thickness and FC03 reconstruction kernel and AIDR 3D standard. The CTA/CFA heart and aorta combination is scanned in one single breath hold (≈12sec).

For the contrast enhanced scans a single injection of 50-75ml I370 contrast fluid is administered at a flow rate of 5ml/s, followed by a saline flush. An 18g IV-line in the right cubital vein is preferred. The scan delay is based on bolus triggering measured in the left ventricle with an automatic start value of 180HU.

CASE

An 84-year-old male candidate for TAVI (66kg and 166cm) was referred for pre-procedural evaluation by means of CT. At arrival, the patient's heart rate was around 80 BPM. The eGFR value was 59 ml/min/1.73 m2, determined on the day of the examination indicating that no intravenous pre- or post-hydration was needed. No premedication (for instance for heart rate control or vasodilation) was administered to the patient.

First a calcium score scan was performed with a scan range of 140mm, triggered at 40% of the RR-interval. 120 kVp and 230 mA were used with a 0.35sec rotation time.

Then the CTA/CFA scan of the heart was performed using a scan range of 160mm including the heart and aortic root (Fig. 3), using 100 kVp, 580mA and a 0.35sec rotation time. During the acquisition the mean RR interval was 736ms. One complete RR-cycle was scanned.

This scan was followed by an ultra helical scan, with an inter scan delay of 6.3 sec. The CTA/CFA and ultra-helical were acquired in one single breath hold. The total breath hold time of CTA/CFA and ultra helical was just over 15sec. The total amount of contrast media for this examination was 75ml I370 contrast @ 5ml/s followed by a saline flush of 50ml NaCl 0.9% @ 5ml/s.

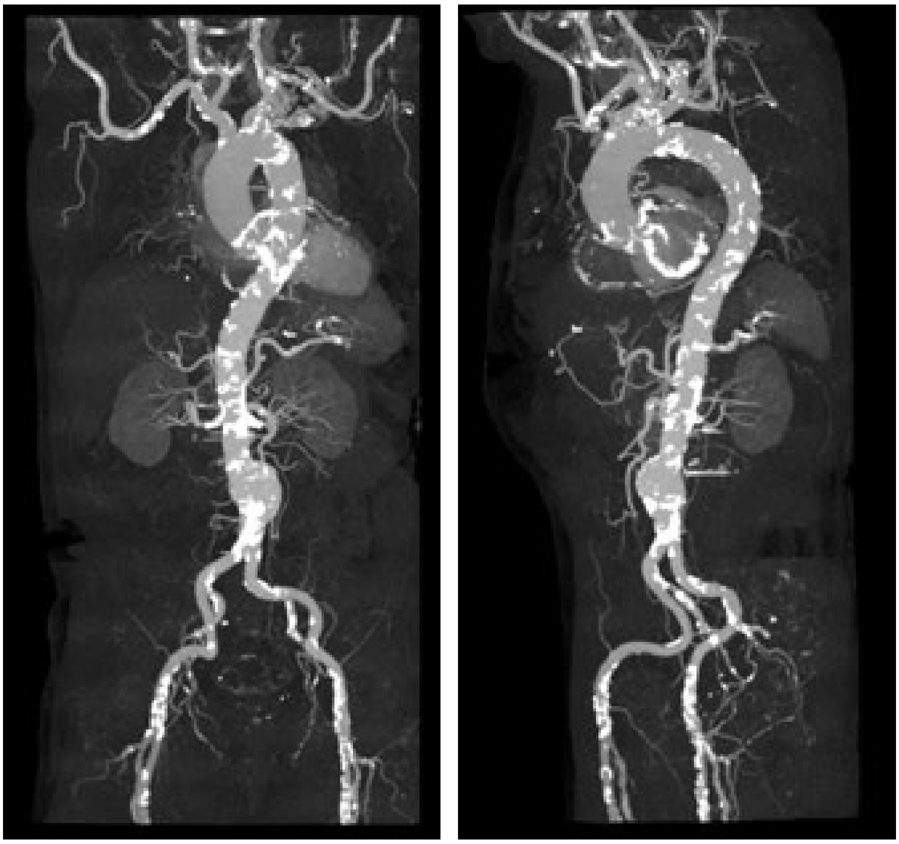


Figure 2: Ultra helical scan (80 x 0.5 mm acquisition, still using the same 75 ml contrast injection) of the entire aorta, subclavian and iliofemoral arteries containing severe calcifications.

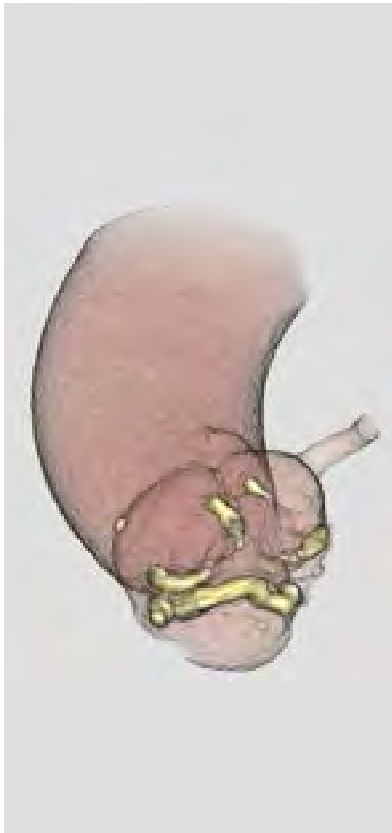


Figure 3: Visualizing the aortic root and calcified lesions using the '3D Calcium' preset in the Vitrea fX software.

POST-PROCESSING

CT image acquisition and accurate post processing is essential for a successful intervention in TAVI patients. To this end, maintaining a detailed and standardized imaging acquisition and analysis approach is crucial.

Semi-automated post-processing using the Vitrea fX for TAVI assists in pre-operative planning and post-operative evaluation of TAVI procedures (figure 4). Key features include semi-automatic identification of the valve annular plane and corresponding measurements, tortuosity calculations, a report template into which user-selected measurements are automatically entered and the flexibility to enable planning for the transfemoral, subclavian and transapical delivery approaches. The automated segmentation and centerlining of the aorta and aortic root guarantee a fast and smooth workflow. Additionally a visual overview of the measurements location along the vessel and a 3D display of the TAVI measurements is generated (figure 5).

Figure 4: Showing the spatial relationship between the aortic valve annular plane and the coronary ostia. The distance from the aortic valve annular plane to the coronary ostia is one of the standard measurements prior to TAVI.

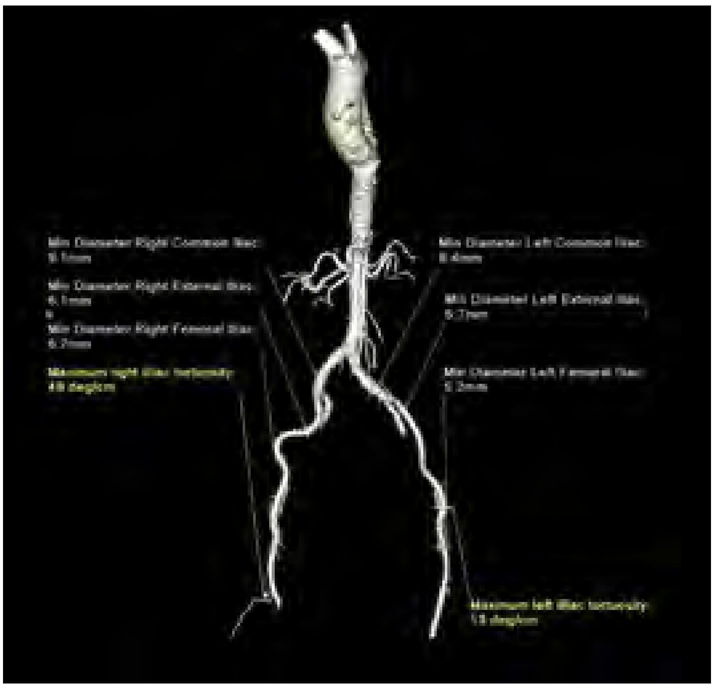


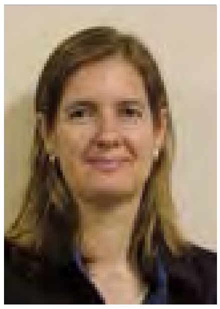
Figure 5: Visual overview of the semi-automated measurements.

©2014 TOSHIBA MEDICAL SYSTEMS

CorE64 - Toshiba's Landmark International Multicenter Trial What does it tell us 6 years on?

Chloe Steveson, MMRS [1)]

The CorE64 Multicenter International Trial was Toshiba's first foray into large scale research. The aim was to determine the accuracy of 64-detector row Coronary CT Angiography (CCTA) to detect coronary artery disease (CAD) compared to quantitative coronary angiography (QCA). The results were presented at the American Heart Association Meeting in November 2007 and published in the New England Journal of Medicine in 2008. The trial also produced a wealth of other scientific papers investigating subsets of the data. A summary of these results and their clinical implications are described in this article.



Chloe Steveson

In 2004, Toshiba introduced the Aquilion 64 CT scanner and cardiac CTA became a clinical reality for the first time. Prior to this, coronary angiography was the only technique to visualize the coronary arteries. Cardiac CTA was poised to replace coronary angiography as a non-invasive technique to visualize the coronary arteries. To ensure widespread acceptance of new technology, the accuracy of that technology had to be validated against the current gold standard. Three trials were undertaken to prove the accuracy of CCTA compared to catheter angiography[1-3]. CorE64 was a trial using the Toshiba Aquilion 64 which included 9 recruiting sites from 7 countries[1]. The ACCURACY trial used the GE Lightspeed VCT 64 slice scanner and included 16 recruiting sites in the US[2]. The Meijboom et al trial was performed in the Netherlands at 3 sites using 64 slice CT systems from multiple vendors[3]. The results of all 3 trials were presented in 2007 and generated tremendous interest in the use of CCTA as a non-invasive test to rule out coronary artery disease in patients with intermediate risk of CAD. Today, the results of these 3 trials have driven the widespread acceptance of CCTA and are still used to demonstrate the accuracy of CCTA to diagnose CAD.

THE CORE64 TRIAL

The CorE64 Trial was a prospective, multi-center, international, single-vendor study examining the diagnostic accuracy of 64 slice CCTA to detect CAD compared to coronary angiography. Miller et al described the study design and methods in a paper published in European Radiology[4]. The recruiting sites and principle investigators are listed in Table 1. Patients were recruited from the population who were scheduled for a clinically indicated catheter angiogram, were enrolled in the study, and underwent a CCTA within 30 days prior to the angiography examination. Patients were then initially followed for 1 year. Raw data from the CCTA examination were sent to the CT core lab at Johns Hopkins University for reconstruction and analysis, and the DICOM catheter angiography images were sent to the Angiography core lab at Johns Hopkins Hospital for analysis. Of the 405 total patients who were enrolled in the study, 291 patients were included in the final analysis of patients with a calcium score less than 600. Patients with a calcium score greater than 600 were included in a registry, analyzed separately, and published by Arbab-Zadeh et al in 2012[5].

Each core lab was blind to the results of the other and each analyzed their data with two blinded readers. Any discrepancies between the two reads were adjudicated

Site	Country	Primary Investigator
Johns Hopkins Hospital	USA	Dr J Miller
Johns Hopkins Bayview	USA	Dr D Bush
Heart Institute INCOR	Brazil	Dr C Rochitte
Charite	Germany	Dr M Dewey
Iwate Medical University	Japan	Dr K Yoshioka
Toronto General Hospital	Canada	Dr N Paul
Beth Israel Deaconess	USA	Dr M Clouse
Mt Elizabeth Hospital	Singapore	Dr J Hoe
Leiden University	The Netherlands	Dr A de Roos

Table 1: Recruiting sites for CorE64.

1) Toshiba Medical Systems Corporation, Otawara, Japan

Figure 1: A complete CorE64 dataset. This 61 year old male presented with atypical chest pain and a history of hypertension and dyslipidemia. He was a former smoker and had no prior history of CAD. There is a significant stenosis (82%) of the proximal LAD on the CTA images. The stenosis is confirmed on the catheter angiogram.

by consensus. In order to accommodate both the standard catheter angiography practices and standard CCTA approaches, a specific 19 segment coronary model was derived for the trial[4]. Stenoses were determined both visually and quantitatively. After the core lab reads were completed and locked, an adjudication process was performed to ensure that the same lesions were ascribed to the same segment in both CT and cath. The rigorous blinded analysis has created a rich dataset that has been used in a number of subsequent evaluations summarized later in this article.

The radiation dose for CorE64 was reported by Geleijns et al in 2011[6]. The average effective dose for the CorE64 patients was 15mSv which is the same as the reported doses for 64-slice CCTA in the literature at that time[6]. The radiation dose for the study was limited to less than 20mSv for each patient[4]. Newer techniques are now available to reduce the radiation dose for CCTA including prospective ECG gating, ECG dose modulation, and iterative reconstruction. None of these were available when the study started recruiting.

	Quantitative CTA	Visual CTA
AUC	0.93	0.93
Sensitivity	85%	83%
Specificity	90%	91%
PPV	91%	92%
NPV	83%	81%

Table 2: Results of CorE64[1]

DIAGNOSTIC ACCURACY OF CCTA

The results of the CorE64 trial showed that the area under the receiver operating characteristic curve (AUC) was 0.93, indicating that CCTA is an excellent test to diagnose coronary stenosis >50%. Also, CCTA was similar to QCA in the ability to predict which patients need revascularization. The disease prevalence for at least one obstructive stenosis of 50% or more was 56%. The results of CorE64 are shown in Table 2. An example of a CorE64 dataset is shown in Fig 1.

Certain patient characteristics associated with image quality can influence the diagnostic accuracy of CCTA to detect CAD. In the CorE64 trial increasing body mass index (BMI), presence of breathing artifact, and increasing heart rate were associated with poor image quality, however these characteristics do not affect the ability of CCTA to detect CAD[7]. The accuracy of CCTA is affected by increasing calcium score results in a vessel even when only patients with Calcium score <600 were analyzed[7].

The researchers also sought to find out if there were any factors that affected the accuracy of stenosis assessment[8]. The absence of coronary calcification in a patient is a predictor for under-recognition of stenosis. This suggests that the reader's vigilance may be reduced when no calcium is seen. Misdiagnosis is also more frequent when the vessels are small in size, are tortuous, or the contrast enhancement is not optimal. The presence of veins adjacent to the artery also leads to more frequent misdiagnosis[8]. These data suggest that readers should take extra care when examining artery segments with these features.

©2014 TOSHIBA MEDICAL SYSTEMS

PATIENTS WITH STENTS

It is generally assumed that CCTA has difficulty imaging patients with stents due to the blooming artifacts from the high density metallic stent struts, and that the diagnostic accuracy of stented segments is reduced when compared to segments without stents. In CorE64, a total of 75 stents in 52 patients were assessed in an ancillary analysis[9]. The results showed that in small stents, less than 3mm in size, CCTA showed a poor ability to detect in-stent re-stenosis. These results are similar to other investigations and explain why the ACC/AHA and ESC guidelines do not recommend CCTA for assessing stents smaller than 3mm in size[10-11].

PATIENTS WITH CALCIUM

As previously mentioned the patients enrolled in CorE64 who had a calcium score greater than 600 were placed in a registry and analyzed separately5. The AUC for detecting a 50% stenosis by CCTA was reduced from 0.93 to 0.81 for the patients with a Ca score >600. The conclusion was that CCTA is ineffective in ruling out CAD in patients with a Ca score >600. These results are similar to other studies, including the ACCURACY trial. The ACC/AHA and ESC guidelines also highlight this issue of high calcium scores impacting the accuracy and effectiveness of CCTA to detect stenosis[10-11].

Another method to analyze the extent of calcium is to measure the degree of the vessel lumen circumference that contains calcium. The CorE64 cohort was used to investigate the accuracy of this novel metric to predict the percentage of stenosis[12-13]. The results showed that an increasing arc of calcification in a vessel is indicative of increasing lesion severity. Also they noted that often the most severe lesion is not calcified, indicating that clinicians should not entirely focus on calcified lesions[12-13].

PATIENTS WITHOUT CALCIUM

In 2007, the AHA indicated that a Calcium score of 0 might exclude the need for coronary angiography in symptomatic patients[14]. In the CorE64 trial, 72 patients had a calcium score of 0. Of these, 19% had a stenosis >50% and 15% had a stenosis >70%[15]. Furthermore, 13% of patients with a calcium score of 0 underwent revascularization. These results indicate that a calcium score of 0 does not rule out significant disease and cannot be used as a gatekeeper to catheter angiography in a symptomatic patient[15]. There was some controversy around these results as they went against the general consensus at the time. Since then, calcium scoring has taken its place alongside CCTA in the non-invasive diagnosis of CAD, but a negative calcium score result does not mean that the CCTA is not performed.

CAN CTA DETECT MYOCARDIAL PERFUSION ABNORMALITIES?

Within the CorE64 dataset, 63 patients underwent a SPECT examination as well as the CCTA and catheter angiogram. The investigators sought to determine

CORE64 - WHAT DOES IT TELL US

Dr Joao Lima, Johns Hopkins University, Baltimore

"Widespread adoption of new technology cannot be based on small single center studies but needs to be supported and guided by large-scale evidence. It is also imperative to prove the effectiveness of a new technique against the current technology. CorE64 has played a crucial role in the acceptance of CCTA as a non-invasive alternative for our patients. Even more, the wealth of data from CorE64 has allowed us to tease out which patients may benefit the most from this new technique.
The results of this trial allow clinicians to have confidence that the techniques they are using are deemed to be effective when rigorously studied in large and varied patient populations.

I have been honored to lead this study and collaborate closely with researchers, both from cardiology and radiology specialties all over the world. The team effort from all institutions as well as Toshiba has developed into a close knit community which resulted in the expansion of the team for the successful CORE320 multicenter study."

CorE 64

TOSHIBA'S COMMITMENT TO GLOBAL RESEARCH

Hisashi Tachizaki, Toshiba Clinical Application Research Center, Japan

"In 2004, Toshiba recognized that in order to obtain widespread acceptance of new and disruptive technology, research was necessary to prove the effectiveness of the technology. Before the introduction of the Aquilion 64, CCTA had been used for research only and was not considered robust enough for routine clinical use. To make this technique mainstream, a large multicenter trial was needed. Toshiba approached one of the leading cardiac visionaries, Dr Joao Lima, to lead the study. This study demonstrates Toshiba's commitment to improving patient's lives by providing innovative clinical solutions that are scientifically proven. Being involved in a complex, large scale international study has allowed Toshiba to gain extensive experience in scientifically rigorous research. We have used this expertise to sponsor and support other multicenter trials in both CT and MRI.

Based on the results of CorE64, the challenge to the equipment manufacturers is to develop technology to expand the capability of CCTA to include segments with high calcium and stents. I am confident Toshiba will continue to push the boundaries with the development of coronary subtraction, and myocardial perfusion is expanding the clinical use of CT in the diagnosis of cardiac disease."

if CCTA at rest could detect myocardial perfusion defects seen on SPECT[16]. The results showed only modest agreement between stenosis and ischemia using either CCTA or coronary angiography. This is similar to the results from other studies[17] and indicates that a functional or stress test is necessary to determine the hemodynamic significance of a coronary artery stenosis, with SPECT, CT Perfusion, MR Perfusion, or FFR.

CONCLUSION

CorE64 provided the scientific evidence that has allowed CCTA to become a significant tool in the diagnostic work up for symptomatic patients with an intermediate pre-test probability of coronary artery disease. These results have provided the rigorous scientific evidence to allow both the AHA and ESC to include coronary CTA in their guidelines. CorE64 was a landmark trial that put CCTA on the map.

References

1. Miller JM, Rochitte CE, Dewey M, Arbab-Zadeh A, Niinuma H, Gottlieb I, Paul N, Clouse ME, Shapiro E Hoe J, Lardo AC, Bush DE, de Roos A, Cox C, Brinker J, Lima JAC, Diagnostic performance of coronary angiography by 64-row CT, New England Journal of Medicine, 2008.
2. Budoff MJ, Dowe D, Jollis JG, Gitter M, Sutherland J, Halamert E, Scherer M, Bellinger R, Martin A, Benton R, Delago A, Min JK, Diagnostic performance of 64-multidetector row coronary computed tomographic angiography for evaluation of coronary artery stenosis in individuals without known coronary artery disease: results from the prospective multicenter ACCURACY (Assessment by Coronary Computed Tomographic Angiography of Individuals Undergoing Invasive Coronary Angiography) trial, J Am Coll Cardiol. 2008 Nov 18;52(21):1724-32.
3. Meijboom WB, Meijs MF, Schuijf JD, Cramer MJ, Mollet NR, van Mieghem CA, Nieman K, van Werkhoven JM, Pundziute G, Weustink AC, de Vos AM, Pugliese F, Rensing B, Jukema JW, Bax JJ, Prokop M, Doevendans PA, Hunink MG, Krestin GP, de Feyter PJ, Diagnostic accuracy of 64-slice computed tomography coronary angiography: a prospective, multicenter, multivendor study, J Am Coll Cardiol. 2008 Dec 16;52(25):2135-44.
4. Miller JM, Dewey M, Vavere AL, Rochitte CE, Niinuma H, Arbab-Zadeh A, Paul N, Hoe J, de Roos A, Yoshioka K, Lemos P, Bush DE, Lardo AC, Texter J, Brinker J, Cox C, Clouse ME, Lima JAC, Coronary CT angiography using 64 detector rows: methods and design of the multi-centre trial CORE-64, European Radiology, 2009.
5. Arbab-Zadeh A, Miller JM, Rochitte CE, Dewey M, Niinuma H, Gottlieb I, Paul N, Clouse ME, Shapiro EP, Hoe J, Lardo AC, Bush DE, de Roos A, Cox C, Brinker J, Lima JA, Diagnostic Accuracy of Computed Tomography Coronary Angiography According to Pre-Test Probability of Coronary Artery Disease and Severity of Coronary Arterial Calcification The CORE-64 (Coronary Artery Evaluation Using 64-Row Multidetector Computed Tomography Angiography) International Multicenter Study, JACC 2012.
6. Geleijns J, Joemai R, Dewey M, de Roos A, Zankl M, Cantera AC, Artells MS, Radiation exposure to patients in a multicenter coronary angiography trial (CORE 64), AJR, 2011.
7. Dewey M, Vavere AL, Arbab-Zadeh A, Miller JM, Sara L, Cox C, Gottlieb I, Yoshioka K, Paul N, Hoe J, de Roos A, Lardo AC, Lima JAC, Clouse ME, Patient characteristics as predictors of image quality and diagnostic accuracy of MDCT compared with conventional coronary angiography for detecting coronary artery stenoses: CORE-64 Multicenter International Trial, AJR, 2010.
8. Yan RT, Miller JM, Rochitte CE, Dewey M, Niinuma H, Clouse ME, Vavere AL, Brinker J, Lima JA, Arbab-Zadeh A. Predictors of inaccurate coronary arterial stenosis assessment by CT angiography, JACC Cardiovasc Imaging, 2013.
9. Wykrzykowska JJ, Arbab-Zadeh A, Godoy G, Miller JM, Lin S, Vavere A, Paul N, Niinuma H, Hoe J, Brinker J, Khosa F, Sarwar S, Lima JAC, Clouse ME, Assessment of in-stent restenosis using 64-MDCT: analysis of the CORE-64 Multicenter International Trial, AJR, 2010.
10. Fihn SD, Gardin JM, Abrams J, Berra K, Blankenship JC, Dallas AP, Douglas PS, Foody JM, Gerber TC, Hinderliter AL, King SB 3rd, Kligfield PD, Krumholz HM, Kwong RY, Lim MJ, Linderbaum JA, Mack MJ, Munger MA, Prager RL, Sabik JF, Shaw LJ, Sikkema JD, Smith CR Jr, Smith SC Jr, Spertus JA, Williams SV; American College of Cardiology Foundation; American Heart Association Task Force on Practice Guidelines; American College of Physicians; American Association for Thoracic Surgery; Preventive Cardiovascular Nurses Association; Society for Cardiovascular Angiography and Interventions; Society of Thoracic Surgeons, 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the diagnosis and management of patients with stable ischemic heart disease: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, and the American College of Physicians, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons., J Am Coll Cardiol. 2012 Dec 18;60(24):e44-e164.
11. Montalescot G, Sechtem U, Achenbach S, Andreotti F, Arden C, Budaj A, Bugiardini R, Crea F, Cuisset T, Di Mario C, Ferreira JR, Gersh BJ, Gitt AK, Hulot JS, Marx N, Opie LH, Pfisterer M, Prescott E, Ruschitzka F, Sabaté M, Senior R, Taggart DP, van der Wall EE, Vrints CJ; ESC Committee for Practice Guidelines, Zamorano JL, Achenbach S, Baumgartner H, Bax JJ, Bueno H, Dean V, Deaton C, Erol C, Fagard R, Ferrari R, Hasdai D, Hoes AW,Kirchhof P, Knuuti J, Kolh P, Lancellotti P, Linhart A, Nihoyannopoulos P, Piepoli MF, Ponikowski P, Sirnes PA, Tamargo JL, Tendera M, Torbicki A, Wijns W,Windecker S; Document Reviewers, Knuuti J, Valgimigli M, Bueno H, Claeys MJ, Donner-Banzhoff N, Erol C, Frank H, Funck-Brentano C, Gaemperli O,Gonzalez-Juanatey JR, Hamilos M, Hasdai D, Husted S, James SK, Kervinen K, Kolh P, Kristensen SD, Lancellotti P, Maggioni AP, Piepoli MF, Pries AR,Romeo F, Rydén L, Simoons ML, Sirnes PA, Steg PG, Timmis A, Wijns W, Windecker S, Yildirir A, Zamorano JL.2013 ESC guidelines on the management of stable coronary artery disease: the Task Force on the management of stable coronary artery disease of the European Society of Cardiology.Task Force Members1, Eur Heart J. 2013 Oct;34(38):2949-3003. doi: 10.1093/eurheartj/eht296. Epub 2013 Aug 30.
12. Cerci R, Vavere AL, Miller JM, Yoneyama K, Rochitte CE, Dewey M, Niinuma H, Clouse ME, Laham R, Bush DE, Shapiro EP, Lardo AC, Cox C, Brinker J, Lima JA, Arbab-Zadeh A, Patterns of coronary arterial lesion calcification by a novel, cross-sectional CT angiographic assessment, Int J Cardiovasc Imaging, 2013.
13. Vavere AL, Arbab-Zadeh A, Rochitte CE, Dewey M, Niinuma H, Gottlieb I, Clouse M, Bush D, Hoe J, de Roos A, Cox C, Lima JAC, Miller JM, Accuracy of 64-slice Computed Tomography in Assessing Coronary Artery Stenoses in segments with Mild, Moderate or Extensive Calcification: A Sub-Analysis of the CORE-64 Trial, Radiology, 2011.
14. Greenland P, Bonow RO, Brundage BH, et al. ACCF/AHA 2007 clinical expert consensus document on coronary artery calcium scoring by computed tomography in global cardiovascular risk assessment and in evaluation of patients with chest pain: a report of the American College of Cardiology Foundation Clinical Expert Consensus Task Force (ACCF/AHA Writing Committee to Update the 2000 Expert Consensus Document on Electron Beam Computed Tomography) J Am Coll Cardiol. 2007;49:378–402.
15. Gottlieb I, Miller J, Arbab-Zadeh A, Dewey M, Clouse M, Sara L, Niinuma H, Bush D, Paul N, Vavere A, Texter J, Brinker J, Lima JAC, Rochitte C, The Absence of Coronary Calcification Does not exclude Obstructive coronary Artery Disease or the Need for Revascularization in Patients referred for Conventional Coronary Angiography, JACC, 2010.
16. Godoy GK, Vavere A, Miller JM, Chahal H, Niinuma H, Lemos P, Hoe J, Paul N, Clouse ME, Ramos CD, Lima JA, Arbab-Zadeh A, Quantitative coronary arterial stenosis assessment by multidetector CT and invasive coronary angiography for identifying patients with myocardial perfusion abnormalities, Journal of Nuclear Cardiology, 2012.
17. Hacker M, Jakobs T, Hack N, Nikolaou K, Becker C, von Ziegler F, et al. Sixty-four slice spiral CT angiography does not predict the functional relevance of coronary artery stenoses in patients with stable angina. Eur J Nucl Med Mol Imaging 2007;34:4-10.

©2014 TOSHIBA MEDICAL SYSTEMS

Advertorial

Toshiba Medical Systems supports Manchester United

The Vantage Titan 3T MR scanner in situ at Manchester United's Medical Centre.

Toshiba Medical Systems kits out Manchester United's Aon Training Complex helping to minimise injury and keep players in action.

Keeping players playing is top of any sports club's priority list, and none more so than Manchester United Football Club. Injury is disruptive to plans and frustrating for players, which is why having the best medical equipment for injury diagnosis and treatment that money can buy is an essential.

This is where Toshiba Medical Systems and Manchester United have joined forces to provide medical scanning equipment to ensure their elite players get elite care: monitoring healing of injuries, fine-tuning rehabilitation processes, and ensuring that speedy diagnosis and treatment underpins top-ranking performance, especially when careers, high profile championships, and multi-million pound investments are at stake.

Dr McNally with his Aplio 500 ultrasound system.

WATCH OUR VIDEO HERE
http://lnkd.in/GsHuKk

The state-of-the-art medical imaging suite is a key component of the Club's newly re-developed Aon Training Complex.

"It's fantastic to have such state-of-the-art equipment at the training ground. I believe the club will be the first to use this equipment as it isn't available anywhere else in the UK yet," said Ryan Giggs in a comment made when the Toshiba-Manchester United partnership was first announced. "It means that having scans or medicals will be much more convenient as everything is there and to hand."

Toshiba Medical Systems is a leading manufacturer of high-technology imaging equipment including Magnetic Resonance Imaging, so-called 'MRI scanners' and Computed Tomography or 'CT scanners'. In March this year Toshiba provided the Club with a Vantage Titan 3T MRI wide bore scanner, and an Aquilion ONE CT scanner, the first of its kind to be installed in the UK.

Steve McNally is the Club doctor, and gives key medical recommendations about who plays and who stays away from the field, alongside his colleagues in the Football Medicine & Science Team. He emphasised that the range of imaging equipment will impact on all areas from player performance and match availability, to injury management and screening.

In 2012, in addition to the latest scanners, the Club installed Toshiba ultrasound equipment – Aplio 500 ultrasound and Viamo ultrasound scanners – in an earlier phase of the partnership between Manchester United and Toshiba Medical Systems. Now, with the "final piece in the jigsaw" in place, Dr McNally highlighted, "I've got the precision tools to help me make the right clinical decision at the right time for both the player and the team."

At the official unveiling, Dr McNally pointed out how the enhanced medical facility was one of the key objectives of the redevelopment of the training ground, with Toshiba Medical Systems' imaging equipment being a major component. Commenting on experience with Toshiba's ultrasound, he said it had taken the monitoring of healing on "leaps and bounds" over the last year, enabling the medical team to look at the smallest muscle tears and see how they were healing. He added that this facility in turn offered greater levels of confidence when making decisions in terms of functional rehabilitation.

The Toshiba Medical Systems-Manchester United partnership aims to take sports medicine to the next level. The partnership will translate the sports medicine innovations and findings into benefits for wider patient populations in the development of new techniques and new treatment pathways.

President and Chief Executive Officer, Toshiba Medical Systems Corporation, Mr Satoshi Tsunakawa, said the innovation and partnership between the company and Manchester United "pushed the boundaries" in sports medicine.

"This partnership will enable Toshiba Medical Systems and Manchester United to provide excellence in sports medicine and, in a controlled environment, to facilitate new treatment pathways and techniques which will eventually lead to the benefit of all."

MANCHESTER UNITED®

TOSHIBA
Leading Innovation >>>

OFFICIAL MEDICAL SYSTEMS PARTNER