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CIRSE 2015 – Lisbon
Sunday, September 27, 2015

Interdisciplinary Endovascular Aortic Symposium
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Aortic Interventions: quo vadis?

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Gruentzig Lecture: Advanced image modelling of abdominal aortic aneurysm – impact on EVAR management

Gilles Soulez

Don't miss it !
Advanced image modelling of abdominal aortic aneurysm: impact on EVAR management
Andreas Gruentzig Lecture
Sunday, September 27, 14:30-15:00
Auditorium 1

The selection of patients with abdominal aortic aneurysm (AAA) for undergoing EVAR is currently based on the evaluation of surgical risk and very basic anatomic criteria via CT-angiography (CTA). The aneurysm's maximal diameter (Dmax) and growth rate are the most important predictive factors for AAA rupture. However, the standardisation and automation of measuring Dmax diameter and growth over time still need to be incorporated into our clinical routine. The future of EVAR management depends on our capacity to integrate anatomical imaging, biomechanical modelling and biomarkers of AAA evolution to predict AAA growth or rupture, optimise stent planning and intra-operative guidance, and personalise EVAR follow-up.

AAA modelling and patient selection before EVAR

The pathophysiology of AAAs is complex, and is the result of a comprehensive inflammatory response with an accompanying proteolytic imbalance; the latter has been deemed responsible for the destruction of elastin, collagen fibres, vascular smooth muscular cells and progressive weakening of the aortic wall [1]. Strong positive associations of clinical AAA incidence with circulating biomarkers of inflammation (CRP, WBC count, fibrinogen), thrombin generation (D-dimer), protease (MMP9) and increased cardiac pressure and vascular stiffness (NT-proBNP) have been reported [2,3]. However, up to now, no clinically useful biomarker for predicting AAA growth or rupture has been identified.

Following ultrasound (US) screening, CTA is the second step taken to accurately evaluate orthogonal diameter and anatomical eligibility for EVAR. The segmentation of the different components of the AAA (lumen, thrombus and calcification) is now possible from CTA data sets [4]. Following this segmentation, a numerical geometric model – called mesh – can easily be generated. This model serves as a basis for providing advanced geometric parameters of growth that can be associated with rupture (Fig. 1). Aside from maximal diameter and gender, indices of convexity and high location of the aortic bulge were independently associated with a higher rupture risk [5]. On this type of AAA model, a finite element analysis can be conducted, including biomechanical properties on each mesh element to provide new indices for rupture prediction. The peak wall stress (PWS) represents the pressure applied to the surface. The peak wall relative index (PWRI) relates to the mechanical stress and strength of the aneurysm wall, and incorporates risk factors associated with aneurysm wall-weakening, including female gender, intraluminal thrombus thickness (ILT) and aortic diameter [6]. These indices can be converted to the equivalent AAA diameter to provide the clinician with useful guidelines [6]. There is still a lot of approximation in these models; in particular, the anisotropy of AAA and the effect of surrounding tissue, especially the spine and wall calcification, are often neglected [6].

The interrelation between biomechanical simulation and the biological alteration of the AAA wall is a future research topic. Gene expressions of destabilising factors within AAA tissue might be correlated with geometric and mechanical properties of the AAA wall [7]. Efforts have been made to correlate AAA inflammation and growth with PET-CT studies (Fig. 2). However, controversial results have been reported [8, 9]. A better integration of the biomechanical and biological risk is expected to provide a personalised prediction of AAA growth and potential rupture beyond gender and measurement of AAA maximal diameter.

Role of AAA modelling in stent planning, peri-procedural guidance and virtual stenting

Most post-processing workstations propose software solutions for creating stent-graft (SG) planning, based on the creation of curved multi-planar CTA reformations alongside AAA and iliac artery centerlines. However, these reconstructions based on pre-operative CTA are purely geometric, and do not take into account the mechanical interaction between the endovascular devices (guidewire, delivery device and SG) and the vascular structure. With finite element analysis, it is now possible to create a biomechanical model of AAA and SG [10, 11]. Several teams are working on virtual SG deployment with interesting preliminary data [12]. Yet these simulations do not fully take into account AAA and surrounding tissue biomechanics, and research in this field is very active.

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Dr. Gilles Soulez is Professor of Radiology at the Centre Hospitalier of the University of Montreal. His research focuses on aneurysm endovascular repair, peripheral vascular disease and advanced image guidance for IR procedures. Dr. Soulez has published 155 peer-reviewed papers, 26 book chapters, and 342 scientific abstracts. He is author or co-author on 9 patents in the field of vascular and interventional radiology. He has been honoured with several awards, including the Société Canadienne Française de Radiologie's Prize of Innovation *in 2008, and the* Award of Excellence and Innovation in Interventional Radiology *at CIRSE 2013. He has also received multiple prizes for his publications, including from the Radiological Society of North America and the International Society of Endovascular Therapy.*

The use of 2D/3D fusion techniques during EVAR procedures has been proposed, involving the overlay of a 3D model of AAA taken from CTA on fluoroscopy in the catheterisation laboratory [13]. These techniques have shown the potential to minimise procedure time and contrast injection in complex EVAR procedures [13]. Currently a rigid registration between CTA

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>> is performed, and the technique is limited by patient motion and the deformation of vascular structures induced by endovascular devices inserted during the procedure [14]. We are currently working on an approach allowing automatic detection of the endovascular device and a correction process based on the alignment of the device and AAA centerlines to improve the accuracy of the registration process [15] (Fig. 3). This approach is possible by using a mesh of the aortic lumen instead of a simple volume-rendering projection of the AAA. Future improvements will be made by way of the integration of biomechanical simulation into the 2D/3D registration process to provide the physician in the interventional room with the best accuracy in SG positioning, as well as different scenarios based on the simulations previously performed.

New imaging approaches to optimise EVAR follow-up

Endoleaks, which are observed in 25% of patients, are the main limitation of EVAR. In a recent study, delayed rupture occurred in 5.4% of patients after EVAR versus 1.4% of patients after open repair during 8 years of follow-up (P<0.001)[16]. Life-long imaging surveillance is required to detect endoleak or AAA growth and, if needed, perform additional interventions. This surveillance is mainly performed via CTA, leading to excessive irradiation, contrast-induced nephropathy and burdensome costs [17]. Approximately 65% of the follow-up costs have been attributed to CT scanning [18]. Doppler ultrasound (DUS) is increasingly used instead of CT for EVAR surveillance [19]. DUS surveillance could decrease the cost of surveillance by 29% [20]. Therefore, efforts have been made for DUS to replace CT, but the main concern is the lower sensitivity and specificity of the former method in detecting endoleaks, in particular type II endoleaks [21, 22]. Better sensitivity has been reported with contrast-enhanced ultrasound (CEUS) [21, 22]. In the absence of rationalised surveillance protocols targeted at those at greatest risk, CEUS would have greater cost implications than DUS for routine surveillance [21]. In addition, no contrast agent has been approved for non-cardiac use in the United States due to safety concerns [23].

Characterisation of thrombus organisation in the sac via imaging could be a good endpoint for monitoring AAA healing after EVAR. We are currently investigating the potential of vascular ultrasound elastography to detect endoleak and evaluate thrombus organisation in the AAA sac after EVAR. Two techniques are under investigation: dynamic elastography, using shear wave imaging (supersonic radiation force), and quasi-static elastography, which relies on natural cardiac pulsation to generate deformation of vascular tissue and strain imaging. Interesting pre-clinical results were observed for the detection of endoleak and thrombus organisation [24] (Fig. 4). Clinical evaluation is currently ongoing. The potential advantages of ultrasound elastography are its easy integration into the workflow of DUS examinations, and the detection of slow-flow endoleak or endotension not easily detected on CTA. In a pre-clinical model of endoleak embolisation, ultrasound elastography was also capable of monitoring thrombus organisation and mechanical characteristics of different embolising agents. Thus this technique could be useful for evaluating future strategies to promote AAA healing following the injection of therapeutic agents in the sac after SG delivery.

The characterisation of thrombus organisation was previously presented as a new concept of follow-up using MRI [25, 26]. It was shown that thrombus intensity on MRI inside the aneurysm sac could be used to detect endotension and predict AAA growth [25, 27]. However, the use of MRI has limited accessibility and entails higher costs than ultrasound, and images are degraded from metal artifact when using stainless-steel stent-grafts [28].

Finally, CT-scans can be optimised in several ways. A decision-algorithm based on morphologic characteristics such as angulation, length, areas, diameter, volume, tortuosity of the aneurysm neck, AAA sac and iliac segments, can identify high-risk patients requiring closer surveillance [29]. The persistence of type II endoleak and associated growth can be predicted after estimation of the number and size of collateral vessels [30] or thrombus volume [31]. Low-dose CT with iterative reconstruction has shown similar performance to standard dose protocol for endoleak detection [32].

Volume measurements are more sensitive than diameter measurements for detecting sac growth, and the absence of volume progression is a good criteria for excluding clinical failure during EVAR follow-up [33, 34]. It is now possible to perform AAA segmentation and volume measurement on unenhanced studies [35]. Thus, in patients having no endoleak or sac progression documented on CTA at one-year follow-up, a long-term follow-up algorithm combining low-dose non-contrast CT with volume measurement as a first step, and CTA only in case of volume progression, could be a good alternative.

Finally, in patients who undergo EVAR with the Nellix Endovascular Aneurysm Sealing (EVAS) System, endoleak detection is hampered by the radiopacity of the endobags during the first 3 months, with endoleaks located at the periphery or in the cleft of endobags [36]. For these patients, volume follow-up can also be an interesting approach.

Conclusion

In conclusion, to improve EVAR performance, we need to introduce new imaging paradigms by combining biomechanical information and specific biomarkers of AAA growth with anatomical imaging to optimise patient selection based on the rupture risk. Stent-planning and peri-operative guidance should also incorporate biomechanical simulation to select the best approach and device for a particular patient. Finally, EVAR follow-up should be cost-efficient and minimise iodine contrast and ionising radiation exposure. The characterisation of AAA healing and thrombus organisation after EVAR by way of imaging is another approach that could complement morphological imaging. It could also be useful to explore new therapeutic approaches – such as sac embolisation – to promote AAA healing after EVAR.

Fig. 2: Meshes of aortic thrombus (green), lumen and wall before finite element analysis.

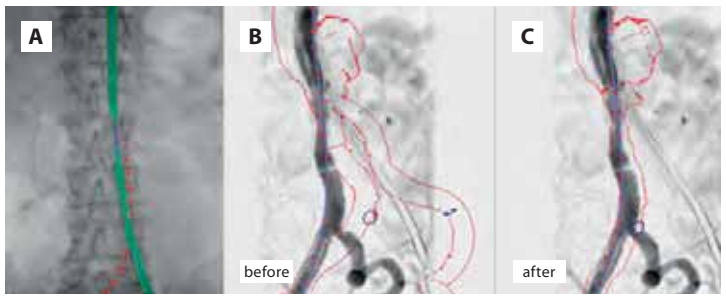

Fig. 3: Example of 2D/3D elastic registration between pre-operative CT and fluoroscopy based on catheter detection.
A. Automatic detection of catheter and delivery-device centreline.
B. Deformation induced by endovascular device before correction.
C. Correction based on vessel and catheter centreline-alignment.

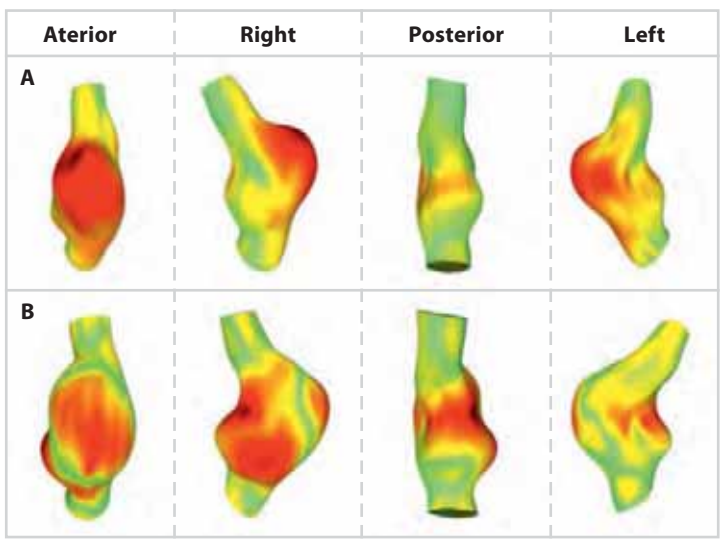

Fig. 1: These coloured maps represent the growth between baseline and follow-up CTA examinations. It allows visualisation of the area with accelerated growth (red zones). This information can be used for correlation and validation of new functional imaging methods (finite element analysis, PET-CT, ultrasound elastography), serum markers of AAA growth and local gene expression on tissue samples.

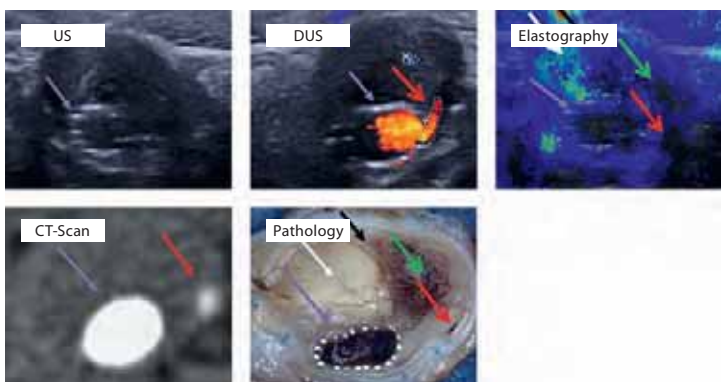

Fig. 4: Shear-wave ultrasound elastography in an animal model of type I endoleak after embolisation with an embolising and sclerosing gel made of chitosan and sodium tetratecyl sulfate (STS) 3%.
On B-mode US, only the stent graft is visible (yellow arrow). The thrombus and the embolising gel have the same echogenicity. On Doppler US, the endoleak is depicted (red arrow). On ultrasound elastography, the endoleak is depicted, the fresh thrombus (green arrow), the embolising gel (white arrow) and the endoleak present different elasticity values. On CT–Scan, only the stent graft and the endoelak are depicted. The correlation is shown on this macroscopic pathologic cut.

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This fascinating session will highlight innovative ways in which interventional radiologists can solve difficult problems and get out of trouble – it's a session that is not to be missed!

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Panellists:
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Francesco Giurazza (Rome/IT)
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Chronic iliac vein and caval occlusion

Rick de Graaf

Don't miss it !
Venous Forum II: Deep vein thrombosis
Special Session
Sunday, September 27, 08:30-09:30
Auditorium 1

Rick de Graaf
Maastricht University Medical Centre
Maastricht, Netherlands

Dr. de Graaf is an interventional radiologist at the Maastricht University Medical Centre (MUMC). He studied medicine at the University of Maastricht, and obtained his PhD at the Department of Surgery and Medical Microbiology of MUMC, where he also completed his training in radiology. Dr. de Graaf obtained his board license in 2010. His clinical focus areas include deep venous interventions and neurovascular interventions, and his main research activities include the diagnosis and treatment of acute and chronic deep venous obstruction.

The incidence of deep venous thrombosis (DVT) reported in the literature is about 3/1,000 per year in the adult population. In the two years following DVT, between 30 and 60% develop post-thrombotic syndrome (PTS), with 10% severe PTS, resulting in disablement and a severe impact on the quality of life. Moreover, the socioeconomic impact is substantial. In the vast majority, PTS is caused by chronic iliofemoral obstructive venous disease due to suboptimal recanalisation after conservative anticoagulative therapy.

Therapy

For long, open surgery was the only available option. However, due to limited success rates and high invasiveness, this approach was mainly reserved for the most severe cases. In recent years, however, the treatment options for chronic deep venous obstructive disease have changed dramatically. Endovascular treatment, involving the use of percutaneous transluminal angioplasty (PTA) and stenting, has become standard care in a great number of specialised centres worldwide. Due to low morbidity, absence of mortality, and excellent short and long-term results, worldwide interest in this type of treatment is quickly increasing, and an increasing number of centres are starting to offer thisoption. Technical success rates of endovascular venous recanalisation described in the literature are well above 90%, generally approaching 100%, depending on studies and patient population. Secondary patency rates are high and generally exceed 90% after 5 years [1, 2]. Clinical outcome is also encouraging, with pain relief, reduction in leg swelling and ulcer healing reported in the vast majority of cases.

Indications

We have identified three groups of indications for recanalisation of chronic deep venous obstructions. First, venous compression syndrome seems to be best treated by stenting. May-Thurner syndrome (MTS), in the most classic form, is caused by compression of the left iliac vein by the right common iliac artery [3]. The pelvic anatomy harbours multiple potential compression sites, however, and several locations have been identified in iliac veins bilaterally. Imaging modalities to identify MTS include duplex ultrasound, phlebography, cross-sectional imaging, and intravascular ultrasound (IVUS). Although historically, IVUS has been suggested to be the most sensitive [4], modern imaging tools do not seem to be inferior (Fig. 1).

Second, DVT-related venous obstructions are nowadays generally accepted as a good indication for stenting. In the acute phase, however, stenting has no place. Awaiting the results of randomised controlled trials (ATTRACT, CAVA), the primary treatment for DVT seems to tend towards endovascular thrombus removal. It is becoming more evident, however, that in a majority of cases, a cause for DVT can be found in underlying compression of the iliac vein, which should be stented to prevent recurrent DVT. Chronic vein obstructions caused by unsuccessful recanalisation after conventional measures should primary be treated by stenting. Over the last two decades, iliofemoral stenting proved feasible with very high patency rates. This does not mean, however, that all obstructed venous segments can be readily stented. Stenting unilateral iliac vein obstructions show the highest patency and usually succeed without complications. Bilateral iliocaval chronic occlusions show lower success rates and long-term patency. Even worse outcomes are seen when stents are positioned below the inguinal ligament, more specifically below the femoral vein confluence, and should therefore be avoided.

Third, congenital disorders, mostly located at the level of the inferior vena cava (IVC), can result in venous flow obstruction. Subsequently, patients might suffer from venous hypertension or secondary DVT caused by a sudden de-compensation in blood outflow patterns. After successful thrombolysis, recanalisation and stenting of the IVC should be performed to relieve complaints and reduce the risk of recurrent DVT (see below).

Technique

The first point of interest is that arterial experience and knowledge do not automatically apply to the treatment of deep venous obstructions. As is further addressed below, not only is the approach to revascularisation different, but so are the interventional tools used during the procedure, as is the risk profile of the intervention.

The recanalisation procedure is performed under local analgesia with some cases of sole external vein compression (i.e. MTS), and under general anaesthesia with most cases of post-thrombotic disease. In contrast to the treatment of arterial obstructions, PTA alone is never enough to durably recanalise the post-thrombotic vein. Stenting with self-expandable stents is always necessary to permanently push away the fibrotic trabeculations and webs. Principally, stenting should be performed from healthy to healthy segments, i.e. all diseased venous segments have to be covered by stents.

First access to the femoral vein is realised under ultrasound guidance. A 5 Fr. sheath is then introduced and angiography is performed to assess extent and localisation of the venous obstruction. In total iliac obstructions it is important to visualise and recognise collateral pathways, which helps to determine the anatomical route for recanalisation. Therefore, angiography in multiple projections is helpful. By using hydrophilic guidewires, the obstruction can be passed in most cases. In difficult cases of extensive post-thrombotic disease, CTO wires and catheters might be used to optimise technical success. Following the crossing of the obstruction, the affected vein segments are pre-dilated with non-compliant balloons. Over-dilating the obstructed veins facilitates complete stent deployment since significant recoil is seen after initial PTA. The risk of vein rupture and subsequent bleeding is extremely low, and pre-dilation up to 16 mm can safely be performed in the iliac veins down to the level of the inguinal ligament.

Stent sizing is fairly standard in occlusive disease, with 14 mm stents used in the iliac veins and 12 mm stents placed over the inguinal ligament into the common femoral vein. Stent migration in this entity is non-existent. However, the risk of stent migration increases in compressive disease because the vein wall is still smooth in most cases and does not have enough hold on the stent. Oversizing the stent is therefore advised. In most cases, 16 mm stents will suffice; however, specific patients with particularly large veins sometimes need diameters up to 18-20 mm.

Following stent placement, the treated segments are dilated again for optimal deployment and wall apposition. Completion angiography is then performed to evaluate flow through the stented segments and the loss of collateral flow. Stagnant flow within the stents should further be evaluated and residual stent compression has to be excluded. IVUS is very helpful to exclude incomplete stent expansion and stent malposition. In case of significant flow obstruction without stent compression, the degree of inflow might be the prominent limiting factor. Principally, the femoral vein and the deep femoral (profunda) vein are the dominant outflow veins of the leg, and are significant for long-term patency of the stented iliac veins. When post-thrombotic disease is limited to the common femoral vein, an exclusive endovascular approach is possible because stents can be extended down to the femoral vein confluence. However, when trabeculations extend into one or both femoral veins, inflow into the stents is hampered and might be worsened by placing stents distal to the femoral confluence. Again, IVUS can be helpful to identify these intraluminal webs and trabeculations. In these cases, the better alternative might be surgical disobstruction of the femoral outflow vein orifices and adding an arteriovenous fistula to further increase flow (Fig. 2). The fistula should be electively closed after 6-8 weeks to prevent focal restenosis.

If the IVC is also involved, the procedure becomes even more complicated. First, the IVC should be stented with large diameter, high radial strength self-expandable stents down to the level of the confluence. Then, both iliac veins need to drain freely into the stented IVC (Fig. 3). It has been shown that self-expandable stents might compress one another when placed in a "kissing configuration." Therefore, it has been suggested to place balloon-expandable stents at the level of the confluence to support the self-expandable stents and optimise inflow [5]. After successful recanalisation, patients are placed under an anticoagulation regimen with vitamin K antagonists for at least 6 months, aiming for an INR of 2.5-3.5. In addition to this rheological aspect, the amount of venous outflow from the leg, and stent design are believed to be the most important factors to maintain patency. Recently, there has been an increasing interest in the development of dedicated venous stents [6, 7]. To what extent these new devices will help increase long-term patency remains to be seen.

Conclusion

Endovascular treatment of iliocaval obstructions is generally accepted, technically feasible in virtually all cases, and shows very high (short- to mid-term) patency rates. Dedicated venous materials and availability of flow-increasing techniques might further optimise long-term results.

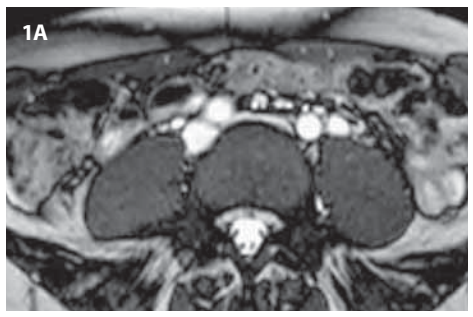

Fig. 1: May-Thurner compression, visualised with (A) MR venography and (B) IVUS

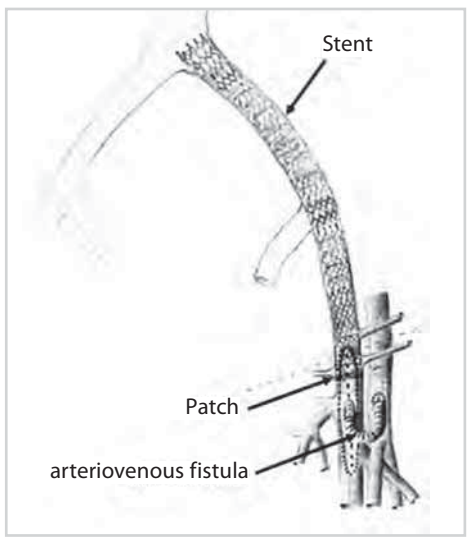

Fig. 2: Drawing showing a typical hybrid procedure, with stenting of the iliac veins and surgical disobstruction of the common femoral vein including AV fistula.

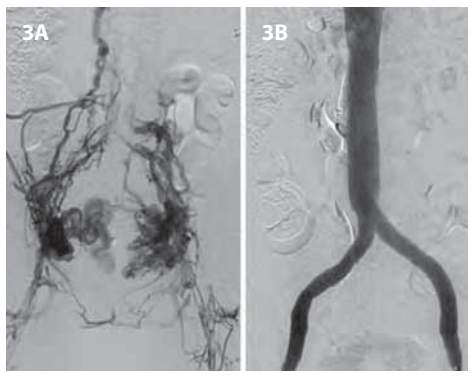

Fig. 3: Total iliocaval reconstruction with 24 mm self-expandable stents in the IVC, balloon-expandable stents at the confluence, and dedicated venous stents in bilateral iliac veins. A: complete obstruction of both iliac veins and IVC with only collaterals visible. B: completion angiography showing perfect flow restoration without filling of collaterals.

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DON'T MISS MEDTRONIC ABLATION SYMPOSIUM!

Date: Sunday, September 27th, 2015
Time: 14:30-15:30
Room: Auditorium 6

ABLATION WITH THERMOSPHERE™ TECHNOLOGY: 1 YEAR FOLLOW-UP

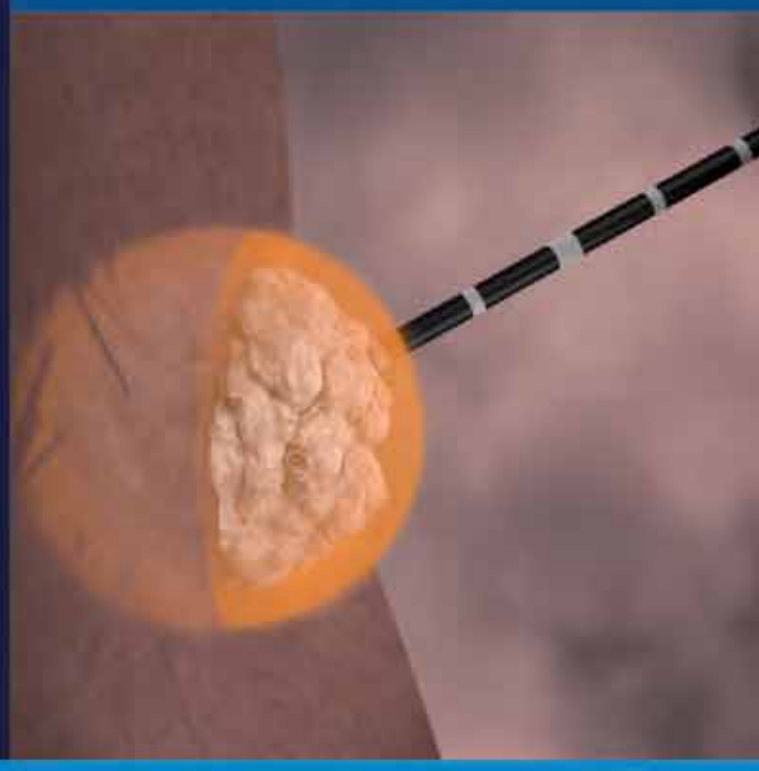
Moderator: Thierry de Baère, France

14:30 – 14:50
Predictability of ablation shape with Thermosphere™ technology
Presenter: Gianpaolo Carrafiello, Italy

14:50 – 15:10
Lung thermal ablations with Thermosphere™ technology
Presenter: Thomas J. Vogl, Germany

15:10 – 15:30
Renal tumor treatments with Thermosphere™ technology
Presenter: Warner Prevoo, Netherlands

FURTHER, TOGETHER



Medtronic

Plexus block for pain management

Julien Garnon

Don't miss it !
Palliation in cancer: alleviation strategies
Special Session
Sunday, September 27, 10:00-11:00
Room 3.A

The management of pain related to locally advanced cancers is a frequently encountered issue in oncology. In these palliative cases, local treatment, such as radiotherapy or percutaneous ablation, is not always possible, nor effective. If the tumour fails to respond to specific systemic therapies, the treatment of pain will usually mainly be based on opioids. However, opioids may not be sufficiently effective and/or may be associated with some adverse events, which may limit their use. In some of these advanced situations, the interventional radiologist can help both the oncologist and the patient by performing a plexus block in order to alleviate the patient's pain. The basic principle of a nerve block (or neurolysis) is to destroy the sympathetic nerves, which conduct the deep visceral innervation responsible for the pain. The level of destruction depends on the location of the tumour.

Historically, percutaneous neurolysis was performed by anaesthesiologists, using alcohol and fluoroscopic guidance. Although these procedures were reported to be safe, some major complications were possible due to malpositioning of the needle and the uncontrolled diffusion of alcohol. The arrival of CT-scanning at the beginning of the 1980s [1] helped to improve the safety of the procedure. Compared to fluoroscopy, CT-guidance offered greater precision, thereby reducing the rate of complications both during the puncture and also during the injection of alcohol (better positioning of the needle helps to reduce the dose of alcohol).

Nowadays, there are several ways to perform a nerve block. Image guidance should be as precise as possible. It is still not possible to identify the sympathetic nerves with imaging, but awareness of their anatomical location helps to target them very precisely with cross-sectional imaging. Most recent publications report the use of CT-scan or MRI [2] for performing nerve blocks. As with many other interventions, CBCT may also represent a viable alternative to CT.

Regarding how to destroy the nerves, the injection of a neurolytic agent is still the cheapest and fastest technique. Typically, a 22- or 20-G needle is advanced close to the sympathetic chain, and after verification of the proper position of the needle with injection of contrast medium, 5-15 ml of a neurolytic agent is injected. Ethanol and phenol are both neurolytic agents, with ethanol reported to be more efficient but more painful. The interventional radiologist should pay attention to the proper distribution of alcohol in order to avoid complications.

Another way to perform neurolysis is to use radiofrequency ablation [3]. RFA produces a small and predictable ablation area, thereby avoiding untargeted ablation, which may occur with alcohol injection. This particular advantage of RFA is especially useful in the cervico-thoracic area. However, RFA has a higher cost and requires very close contact with the sympathetic chain to be efficient. More recently, cryoablation has also been proposed [4]. The main advantage of cryoablation is the clear visualisation of the zone of ablation, owing to the monitoring of the ice ball with imaging. Cryoablation is also less painful than RFA, although both techniques are feasible under local anaesthesia. The major drawback of cryotherapy is still the high cost of the procedure. In the very near future, it is possible that high-intensity focused ultrasound (HIFU) may represent a new way to perform nerve blocks, with a completely non-invasive approach.

The result of a nerve block is highly dependent on the indication. As with other interventions, the interventional radiologist should see the patient clinically and obtain his informed consent. Percutaneous nerve blocking is a palliative intervention and should not be proposed as a first-line treatment, or if the patient is potentially curable. Typical indication of a neurolysis is a patient presenting with a locally advanced cancer associated with an ill-defined deep (visceral) pain refractory to a level 3 analgesic therapy. The radiologist should be aware of the anatomy of the sympathetic chains, as the site of neurolysis depends on the location of the cancer:

- The stellate ganglion block is indicated when a cancer invades the stellate ganglion with upper arm pain and Horner's syndrome. The target point is the stellate ganglion, which is located in front of the neck of the 1st rib and transverse process of C7 just behind the origin of the vertebral artery (Fig.1).

- The upper thoracic chain block is indicated for neoplasms which are invading the paravertebral gutter. The target point is the thoracic chain, which is located laterally to the middle part of the vertebral body.

- The lumbar ganglia block is indicated for retroperitoneal tumours invading paravertebral gutters. The target point is the lumbar ganglia located in the pre-vertebral space from L1 to L3.

- The hypogastric plexus block for rectal, left colon, bladder, prostate and gynaecological cancers. Approach to the plexus may be anterior or posterior.

- The impar ganglion block for cancers of the anus, distal urethra, vulva and distal third of the vagina. The neurolysis should be performed in front of the sacrococcygeal joint.

- Finally, the coeliac plexus block is probably the most effective block indicated for the management of pain secondary to advanced pancreatic cancers. Patients usually present with transfixing epigastric pain. Several approaches have been described in the literature: coeliac block with an anterior approach, coeliac block with a posterior approach, splanchnic nerve block requiring a posterior bilateral approach (Fig.2), and even a combination of the two latter approaches.

In conclusion, every interventional radiologist dealing with oncologic patients should know when and how to perform a nerve block, especially the coeliac block. If the indication is good and the procedure correctly performed, the patient's pain is relieved within a few minutes and the patient's quality of life may be dramatically improved with a 30-minute intervention.

Julien Garnon
University Hospital of Strasbourg
Strasbourg, France

Dr. Garnon works in the Department of Radiology at the University Hospital of Strasbourg. He is an active contributor at CIRSE events, participating in video-learning sessions, leading hands-on workshops and delivering lectures at various conferences, including ECIO 2013, ECIO 2014 and ECIO 2015, as well as CIRSE 2011 and CIRSE 2012. He has also contributed to numerous electronic posters, including one on insulation and temperature monitoring during tumour thermal ablation, which won the Magna Cum Laude Award in the educational category at CIRSE 2011. Dr. Garnon's research interests include RFA, cryoablation and cementoplasty.

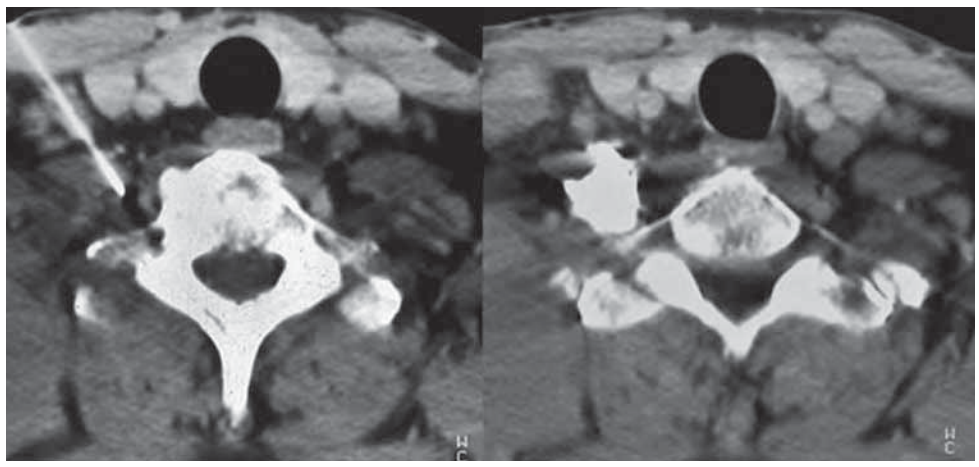


Fig.1: Stellate ganglion block with ethanol (anterior approach). The needle is advanced in front of the transverse process of C7. Proper repartition of contrast medium allows injection of the ethanol.

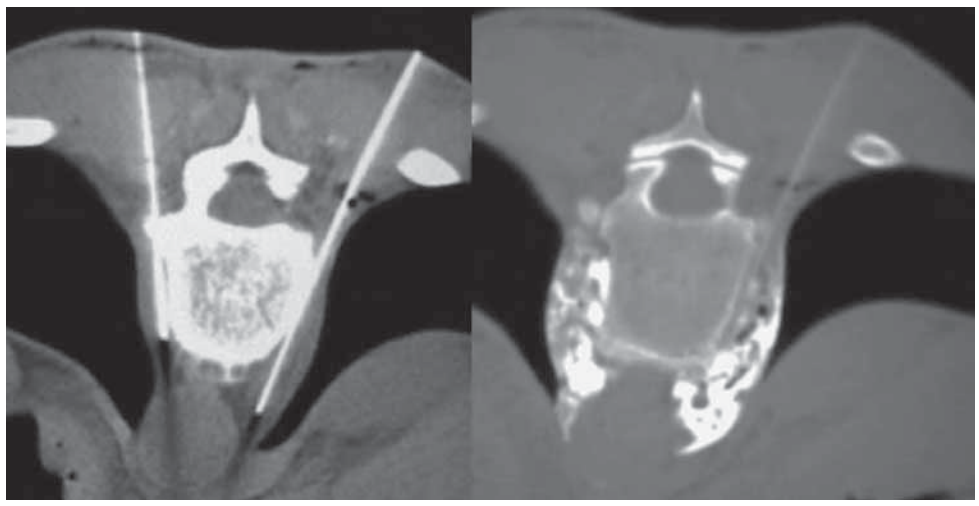


Fig.2: Splanchnic neurolysis with ethanol (posterior approach). Two needles are positioned in front of the vertebral body at the level of TH12. The diffusion of ethanol is checked with CT and should run along the pre-vertebral space.

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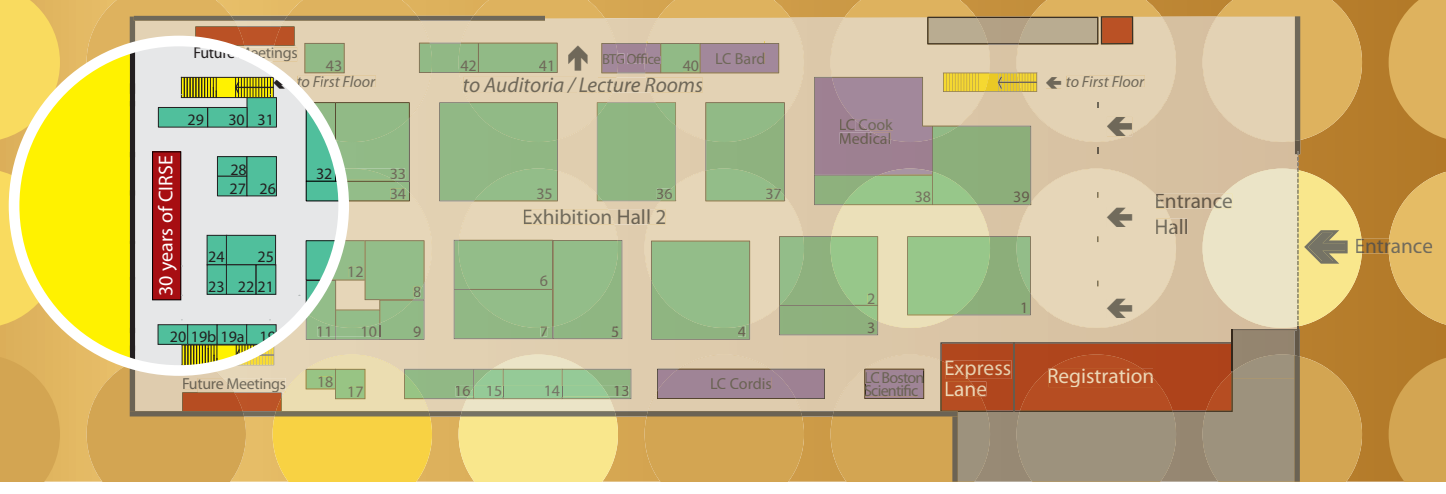
Come celebrate 30 years of CIRSE with us!

Visit the **jubilee lounge,** located at the back of **Exhibition Hall 2,** and be one of the first to view our specially designed webpage, charting the history of IR and the CIRSE society.

Come browse a host of historical photos, videos and documents – and see if you can spot any familiar faces!



Insight into ICSS long-term data

Andreas Mahnken (EBIR)

Atherosclerosis is a common disease and a well-known risk factor for stroke, while stroke is a leading cause of death and long-term morbidity. About 10-15% of all strokes are due to atherosclerotic stenosis of the internal carotid artery. Carotid endarterectomy (CEA) was introduced more than 60 years ago and is a well-accepted standard of care for lowering the risk of stroke in patients with symptomatic carotid artery stenosis. Starting in the 1990s, carotid artery stenting (CAS) evolved as a treatment alternative without the discomfort of anaesthesia and neck incision. Moreover, endovascular treatment has repeatedly been shown to reduce the risk of myocardial infarction, cranial nerve injury and neck haematoma. However, the efficacy of stenting and surgery for the goal of reducing the risk of stroke has long been debated.

After early encouraging reports on the outcome of CAS, several studies raised safety issues with CAS, noting an increased rate of early stroke. In 2010 a meta-analysis on the short-term results from three major trials (EVA-3S, SPACE, ICSS) comparing endarterectomy versus stenting in patients with symptomatic carotid stenosis confirmed the higher peri-procedural risk of stroke and death after CAS when compared to CEA (8.9% vs 5.8%) [1]. These findings were repeatedly confirmed, and in 2015, another meta-analysis summarised the results from randomised controlled trials as well as from other comparative case series [2]. As a consequence, the use of CAS was limited to very few indications such as restenosis after surgery.

The new kid on the block had failed despite a promising start – or so it seemed.

These data, however, were largely based on peri-procedural results and short-term follow-up, usually of less than one year. In February of this year, the long-term data from the Internal Carotid Stenting Study (ICSS) was published [3], providing interesting insights. There was an interesting development over time, with a late "catch up" for the risk of disabling stroke or death in the carotid endarterectomy group. While the interim analysis at 120 days after randomisation favoured CEA over CAS for disabling or fatal stroke (4.0% vs. 3.2%; HR 1.28; p=0.34), the long-term analysis at 5 years after randomisation (6.4% vs. 6.5%; HR 1.06; p=0.77) did not sustain this finding. Probably even more important is the development of the all-cause death rate. At the interim analysis, CEA was shown to provide a significantly lower all-cause death rate, when compared with CAS (2.3% vs. 0.8%; HR 2.76; p=0.017). After a median follow-up of 4.2 years, this difference vanished (17.4% vs. 17.2%; HR 1.17; p=0.19) [3, 4]. Nevertheless, there still is an excess of stroke in the stenting group, with a 5-year cumulative risk of 15.2%, compared with 9.4% in the surgery group (HR: 1.71; p<0.001) [3], although functional disability and quality of life did not differ between groups. This effect is driven by the markedly higher number of non-disabling strokes (Rankin Score < 3) in the stenting groups during the peri-procedural phase.

A more detailed analysis of the ICSS data confirms previous findings that the excess in procedural stroke is limited to patients older than 70. Moreover, the individual interventionalists appear to play a major role, while this could not be confirmed for centre or interventionalist experience. Most interestingly, the pre-procedural presence of white-matter lesions played a major role in the risk of stroke after stenting, while there was no such association after endarterectomy.

Based on the recent long-term data from the ICSS, there will be interesting discussions regarding whether stenting may re-emerge for a well-selected group of patients, and what this group may look like.

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Don't miss today's *Controversies* session, where Dr. Mahnken will debate the issue in more depth with Dr. Barry Katzen – join us in Auditorium 1!

Don't miss it!

Controversies in arterial intervention
Special Session
Sunday, September 27, 10:00-11:00
Auditorium 1

e-voting

Andreas H. Mahnken
(EBIR)
Marburg University Hospital
Marburg, Germany

Alongside his clinical interest in stroke diagnosis and therapy, Prof. Andreas Mahnken specialises in vascular interventions and tumour therapy. He is currently Chair of Radiology and Director of the Clinic for Diagnostic and Interventional Radiology of the University Clinic of Marburg. Prof. Mahnken holds both MBA and MME degrees, and has authored or co-authored more than 300 peer-reviewed journal articles and book chapters on diagnostic and interventional radiology, as well as holding several patents. He has served on the CIRSE Standards of Practice Committee and Research Committee, and is part of the Vascular Division of the ESIRonline Editorial Board.

Today's Featured Papers

will be presented in the Free Paper sessions, taking place from 16:15-17:15 and from 17:30-18:30

16:15 – 17:15

FP 1405 Vascular: BTK
Room 5.B
Paclitaxel-coated balloon for the treatment of infrapoplilteal arteries: 12-month results from the BIOLUX P-II randomized trial
M. Brodmann[1], T. Zeller[2], M. Bosiers[3], P. Peeters[4], K.-L. Schulte[5], D. Scheinert[6], U. Beschorner[2], E. Pilger[1];
[1]Graz/AT, [2]Bad Krozingen/DE, [3]Dendermonde/BE, [4]Bonheiden/BE, [5]Berlin/DE, [6]Leipzig/DE

FP 1406 Embolisation: special areas
Room 3.A
Superior rectal artery embolization "EMBORRHOID" as the first-line treatment in patients suffering from haemorrhoidal disease: mid-term results
V. Vidal, F. Tradi, D. Mege, G. Louis, J.-M. Bartoli, I. Sielezneff; Marseille/FR

FP 1407 Liver ablation
Room 3.B
Radiofrequency ablation versus surgical resection for hepatocellular carcinoma within the Milan criteria: a propensity score-matched study
A. Hocquelet[1], P. Balageas[1], C. Laurent[1], J.-F. Blanc[1], N. Frulio[1], C. Salut[1], M. Bouzgarrou[1], C. Cassinotto[1], J. Hoareau[1], M. Montaudon[2], H. Trillaud[1];
[1]Bordeaux/FR, [2]Pessac/FR

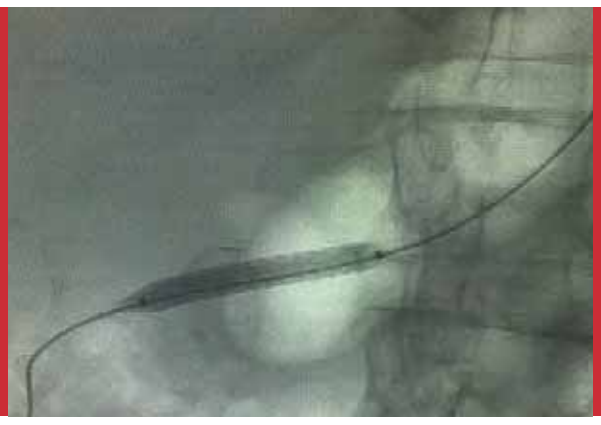
17:30 – 18:30

FP 1505 Vascular: femoro-popliteal
Room 5.B
Twelve-month results from the MAJESTIC trial of the Eluvia drug-eluting vascular stent system
S. Müller-Hülsbeck[1], K.F. Keirse[2], T. Zeller[3], H. Schroë[4], J. Diaz-Cartelle[5];
[1]Flensburg/DE, [2]Tienen/BE, [3]Bad Krozingen/DE, [4]Genk/BE, [5]Marlborough, MA/US

FP 1506 Liver TACE: clinical studies
Room 1.15
Chemoembolization with DC beads preloaded with irinotecan (DEBIRI) vs. doxorubicin (DEBDOX) as the second-line treatment for liver metastases from cholangiocarcinoma: technical aspects, complications, and efficacy
C. Sallemi, M. Venturini, G. Agostini, G. Cammi, A. Del Maschio, F. De Cobelli; Milan/IT

FP 1507 Biliary interventions
Room 3.A
Percutaneous treatment of benign biliary strictures with biodegradable biliary stents: midterm outcomes
E. Criado Paredes, J.F. Falco-Fages, N. Bejarano, A. Alguersuari, J. Guitart, J.R. Fortuño, F.J. García Borobia; Barcelona/ES

Transradial Access for Interventional Radiology Procedures



Transradial access has become increasingly popular for coronary interventions; the most advantageous aspect being very low access-site bleeding complications, which may help contribute to reductions in the risk of adverse events.

Recently, interventional radiologists have begun to utilize transradial access for procedures – from uterine fibroid embolization, interventional oncology, and trauma.

"Aside from the benefits of earlier ambulation and fewer complications, transradial access procedures are less expensive," says Darren Klass, MD, PhD, Interventional Radiologist, Vancouver Coastal Health, who has performed more than 200 procedures using the radial approach.

"I have received thank-you notes from the nursing staff because the radial approach requires fewer post-procedure nursing hours."

"Not going to a radial approach is to do yourself a disservice," says Michael Neuwirth, MD, Interventional Radiologist, Carle Heart and Vascular Institute, Urbana, Ill. "Sticking with the femoral approach for interventional radiology procedures is to keep your head in the sand. I tell my colleagues that the radial approach will change their practices, affect their bottom lines, and is significantly better for patients. I have had a number of patients thank me because their procedures were simpler and less complicated for them. We have seen a great deal of success in a number of procedures that fall outside of cardiac interventions, including AV fistulagrams, fibroid embolizations, mesenteric and renal angiograms and stenting, liver Interventional Oncology, and for standard lower extremity angiograms. You can even use it for subclavian stenting."

Using transradial access for many interventional radiology procedures requires longer catheters than the standard lengths used for cardiac interventions. Merit Medical carries catheters in the lengths and shapes needed for IR procedures. Furthermore, the company offers practitioners the option of customizing catheters to meet their specific shape and length requirements. "Using Merit's catheters, I catheterize to almost any point in the body above the knee," shares Klass.

Patient Experience with Transradial Procedures

Since 1997, surveys of patients who have had transradial intervention indicate that they are more satisfied with radial access procedures than with femoral. Most often, patients cited the shorter post-procedure recovery time and earlier times to ambulation; however, less discomfort and pain have also been reported. Patient preference for transradial access could be a motivating factor in the adoption of a radial-first approach for interventionalists. According to Kiemeneij et al., a survey of patients found that 75 percent of the patients who underwent transradial PTCA after transfemoral diagnostic catheterization preferred the radial approach because of post-procedural ambulation. In 1999, a randomized comparison of transradial access on quality of life and cost effectiveness conducted by Cooper et al., discovered that radial was preferred by 80 percent of the patients surveyed. A study of patient experience during PCI using both radial and femoral access by Geijer et al. in 2004 included a patient questionnaire that asked patients to rate the discomfort and pain they felt during and after the procedure. Patients graded discomfort and pain much lower when using radial access.

The 2011 RIVAL trial reported that 90 percent of the patients who had transradial approach said they would prefer it if an additional procedure were needed. In a patient satisfaction survey conducted from October 2010 to April 2011 by the Jesse Brown VA Medical Center in Chicago, 97 percent of the 32 patients surveyed said they preferred the radial procedure; 91 percent rated the radial procedure an 8 on a scale of 1 to 10; and 94 percent would recommend the radial approach over the femoral.

Learning Transradial Access

Merit Medical will be conducting a ThinkRadial™ course for Interventional Radiology, October 22–24, 2015, at their South Jordan, Utah, headquarters. Dr. Klass will be leading the IR track of the course, while Sandeep Nathan, MD, will conduct the interventional cardiology track.

Islam A. Shahin, MD, Interventional Radiology, Methodist Dallas Medical Center, recently attended the ThinkRadial™ course. "I got a lot out of the course, particularly in the hands-on portion. The practical training that Merit Medical provides saves time and allows attendees to have hands-on practice using cutting-edge technology. Having experienced operators on hand to answer questions was a great benefit."

"Merit's training was a class act," says Dr. Neuwirth. "The course gave me the opportunity to practice the radial approach and understand the nuances of the procedure while interacting with peers. The way that Merit ran the ThinkRadial™ course is that they cover several types of procedures and give real-world tips and tricks on how to be successful for the different kinds of procedures. I left the course feeling like I was ready to do radial access."

"I got a lot out of the course, particularly in the hands-on portion. The practical training that Merit Medical provides saves time and allows attendees to have hands-on practice using cutting-edge technology. Having experienced operators on hand to answer questions was a great benefit."

"I am very honored to work with Merit on the ThinkRadial™ course specifically designed for interventional radiologists," says Dr. Klass. "The obvious benefits of transradial access have been proven in other disciplines and will continue to be adopted by radiologists."

The ThinkRadial™ course is also unique because the senior leadership of Merit Medical participates. "It was very nice to see firsthand how Merit works, what drives them, seeing the actual CEO, CFO and CMO, speak with them and hear their visions. At one meal during the conference, the senior management of Merit spent time asking participants what our priorities and needs are. It was eye opening," says Dr. Neuwirth.

To learn more about Merit Medical's ThinkRadial™ program, including upcoming training opportunities, go to www.ThinkRadial.com/CIRSE.

"While there's not much in the peer-reviewed literature on transradial access for Interventional Radiology, I feel that will soon change," says Dr. Klass. "Until the literature catches up, the course in October will be practical and hands-on, not a literature review."

"I am very selective about attending any event that takes me away from my family," shares Dr. Neuwirth.

"The Merit ThinkRadial™ course was worth the time investment."

"I got a great deal from the course that I am implementing into my practice," says Dr. Shahin. "The people at Merit were gracious and helpful, and I really enjoyed the course."

SOURCE MATERIALS

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MATRIX: Radial Access Reduces Net Adverse Events; Bivalirudin Shows Mixed Results in ACS Patients | ACC News Story. American College of Cardiology Website. http://www.acc.org/latest-in-cardiology/articles/2015/03/15/20/00/1045am-pt-316-matrix-radial-access-reduces-net-adverse-events-bivalirudin-shows-mixed-results-in-acs-patients. Published March 16, 2015. Accessed June 4, 2015

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The future challenges of endovascular stroke therapy

Tommy Andersson

Don't miss it !

How to improve acute stroke management: new horizons
Special Session
Sunday, September 27, 08:30-09:30
Room 5.A

Tommy Andersson
AZ Groeninge Teaching Hospital
Kortrijk, Belgium

Prof. Tommy Andersson is professor of neurointervention, and heads the Neurointervention Unit at the AZ Groeninge Teaching Hospital. He is currently on a leave of absence from Karolinska University Hospital, where he is Head of Neurointervention and Director for Education in Neuroendovascular Treatment. Prof. Andersson is the Chairman of the Swedish Society of Neuroradiology and of the Swedish national quality registry (Endovascular therapy for Acute Ischemic Stroke, or EVAS). He serves on the editorial board of Neurointervention and The Stroke Interventionalist.

Recently no less than five randomised controlled trials (RCTs) have shown that, for large artery stroke in the anterior circulation, intra-arterial treatment (IAT) added to intravenous thrombolysis (IVT) is superior compared to stand-alone IVT [1-5]. In addition, in two of the studies, subgroup analyses revealed superior patient outcomes after IAT for patients not eligible for IVT. This obvious breakthrough is welcome news, but may also put pressure on political decision makers and hospital managers. Now that IAT for acute stroke is a proven therapy, many hospitals want to set up an endovascular stroke service, especially because time is such an important factor for this particular treatment, and patient transfer with inherited time delay may negatively affect patient outcome. This is an obvious challenge for the future: who should perform these procedures in order to guarantee patient safety and achieve good outcomes similar to those achieved in recent studies?

Another challenge that we face is based on the results from these studies. It is clear that the revascularisation percentage is far from 100% in all of the studies. Further, even if perfect revascularisation is achieved, the percentage of patients having a good outcome is much lower. Such so-called futile revascularisation may result due to many reasons, all of which need to be addressed.

Who should perform mechanical thrombectomy?

It is clear that, to be able to perform mechanical thrombectomy safely and efficiently, one needs knowledge, training and experience. The problem is that acute stroke treatment is just that: a very acute intervention, which means that it is basically impossible to pile up a number of cases for visiting physician training purposes, even in an experienced centre. In a particular week, even in a high-volume centre, a visiting doctor may see no patients at all or one or more every day. Courses with animal and/or simulator training are very good in this respect, but cannot replace a high volume of experience.

Even though a straightforward thrombectomy may seem like an "easy" procedure, many interventions in these vasculopathic patients are far from risk-free for complications. For instance, if you embark on performing thrombectomies, do you have a plan for how to act if a device gets stuck or if there is too much resistance when pulling? Do you have a protocol for how to handle vasospasm? What´s the strategy if there are aortic arch problems and you can't advance the long sheath or guide catheter? What is the strategy if there is a T-occlusion and you see nothing of the internal carotid because the outflow is obstructed? Are you comfortable navigating the catheter to the intracranial circulation "blindly"? In addition, the intracranial arteries differ significantly from cardiac or peripheral arteries (Table 1, Fig. 1). For instance, they lack an external elastic lamina and are generally much more prone to rupture and vasospasm, with many perforators that may easily be disrupted.

For these reasons, it is of utmost importance that physicians performing mechanical thrombectomy, regardless of their background, are used to working in this environment and possess the adequate knowledge, training and experience. For patient safety, it is not acceptable to work intra-cranially for instance once a month or even once a week. It has to be an experience based on almost daily exposure to intracerebral interventions. There is a reason for subspecialisation; no one would have an orthopaedic surgeon clip his or her intracranial aneurysm!

How can the revascularisation rate be increased?

In the recently-published RCTs, the revascularisation rates varied from 59% to 88% (Fig. 2). This obviously means that a substantial proportion of patients, between approximately 15% and 40%, do not become revascularised. This is due mainly to technical reasons. Access problems may to some extent provide the explanation, but only for a relatively small proportion of patients, given that most of the time it´s possible to access the embolic obstruction. Instead, clot properties may be the determining factor. A thromboemboli contains many different substances, but one very important factor seems to be the content of fibrin. A mature, fibrin-rich clot is firm, tough and sticky, and therefore much less likely to deform. With this follows the obvious risk of being difficult to remove with conventional stent retrievers or with aspiration alone. In contrast, clots rich in red blood cells are soft, friable and slippery, which means that they may be easier to remove but instead more prone to embolisation, in the same or in a previously unaffected territory. Flow-arrest utilising a balloon guide catheter becomes crucial in this context. This knowledge about clot properties has just recently been noticed and today there is at least one device on the European market that is designed to be able to effectively remove clots with variable fibrin content. In the future, we will probably see more research into this important field to further increase the yield of our thrombectomy efforts.

How can we avoid futile revascularisation?

Futile revascularisation occurred in all the recent RCTs (Fig. 2). This has many reasons, the most important probably being faulty patient selection and a prolonged procedure time. The best way to select patients is still to some extent controversial. You may want to treat patients with a small infarct core, but the question is how to quickly and reliably select these patients. The selection process varied quite substantially in the recent RCTs mentioned above, which suggests that the ideal method is yet to be proven. From the relatively low percentage of futile revascularisation seen in EXTEND-IA, it seems that CT-perfusion (CTP) may today be a very valid alternative. The SWIFT-PRIME data has also shown that CTP was as good as MR for identifying the infarct core. In the future, we will probably see new ways to adequately select patients, perhaps based on the extent of pial collaterals or oxygen metabolism.

Another reason for futile revascularisation is prolonged procedure time. One reason for this may be that the set-up and pre-procedure arrangements take too long. For instance, general anaesthesia takes longer than conscious sedation; for this and other reasons it is not surprising that it was a clear predictor of bad outcome in the MR CLEAN study. However, the blood pressure drop that is almost inevitable with general anaesthesia is most likely even more important in this respect. Even if we succeed in having a perfect and quick patient preparation, but then the actual procedure takes too long, the patient may develop a definite infarct with a concomitant bad patient outcome. Here, again, clot properties become important. Ideally, it should be possible to remove the majority of clots with 1-2 attempts, and the total time of the procedure, from groin puncture to revascularisation, should take no more than 15-30 minutes. With a good technique and efficient and safe devices, this is definitely achievable.

In summary, we need to provide all physicians who perform mechanical thrombectomy with sufficient knowledge, training and experience. This is the only way to guarantee patient safety and efficient procedures. We need to use proper patient selection and an adequate technique with efficient devices to be able to quickly and safely remove all types of clots. This will help us both to increase the number of patients who can be revascularised, and to avoid futile revascularisation.

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Cerebral arteries have/are:

- Smaller diameter
- More tortuous, more distal
- Thinner wall
- No external elastic lamina
- The outermost layer of the muscle cells as boundary media-adventitia
- Intima-media-adventitia contributing differently to wall thickness
- Dominiscance of tunica media, stiffer in circumferential and longitudinal dimensions, suspended in CSF, tethered to the brain by small branching arteries, e.g. lenticulostriates, BA-perforators
- Prone to rupture at much lower forces, perforators that may easily be disrupted, more difficult to navigate, prone to vasopasm

Table 1: Comparison between cerebral and systemic/cardiac arteries.

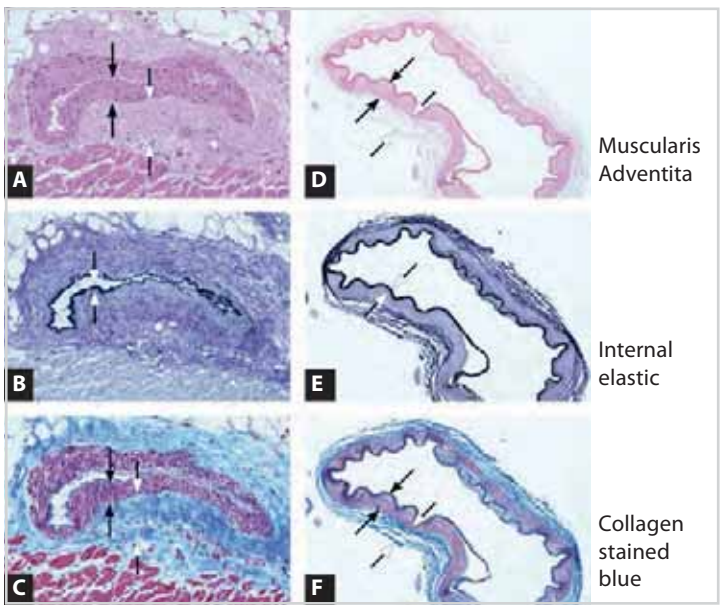

Fig. 1: Comparison of histological sections of normal left anterior descending coronary artery (LAD; A, C, E) and normal middle cerebral artery (MCA; B, D, F). Adapted with permission from Meyers PM et al, Annu. Rev. Med. 2007;58:107-22.

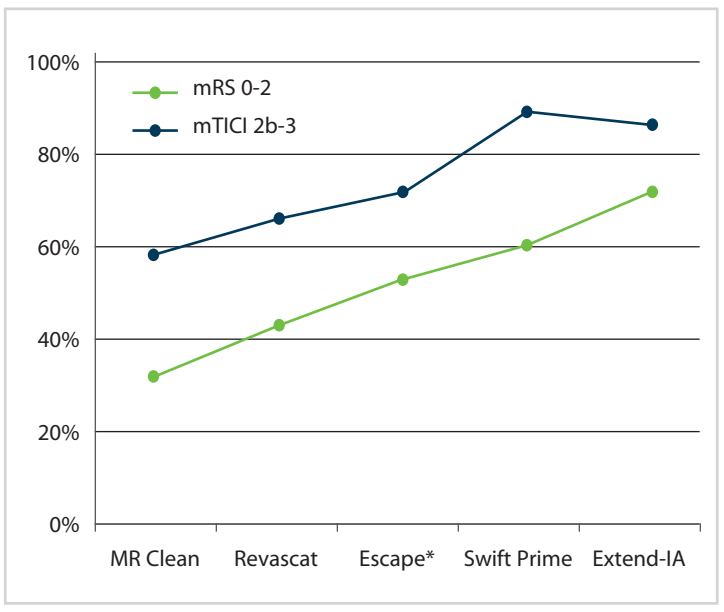

*Fig. 2: Percentage of adequate revascularisation and good patient outcome after mechanical thrombectomy in five recently-published RCTs. *used TICI scale vs. modified TICI*

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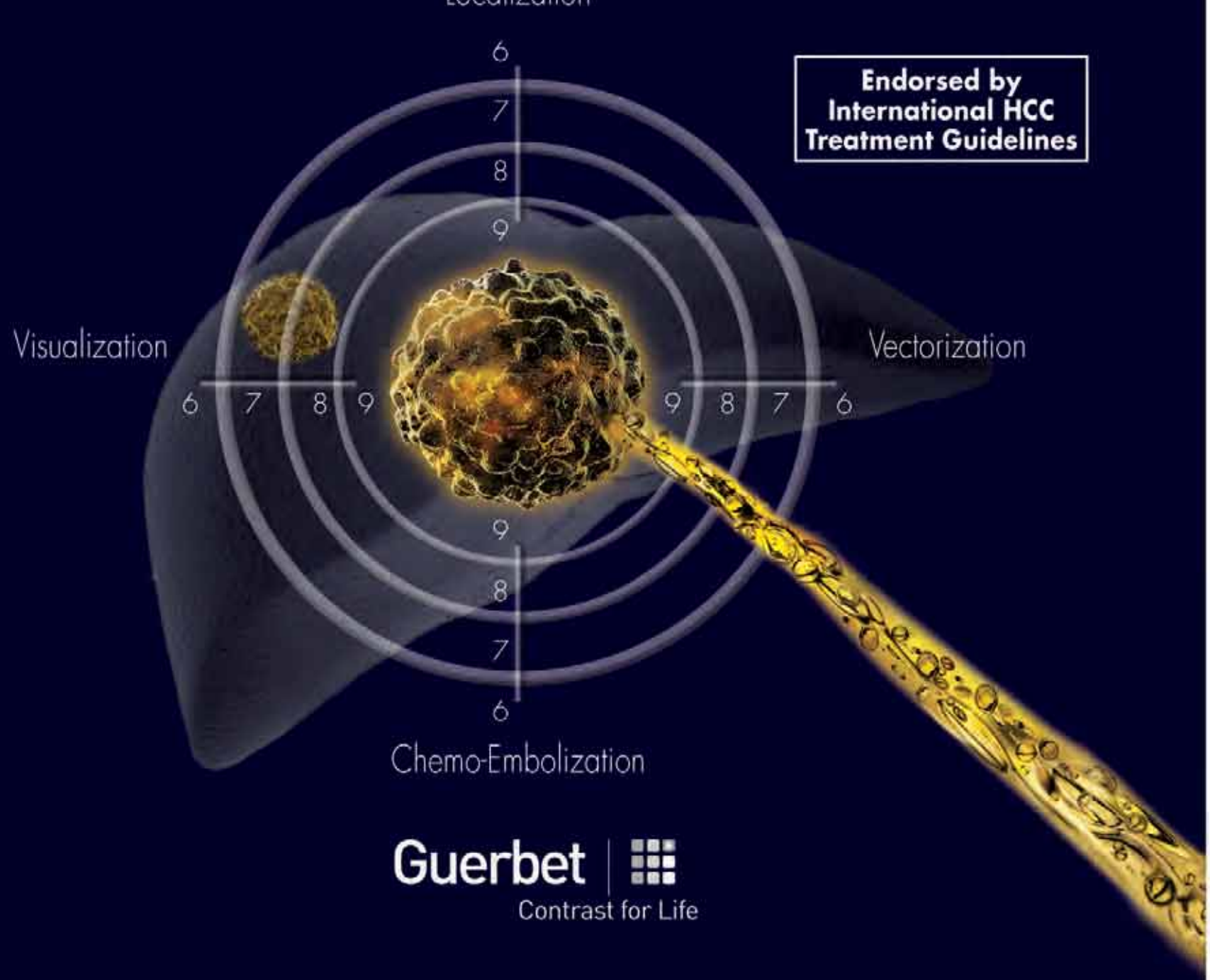

Endorsed by International HCC Treatment Guidelines

Guerbet
Contrast for Life

LIPIODOL® ULTRA-FLUID. Composition: Ethyl esters of iodized fatty acids of poppy seed oil 10 mL, corresponding to an iodine content of 480 mg/mL. **Indications (**):** In diagnostic radiology - Hysterosalpingography - Ascending urethrography – Lymphography – Sialography - Fistulography and exploration of abscesses - Exploration of frontal sinuses - Pre and post-operative cholangiography. In interventional radiology – Visualisation and localization (by selective intra-arterial use during CT) of liver lesions in adults with known or suspected hepatocellular carcinoma - Visualisation, localisation and vectorisation during Trans-Arterial Chemo-Embolisation (TACE) of hepatocellular carcinoma at intermediate stage, in adults – Selective embolization in combination with Histoacryl glue (particularly for arteriovenous malformation or aneurysms) – Selective injections of LIPIODOL® ULTRA-FLUID into the hepatic artery for diagnostic purposes where a spiral CT scan is not practical. In endocrinology - Prevention of severe cases of iodine deficiency. **Posology and method of administration (*):** have to be adapted according to the type of examination, the territories explored, the age and weight of the patient. The volume to be administered depends on the particular requirements of the technique and the size of the patient. Contraindications: Hypersensitivity to LIPIODOL® ULTRA-FLUID - Confirmed hyperthyroidism - Patients with traumatic injuries, recent haemorrage or bleeding – Hysterosalpingography during pregnancy or acute pelvic inflammation – Bronchography. In interventional radiology (Trans-Arterial Chemo-Embolization), administration in liver areas with dilated bile ducts unless drainage has been performed. **Special warnings and special precautions for use (*):** There is a risk of hypersensitivity regardless of the dose administered. Lymphography: Pulmonary embolism may occur immediately or after few hours to days from inadvertent systemic vascular injection or intravasation of LIPIODOL® ULTRA-FLUID: Perform radiological monitoring during LIPIODOL® ULTRA-FLUID injection and avoid use in patients with severely impaired lung function, cardiorespiratory failure or right-sided cardiac overload. Hypersensitivity: all iodinated contrast agents can lead to minor or major hypersensitivity reactions, which can be life-threatening. These hypersensitivity reactions are of an allergic nature (known as anaphylactic reactions if they are serious) or a non-allergic nature. They can be immediate (occurring within 60 min) or delayed (not occurring until up to 7 days later). Anaphylactic reactions are immediate and can be fatal. They are dose-independent, can occur right from the first administration of the product, and are often unpredictable: avoid use in patients with a history of sensitivity to other iodinated contrast agents, bronchial asthma or allergic disorders because of an increased risk of a hypersensitivity reaction to LIPIODOL® ULTRA-FLUID. Thyroid: can cause hyperthyroidism in predisposed patients. Lymphography saturates the thyroid with iodine for several months and thyroid exploration should be performed before radiological examination. Chemo-Embolization: Trans-Arterial Chemo-Embolisation is not recommended in patients with decompensated liver cirrhosis (Child-Pugh ≥8), advanced liver dysfunction, macroscopic invasion and/or extra-hepatic spread of the tumour. Renal insufficiency must be prevented by correct rehydration before and after the procedure. Oesophageal varices must be carefully monitored. Hepatic intra-arterial treatment can progressively cause an irreversible liver insufficiency in patients with serious liver malfunction and/or undergoing close multiple sessions. The risk of superinfection in the treated area is normally prevented by administration of antibiotics. Embolization with glue: An early polymerisation reaction may exceptionally occur between LIPIODOL® ULTRA-FLUID and certain surgical glues, or even certain batches of glue. Before using new batches of LIPIODOL® ULTRA-FLUID or surgical glue, the compatibility of LIPIODOL® ULTRA-FLUID and the glue must be tested in vitro. **Interaction with other medicinal products and other forms of interaction(*):** Metformin, Beta blockers, vasoactive substances, angiotensin-converting enzyme inhibitors, angiotensin-receptor antagonists, Diuretics, Interleukin II. **Fertility, pregnancy and lactation (*):** LIPIODOL® ULTRA-FLUID must only be used in pregnant women if absolutely necessary and under strict medical supervision. Breastfeeding should be discontinued if LIPIODOL® ULTRA-FLUID must be used - **Effects on ability to drive and use machines:** The effects on ability to drive and to use machines have not been investigated - **Undesirable effects (*)** most adverse effects are dose-related and dosage should therefore be kept as low as possible: hypersensitivity, anaphylactic reaction, anaphylactoid reaction, vomiting, diarrhea, nausea, fever, pain, dyspnea, cough, hypothyroidism, hyperthyroidism, thyroiditis, pulmonary embolism, cerebral embolism, retinal vein thrombosis, lymphoedema aggravation, hepatic vein thrombosis, granuloma. **Overdose (*)** The total dose of LIPIODOL® ULTRA-FLUID administered must not exceed 20 mL - **Pharmacodynamic properties (*)** Pharmacotherapeutic group: X-ray contrast media, iodinated. **Presentation (**)** - 10 mL glass ampoule, box of 1 - 10 mL glass ampoule, box of 50. **Marketing authorization holder (*):** Guerbet - BP 57400 - F-95943 Roissy CdG cedex – FRANCE. **Information:** tel : 33 (0)1 45 91 50 00. **Revision:** August 12th, 2015.

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Diagnosis and treatment: low-flow malformations

Bora Peynircioglu

Vascular malformations (VMs) are now described according to widely accepted guidelines, and the principle of proper treatment is becoming clear. An appropriate classification scheme for vascular anomalies and definite indications for treatment are important for an overall successful treatment. Findings from non-invasive imaging (mostly Doppler ultrasound with magnetic resonance imaging [MRI] and CT for high-flow malformations) in association with clinical findings are critical for establishing the diagnosis, evaluating the extent of malformation, and planning appropriate treatment.

In most cases, conservative treatment is recommended; however, when a patient suffers clinical complications (e.g. ulceration, pain, haemorrhage, cardiac failure, organ dysfunction or unacceptable cosmetic consequences), nidus sclerotherapy/embolotherapy becomes mandatory. A multidisciplinary approach is needed in the treatment of any VM, and a dedicated team approach is necessary for appropriate management in most cases.

As interventionalists, we are now playing a very important role not only in characterising these vascular malformations, but also in treating them. Surgical excision, which includes excision of lesions, offers an attractive solution in theory. However, the infiltrating nature of VMs increases the possibility of recurrence and complications. As percutaneous management techniques, embolisation and sclerotherapy procedures offer a superior alternative and/or complimentary treatment choices with increasingly recognised safety and efficacy. Embolisation is the intentional occlusion of the nidus and feeder vessels of a VM via a foreign material (e.g. n-butyl cyanoacrylate [NBCA] or ethylene-vinyl alcohol copolymer derivatives), whereas sclerotherapy is the obliteration of a VM via an aggressive sclerosing agent (e.g. alcohol, polydocanol and bleomycin).

Use of the embolisation technique in low-flow VM is generally reserved for cases that are to be surgically resected, not only to achieve better haemostasis during surgery but also to serve as a roadmap for the surgeon to better delineate the extent of VM filled with embolic agent inside. The combination of embolisation and sclerotherapy can potentially serve as a treatment method in cases with relatively large VM, with the goal of ultimately obtaining a curative result with surgical resection. All of these embolisation and sclerotherapy procedures can be performed under ultrasound and/or fluoroscopy guidance in an interventional radiology unit. General anaesthesia may be needed in cases of alcohol sclerotherapy or for any treatment in the paediatric population.

Currently, there is no consensus on the selection of an appropriate agent for percutaneous treatment options. The lymphatic or venous nature of the lesion, location (deep vs. superficial), operator experience, presence of an adjunct surgery plan, patient expectations, cost and availability are the main factors that influence agent selection. For the percutaneous technique in the treatment of low-flow VM, following the appropriate sterile preparation and draping of the puncture site, a 19-23 G butterfly needle(s) or 21 G micropuncture needle(s) may be placed into the VM (mostly under US guidance), and diluted contrast injected into the VM to depict the vascularity and venous drainage of the VM.

Compression of the lesion itself or of the drainage veins only may create a different haemodynamic environment within the malformation, and hence sometimes help the treatment. Only after assessing the behaviour of the given liquids are the chosen sclerotherapy (Fig. 1) or embolic (Fig. 2) agents injected under the guidance of fluoroscopy and/or US. Additional punctures may be performed when needed during the therapy. In both techniques (embolotherapy/sclerotherapy), complete obliteration of the VM is the goal; for diffuse, large VMs, additional treatment sessions are to be scheduled at 4-6 week intervals. While dose limitations are one important reason for doing session-by-session treatments for select agents (such as alcohol, lipiodol, and polidocanol), staying on the safe side with more limited sclerotherapy is another vital reason, particularly to avoid potential complications with large lesions. Periodic (1-3 month) follow-up evaluations should be performed based on physical examination, using gray scale and/or colour Doppler US and MRI, as needed.

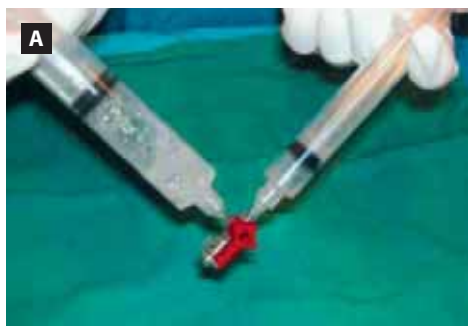
In general, low-flow VM lesions are rare and present challenges in both diagnosis and management. Percutaneous management with sclerotherapy can be effectively used alone or with surgery for the treatment of PVM lesions, provided that the lesion is correctly classified and an appropriate agent is selected. To achieve better outcomes with these potentially complex lesions, interventional radiologists and plastic surgeons must work together, beginning with the diagnosis and continuing throughout treatment, so that these lesions can be treated aggressively and patiently, yielding excellent outcomes with an acceptable rate of complications. Choice of the embolisation/sclerotherapy route and embolic agent plays an important role in the management of these lesions, and requires significant experience and expertise in all kinds of image-guided embolisation.

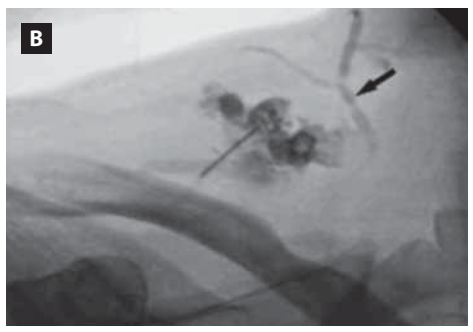
Don't miss it !

State-of-the-art vascular malformation management
Special Session
Sunday, September 27, 10:00-11:00
Auditorium 8

Bora Peynircioglu
Hacettepe University Hospital
Ankara, Turkey

Prof. Peynircioglu is Professor of Radiology at Hacettepe University, where he has taught since 2005, and a practicing interventional radiologist at the university's hospital. He was a Clinical Fellow at the University of Michigan in 2004. Prof. Peynircioglu has presented lectures at several CIRSE events, including CIRSE 2013 and CIRSE 2014. He also serves on the CIRT Steering Committee. His recent research efforts have focused on massive gastrointestinal haemorrhage, quantitative liver tumour blood volume measurements, and intra-arterial polidocanol injection for treating peripheral arteriovenous malformations.





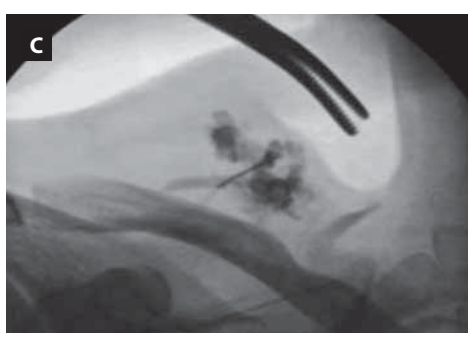


Fig. 1 a-c: sclerotherapy, agents and effect

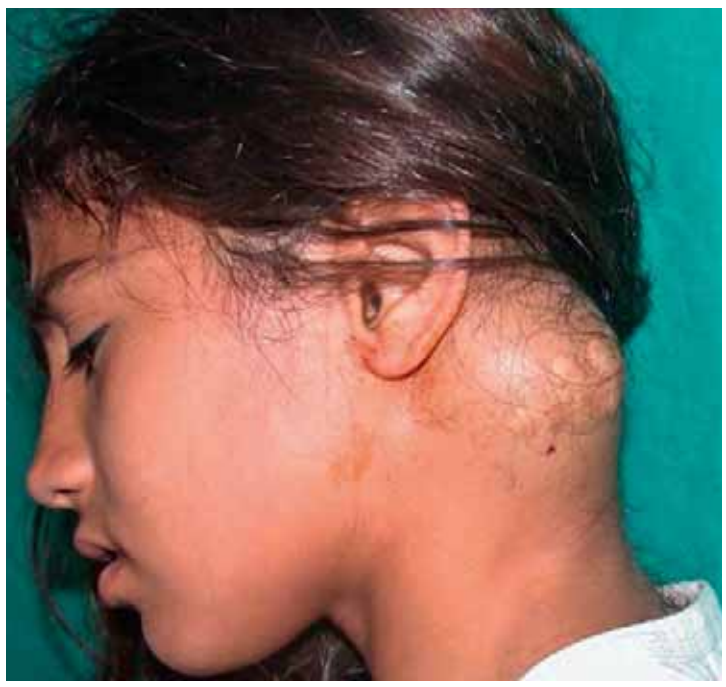


Fig. 2a: malformation suitable for treatment with embolics

Fig. 2b: malformation treated with embolics

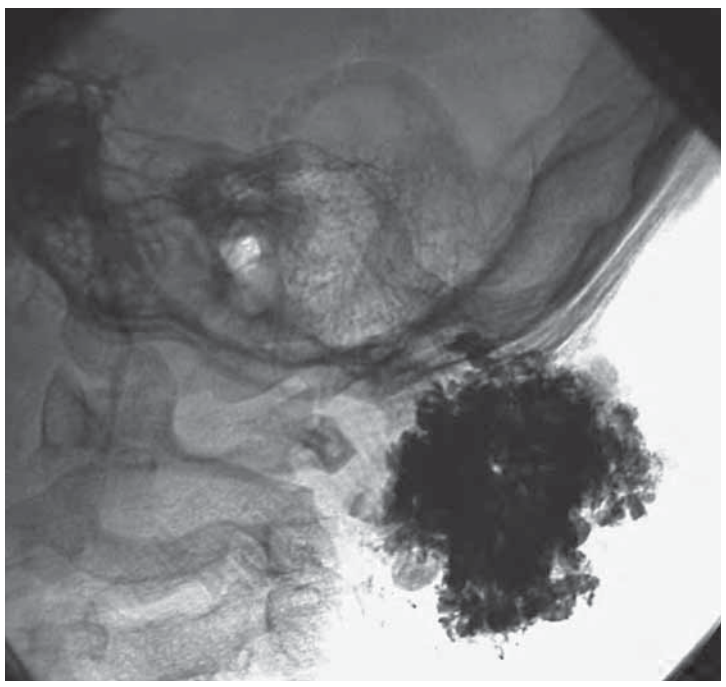


Fig. 2c: embolics in action

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Today's Radiation Protection Highlights

CIRSE's Radiation Protection Pavilion, located in the exhibition hall, is here for you during the entire Annual Meeting, offering pertinent informational material, interactive tools, and opportunities to engage directly with experts in RP matters.

Complementing the diverse features on offer in the Pavilion, the scientific programme includes several sessions delving further into various aspects of radiation safety. The importance of monitoring and managing occupational radiation exposure looms large in today's programme, which includes workshops aimed at both practitioners and staff members.

In addition, today's RPP Mini Talks, which feature short expert presentations, again cover a wide range of topics, including dealing with problematic cases; the use of simulators; optimising equipment settings and imaging protocols; as well as promoting RP in practice. We hope to see you there!

CIRSE RADIATION PROTECTION

Today's RPP Mini Talks

Sunday, September 27

11:00 – 11:15
Problematic cases – what went wrong / what would you do?
R.W. Loose (Nuremberg/DE)

11:15 – 11:30
Industry presentation – SIMBIONIX
Patient and staff dose management using medical simulators in complex endovascular procedures
G. Bartal (Kfar-Saba/IL)

12:30 – 12:45
Endovascular simulators reduce patient and staff exposure
G. Bartal (Kfar-Saba/IL)

12:45 – 13:00
Industry presentation – MENTICE
Radiation Safety – What's in it for you, what's in it for the patient?
L.B. Lönn (Copenhagen/DK), E.Fält (Gothenburg/SE)

13:00 – 13:15
Optimal angiography equipment settings make a difference
M.C. Freund (Innsbruck/AT)

14:00 – 14:15
Industry presentation – SIEMENS
Dose optimised imaging protocols for complex endovascular procedures
E. Verhoeven (Nuremberg/DE)

14:15 – 14:30
How to create an RP safety culture
E.P. Efstathopoulos (Athens/GR)

16:00 – 16:15
Industry presentation – MDT
Radiation Protection in Practice
D. Janssen (Hilvarenbeek/NL)

Today's Workshops on Radiation Safety

Sunday, September 27, 11:30-12:30
Room 3.A

RWS 1104 **Optimising radiation protection in interventional radiology: what can the radiographer do?***
1104.1 *S. McFadden (Belfast/UK)*
1104.2 *R. Gould (Belfast/UK)*

* Offered in co-operation with the European Federation of Radiographer Societies (EFRS); especially designed for radiographers and nurses.

Sunday, September 27, 17:30-18:30
Room 5.A

WS 1503 **Practical issues in dose optimisation and monitoring during IR procedures**
1503.1 *G. Bartal (Kfar-Saba/IL)*
1503.2 *E. Vano (Madrid/ES)*

Medtronic

Reducing radiation exposure during vertebral augmentation procedures: challenges and solutions

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Service of Diagnostic and Interventional Neuroradiology, Geneva University Hospitals, Geneva, Switzerland

Marta Sans-Merce
Institute of Radiation Physics, Lausanne University Hospital, Switzerland

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Figures:

Fig.1 Kyphon® Cement Delivery System (CDSTM)

Fig.2. Cement delivery with the Kyphon® CDSTM. Note the distance of the operator from the needle and also the effective shielding between operator and X-ray source.

EMO4672

Radiation exposure, as occupational hazard, has received in the past few years more attention in both the scientific and public media. Although the increased incidence of solid cancer, leukemia and of radiation induced cataract in the community of physicians performing X-ray image-guided interventions has been already recognized, the impact of recent scientific data on invasive cardiologists developing brain tumor in the left hemisphere, was substantial. The explanation for this phenomenon may be simple: according to the conventional design of the angiography units, the physician's left side will be closer to the X-ray source and directly exposed to scattered radiation.

Minimally invasive, X-ray image-guided procedures are increasingly used in the field of Interventional Neuroradiology (INR), Radiology (IR), Cardiology (IC) and Orthopedic and Spine Surgery as an alternative to invasive surgical procedures. The procedures very often imply high radiation doses to patients and staff, exposing them to radiation-induced effects. Although the X-ray primarily affects the patient, the performing physicians and the assisting personnel should remain close to the patient thus close to primary X-ray source, being exposed to scattered radiation. On the other hand, contrary to the patients, interventionists have to face exposure day by day.

Physicians and other members of the interventional team (technicians, anesthetists) are affected mostly by inelastic scatter. This relates to the X-Ray beams scattered by the operation table and the body of the patient which have changed direction and also energy.

Radiation exposure in percutaneous vertebral augmentation procedures

Percutaneous vertebroplasty and kyphoplasty procedures belong to the most demanding image guided interventions in terms of radiation exposure of the performing physician, regardless of the imaging technique used (angiography unit, C-arm or CT-guided). The scientific data in the relevant literature has unanimously shown that the hands and the eyes of the performing physician were at highest exposed. The reason is many fold and related to the different segments of the procedure. During needle insertion the hands and arms of the physician may be directly irradiated and will also receive more elastic and inelastic scatter. Exposure will obviously increase with the number of levels treated and the penetration technique used (mono-lateral vs. bilateral needle insertion). This will conflict with two important factors of the radiation protection, namely having insufficient distance from the radiation source and the lack of adequate shielding due to the posture of the operator.

The radiation exposure during cement injection is very dependent on the technique and system used.

Practical measures to reduce radiation exposure

Reducing the staff exposure can be achieved by considering very simple measures (ALARA principle: keeping exposure As Low As Reasonably Achievable) taking in consideration the three most important factors: time, shielding and distance.

- **Time.** Needle insertion does not require continuous fluoroscopy use. Navigation can be well based on anatomical landmarks of last image hold imaging, with short fluoroscopic scans while the physician can step away and hide behind shielding material. Needle advancement is performed "blindly" without compromising safety, technique, which in the same time, would allow minimizing fluoroscopy time. The use of pulsed fluoroscopy at low frame rate should be preferred. Cement injection has to be performed however with continuous fluoroscopic control to reduce cement injection related complications, like leakage into the spinal canal or into the venous system causing pulmonary embolism. During the procedure limited number of images should be acquired and only for documentation and diagnostic purposes.

- **Shielding.** The size of the field of view should be limited by using the collimation to visualize only the region of interest. The staff should be protected by wearing the adequate protective gears: well fitted protective apron, thyroid collar and glasses. The collective protective equipment such as table curtain under the table, protective screen attached to the ceiling should be systematically used and special care has to be taken for positioning it correctly.

- **Distance** from the X-ray source is one of the most important parameter for both patient and staff protection. According to the inverse square law radiation intensity is inversely proportional to the square of the distance from the source, which means increasing the distance will exponentially decrease radiation. In practice for the patient the tube should be as far as possible and the image receptor as close as possible. The staff should stay as distant from the patient and from the tube as possible.

Technical solutions for exposure reduction

Since the development of percutaneous cement augmentation techniques, namely vertebroplasty and later on kyphoplasty, the cement injection method has also gone through important changes, from manual injection with 1 ml, pressure resistant syringes, through bone filler cannulas designed to deliver cement with higher pressure to more complex hand injection guns. The advantage of the direct cement injection techniques, like the 1 ml syringes and bone fillers is twofold. The injection control is one-to-one since the operator senses and controls directly the speed and pressure of injection. This technique is also very efficient with very viscous cements, because very high pressures can be exerted, reaching 1000-1200 PSI. In case of beginning cement leakage, injection can be stopped without pressure related energy being stored in the injection system. The stored energy may cause continuing cement delivery also after injection has been stopped. The major and outmost important drawback of this injection technique is the above described immense radiation exposure of the operator.

To reduce exposure during cement delivery requires increase of distance between the operator and the inserted needle, to benefit from the inverse square law, and to allow positioning of shielding material between patient and physician. The challenges of such technical solutions are the ability of delivering high pressures in flexible and long enough tubes, without storing pressure related energy in the system. These methods should also be able to allow for controlled cement delivery and for immediate pressure release in case of inadvertent cement flow patterns.

One of the recently developed cement injection systems which answers the requirements of a distant injection is the Kyphon® Cement Delivery System (CDSTM). The Kyphon® CDS TM is composed of a handgun, of a 120 cm long flexible, pressure resistant tubing and of two 8ml cement cartridges (Fig 1). The injection is controlled though the lever and through a pressure release button of the handgun. The handgun is connected through the flexible tubing to the cement cartridge, which is directly luer-lock adapted to the cement delivery cannula. The handgun will deliver with each full squeeze of the lever 0.2 ml of cement, small enough amount to allow for cement flow control. The pressure release button will eliminate pressure from the system in one instance. The 120 cm long, flexible connection tubing has a twofold advantage. Through the length it will allow the operator to get distant from the needle, but also to have effective shielding material between the patient and the physician (Fig.2). According to data published in the relevant scientific literature, up to 80% of radiation reduction can be achieved with the use of distant injection as compared to direct hand injections. According to our own measurements with the real-time dosimetry system Dose Aware®, the radiation exposure could be further reduced by a factor of ten, when using effective shielding techniques.

Conclusions

Radiation exposure of interventionists using X-ray image guided techniques is increasing due to the evolution of minimally invasive techniques. Besides the protection of patients from abusing of X-ray in diagnostics and therapy, the interventionists and staff should also recognize the hazards related to their own radiation exposure. Therefore radiation protection of all means has major importance. In percutaneous vertebral cement augmentation techniques, the increased distance from the needle and the interposition of effective shielding tools will allow to major reduction in radiation exposure.

MICHELSON TECHNOLOGY AT WORK

Don't miss it !
Abdominal aorta
Lecture Session
Sunday, September 27, 08:30-09:30
Auditorium 2

IDEAS 2015

Debate on infrarenal AAA: A fit 65-year-old with AAA suitable for EVAR should not undergo open surgery

Michiel de Haan (EBIR)

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Prof. de Haan is a professor of interventional radiology at the Maastricht University Medical Center. He received his M.D. at the University of Leiden in 1986. After a three-year period as surgical resident in The Hague, Prof. de Haan completed his residence in radiology at the University of Maastricht, before completing a fellowship in interventional radiology at the University of Leuven (Belgium). Prof. de Haan returned to Maastricht, where he became the Head of the Department of Interventional Radiology. He is a committee member of the Dutch Society of Interventional Radiology. His interests include advanced endovascular repair techniques in complex thoraco-abdominal aneurysms, interventions in critical limb ischaemia and non-invasive vascular imaging.

Abdominal aortic aneurysms (AAAs) are common in the Western world, carrying a significant risk of rupture when having grown beyond 5.0–5.5 cm in diameter. Ruptured aneurysms have a >50% mortality rate, accounting for 2% of all male deaths over 55 years of age. Elective surgical repair of AAA aims to prevent death from rupture.

Repair of AAA has traditionally been surgical, involving clamping the aorta above and below the aneurysm and graft interposition, thus excluding it from the circulation. This so-called open repair (OR) carries a 1-8% postoperative mortality and major complication rate of 15-30% [1]. The morbidity and mortality rates increase substantially in elderly patients and in those with pulmonary, cardiac and/or renal comorbidities.

Endovascular aneurysm repair (EVAR) was introduced into clinical practice in the 1990s. The aneurysmal sac is excluded from the circulation by placing an endograft under fluoroscopic guidance, which involves only small incisions of the groin to access the femoral arteries. Compared to open repair, EVAR causes less surgical trauma, does not require cross-clamping of the aorta, and reduces perioperative analgesia requirements. EVAR is safe and can be successfully performed in patients with suitable anatomies (Fig. 1).

Since its introduction, EVAR has during the past decades gained popularity as a minimally invasive alternative to open repair. It has become a well-accepted technique, with a significantly lower short-term mortality compared with that for open surgery. The randomised controlled UK EVAR and Dutch DREAM trials showed a 2.5-fold reduction in surgical 30-day mortality following EVAR: 4.6% vs. 1.2% in the open vs. EVAR group, respectively, for the DREAM trail; 4.7% vs. 1.7% in the open vs. endovascular group, respectively, in the EVAR 1 trial [2-4]. A recent Medicare population study using administrative data from 45,000 Medicare beneficiaries undergoing elective EVAR in the US showed a 1.2% 30-day mortality rate with EVAR, and 4.8% with open surgery. This survival benefit applied particularly to older patients [5]. In a very recent study, however, it was demonstrated that the endovascular approach was associated with reduced perioperative mortality and major complications even in male patients at low risk for OR [6].

The advantages of EVAR in terms of short-term mortality reportedly do not persist over time. Intention-to-treat analyses found no difference in all-cause mortality at intermediate and long-term follow-up between the two treatment options. The early benefit from EVAR is annulled by the number of late deaths from cardiac and other unrelated causes. The EVAR and DREAM trials showed similar overall survival rates for open and endovascular repair after two years [7]. The long-term outcome of the DREAM trial showed similar results for OR and EVAR six years after randomisation, with a cumulative survival rate of 69.9% and 68.9%, respectively [8] (Fig. 2). In a propensity score-matched analysis of 45,660 Medicare patients undergoing open repair and EVAR, the early benefit from EVAR persisted for more than three years, after which the survival rates for both procedures were similar [5].However, for this patient population with reported 5-year mortality rates of 30% or higher, the short-term benefits may be highly relevant, even if not maintained in the period thereafter.

Earlier trials reported a significantly higher incidence of additional interventions for procedure-related complications in participants undergoing EVAR compared with those receiving open surgical repair. The incidence of endograft-related complications has been reported to be as high as 25%, the vast majority of which involve type-II endoleaks [1]. Between 50 to 80% of these endoleaks resolve spontaneously over time. A minority persists and may cause concern, especially when associated with sac enlargement. The majority of the subsequent transarterial and/or translumbar interventions entail relatively low morbidity. Although the Medicare analysis confirmed the higher late re-intervention rate related to abdominal aortic aneurysm in the EVAR group compared to OR (9.0% vs. 1.7%), this was balanced by an increase in laparotomy-related re-interventions and hospitalisations after open repair [5].

Many of the patients in the initial, randomised studies received a first- or second-generation endovascular device. A majority of these devices have been partly or fully modified on the basis of identified imperfections, or have been withdrawn from the market. With the current third- and fourth-generation endovascular devices, the repair-associated morbidity and aneurysm-related and all-cause peri-operative mortality are likely to diminish in comparison with open surgical repair. In addition, there is growing evidence that endograft complications are related to aortic morphology rather than comorbidity or physiology [9]. These data show a significant increase in graft and/or procedure-related mortality in patients with adverse anatomy. Especially the aortic neck angulation has shown to be an important determinant in the outcome of EVAR [10]. Moderate (400-590) or severe (≥600) neck angulation was associated with an increased risk of adverse events, i.e. death, conversion, type-I endoleaks, and graft migration despite an adequate neck length.

Based on modern three-dimensional imaging techniques, several anatomic grading scores have been suggested for assessing the risk of developing endograft-related complications pre-operatively [11, 12]. This makes it possible to prevent complications. Furthermore, this individual pre-operative assessment is in line with the increasing importance of the role of the patient in the decision-making process and patient-clinician agreement on treatment pathways. Patient preferences were evaluated in several studies, showing an overall strong preference for EVAR over open repair [13, 14]. The results of these studies support the trend toward offering EVAR to patients in whom this procedure is technically feasible.

The higher incidence of late complications has resulted in the consensus that surveillance following EVAR is mandatory. The standard surveillance protocols for EVAR patients are derived from the early trials and include serial CTA and plain abdominal radiographs at 1, 6 and 12 months, and yearly thereafter, representing a third of the total costs of EVAR in a 5-year follow-up period. Not only concerns about costs, but also discussions on the (limited) clinically relevant results, cumulative radiation exposure and contrast nephrotoxicity have prompted initiatives to redefine follow-up strategies. Several protocols have been suggested, the majority of which include risk stratification based on pre- or post-procedural CTA and serial Duplex ultrasound and plain abdominal X-rays [15]. These adjusted protocols will not only simplify follow-up but also reduce costs considerably.

Not surprisingly, endovascular repair has become a mainstay in the treatment of abdominal aortic aneurysms, accounting for over 60% (and counting…) of elective repairs. Therefore, in this endovascular era, a fit 65-year-old patient with EVAR-suitable AAA should be treated by endovascular means.

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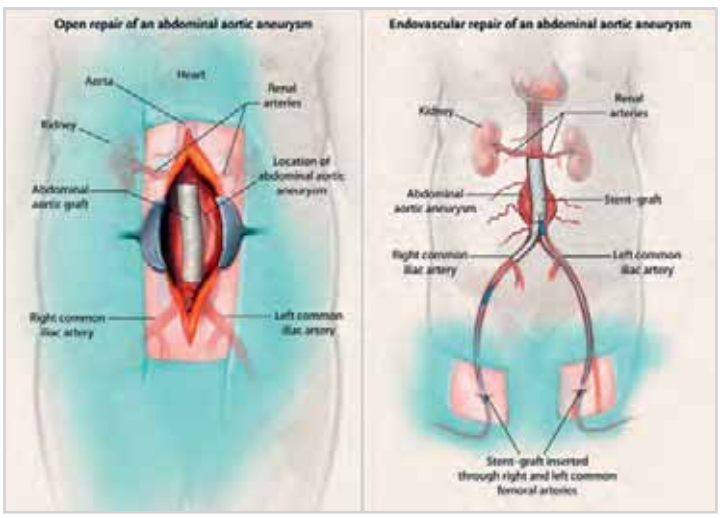

Fig. 1: Open vs. endovascular repair for AAA

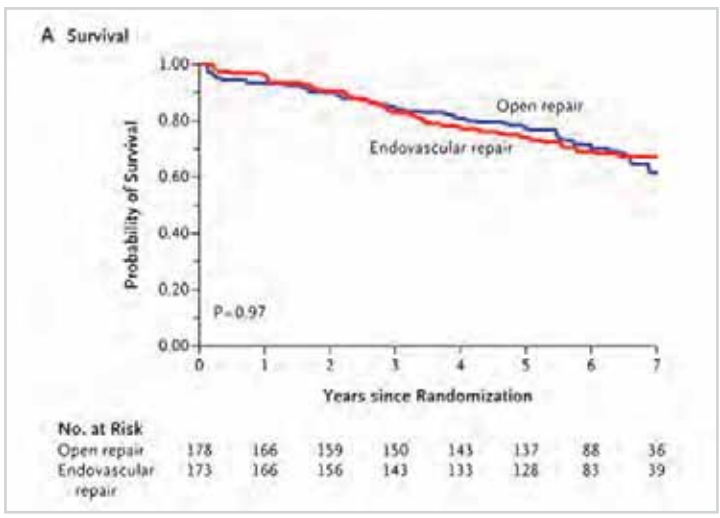

Fig. 2: Long-term outcomes of the DREAM trial

IDEAS 2015

Debate on infrarenal AAA: A fit 65-year-old with AAA suitable for EVAR should undergo open surgery

Luca di Marzo

Don't miss it !
Abdominal aorta
Lecture Session
Sunday, September 27, 08:30-09:30
Auditorium 2

Abdominal aortic aneurysm (AAA) is a disease that affects 4-7% of adults over the age of 65, with a higher prevalence in white males. Nearly 180,000 people in Europe are diagnosed with AAA annually, and approximately 15,000 patients die each year from a ruptured AAA.

Most AAAs are never detected because approximately 70% to 80% of AAA patients are asymptomatic at initial diagnosis. Therefore, AAA is generally discovered inadvertently during procedures conducted to diagnose unrelated medical conditions.

Since its first introduction in 1952 by Dubost and colleagues, open aneurysm repair (OAR) was the gold standard for the treatment of AAA for almost 40 years. Even though this surgical option has undergone many improvements in technique and postoperative care, in 1991 Parodi introduced a new procedure for the treatment of infrarenal abdominal aortic aneurysm: endovascular aneurysm repair (EVAR).

Nowadays both methods of repair are available and deciding which to use involves the balancing of risks and benefits: the treating physician must take into account anatomic suitability for EVAR (up to 37% of all patients may not be suitable candidates for EVAR), the patient's life expectancy and, most of all, the patient's fitness.

Enthusiasm about the good early results achieved and about the less invasive nature of the EVAR technique compared to conventional surgical repair has led to the proliferation of studies reporting its clinical feasibility and benefits.

In reality, however, risk evaluation is essential for the choice of individual therapy: patient selection in terms of anatomical suitability has emerged as the most important factor related to successful EVAR, and patient fitness should be assessed before open surgery, using available scoring systems and classifications (the SVS / AAVS Comorbidity Severity Score of the Society for Vascular Surgery/ American Association for Vascular Surgery; the American Society of Anaesthesiologists Physical Status Classification Scale; and Eagle's Vascular Surgery Low Risk Clinical Markers).

Although the long-term durability (5-year survival of 70%) of open repair and its effectiveness in preventing rupture (risk of major morbidity or mortality, 5-10%) have been well documented, the complications associated with endovascular repair have become more frequent with its widespread use. One of the main concerns regarding EVAR is early (2 years) and mid-term (>4 years) technical failure.

The immediate benefits of EVAR – low early morbidity and mortality – are well-known. However, recent reports have raised some doubts about its clinical and economic benefits in young patients.

The long-term success of EVAR is one main concern, given the need for lifelong surveillance, secondary intervention, and the continued risk of aneurysmal rupture.

The most important studies comparing OAR with EVAR include a US trial (Open versus Endovascular Repair Veterans Affairs Cooperative Study [OVER]) and several European trials and a registry (UK Endovascular versus Open Repair of Abdominal Aortic Aneurysm Trial [EVAR Trial], Dutch Randomized Endovascular Aneurysm Management Trial [DREAM], and European Collaborators on Stent Graft Techniques for Abdominal Aortic Aneurysm Repair Registry [EUROSTAR]).

The main findings of these studies are:

A. the necessity of careful long-term surveillance of patients who underwent EVAR with first-generation devices;

B. the favourable postoperative outcome for EVAR compared to open repair, with less operative and 30-day mortality; and

C. similar survival rates in both groups at 2-year follow-up.

Moreover, in the EVAR Trial it was demonstrated that the advantage of endovascular repair diminished during long-term follow-up, with significant late death rates related to aneurysm rupture in these patients.

Furthermore, the overall re-intervention rate for graft-related complications is four times higher in patients who underwent EVAR than in those who underwent open aneurysm repair (12-16% vs. 3-4%).

The literature emphasises the need for expensive, lifelong surveillance of these patients due to EVAR's complication rates (15-25% of endoleak, 7% of graft kinking, branch stenosis or thrombosis, 2.5 % of device migration and 1% of AAA rupture) and the high incidence of late secondary interventions. Because of this, even if the immediate hospital stay costs are higher for the traditional technique, OAR is ultimately less expensive than EVAR.

We firmly believe that the patient's age alone is not the true cut-off for the treatment choice. In our opinion, each patient should be evaluated concerning his fitness, using proper scoring methods (SVS / AAVS Comorbidity Severity Score of the Society for Vascular Surgery/ American Association for Vascular Surgery; American Society of Anaesthesiologists Physical Status Classification Scale (ASA classes) and Eagle's Vascular Surgery Low Risk Clinical Markers).

In conclusion, taking into consideration his long life expectancy, a fit 65-year-old patient with AAA should undergo open surgery: the traditional technique is associated with a 10-year survival rate of 80%, and it entails a lower postoperative complication rate.

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MEDTRONIC SESSIONS
LET'S GO FURTHER, TOGETHER

Date: Monday, September 28, 2015
Time: 13:00-14:00
Room: Auditorium 6

FROM STRAIGHTFORWARD TO COMPLEX:

Review of IN.PACT™ Admiral™ DEB Evidence in Challenging Clinical Scenarios

Chairman and Moderator: D. Karnabatidis, Greece - P. Krishnan, US

- DCB Effectiveness in Long SFA Lesions: Results from IN.PACT Global Study and Imaging Cohort
G. Tepe, Germany

- DCB Effectiveness in Long SFA Lesions: Experience and Clinical Evidence from an Independent Study
A. Micari, Italy

- Beyond Long SFA Lesions: Do Current Results Encourage Further Expansion of Indications?
K. Katsanos, UK

- Success with DCB: Important Technical Considerations
P. Krishnan, US

- Open discussion and take home messages

Date: Tuesday, September 29, 2015
Time: 13:00-14:00
Room: Auditorium 1

ENDOVASCULAR TRAUMA MANAGEMENT AND ENDOLEAK MANAGEMENT

Chairman and Moderator: MD PhD. J. Urbano, Spain

- Endovascular Trauma Management
T. Horer, Sweden

- Embolization in Emergency Settings, How to Treat?
G. Carrafiello, Italy

- Endoleak Type I and II Management
R. Morgan, UK

Medtronic

IDEAS 2015

Type B Dissection

Eric Ducasse

Don't miss it !
Aortic dissection
Lecture Session
Sunday, September 27, 10:00-11:00
Auditorium 2

The incidence of aortic dissection averages 4 in 100,000 people. Three stages of aortic dissections have been identified: acute (<14 days from the onset of symptoms), sub-acute (15-90 days, patients may still develop complications but the aorta may also remodel itself) and chronic (>90 days, with a risk of aneurysmal degeneration).

The DeBakey [1] and the Stanford [2] classifications categorise the dissections of the ascending and the descending aorta as shown in Table I. Type B dissections (TBD) involve only the descending aorta, and have come to be of great interest over the past years. With endovascular techniques assuming a growing role in the management of this disease, the relevance of these classifications has been questioned by the Working Group on Aortic Diseases in the DEFINE Project. Dake introduced the DISSECT classification system featuring the specific anatomic and clinical manifestations of the disease process that are most relevant to contemporary decision-making: **d**uration of disease, **i**ntimal tear location, **s**ize of the dissected aorta, **s**egmental **e**xtent of aortic involvement, clinical **c**omplications of the dissection, and **t**hrombus within the aortic false lumen [3].

Today, most uncomplicated acute TBD are managed medically, with a mortality rate of 10%, and the need for surgery in 25% at 4 years [4, 5]. The morbidity is significant, with a 10% incidence of mesenteric ischaemia, 21% of acute renal failure, 4.7% of limb ischaemia and 8.5% of spinal cord ischaemia. This is mostly due to dynamic malperfusion and, to a lesser extent, static malperfusion. As a matter of fact, in the INSTEAD trial, thoracic endovascular aortic repair (TEVAR) showed no clinical benefit over medical therapy at two years, with survival rates of 89% vs. 96% ($p = 0.15$), respectively. However, TEVAR seemed effective for aortic remodeling, with 91% vs. 19% ($p < 0.001$), respectively [6]. But the INSTEAD XL trial, providing extended results of the same cohort, showed significant results in favour of TEVAR at 5 years, with an aorta-related mortality of 6.9 vs. 19.3% ($p = 0.04$) and disease progression of 27.0 vs. 46.1% ($p = 0.04$) [7].

Despite these results, surgical treatment is still often reserved for complicated TBD, presenting with rupture, visceral malperfusion, limb ischaemia, spinal cord ischaemia, rapidly expanding false lumen (FL), refractory pain or hypertension.

Endovascular techniques have emerged as promising alternatives to open surgery, with lower 30-day mortality rates (4.2% vs. 17.8%; $p < 0.001$), shorter length of hospitalisation ($p = 0.001$), higher mid-term survival rate (76% vs. 92% at 1 year, 73% vs. 86% at 2 years, 71% vs. 82% at 3 years, and 68% vs. 79% at 4 years), less post-operative respiratory failure ($p = 0.022$), and fewer access site complications ($p = 0.008$)[8] making aortic dissection the second-most common investigational application of thoracic stent-graft technology [9-12].

The first procedures were performed with "off-label" devices, initially designed for the treatment of aneurysms. Unfavourable consequences such as retrograde dissection, device-induced new-entry tear and stent graft infolding were observed, leading to the development of dedicated material and the diminution of the oversizing.

Clinical indications for endovascular treatment of TBD include: persistent refractory pain, resistant hypertension, peri-aortic haematoma, evidence of clinical manifest dynamic malperfusion or radiologic evidence of true lumen (TL) collapse, transaortic growth ≥10 mm within 3 months, and transaortic diameter ≥40 mm. To be eligible for the dedicated devices, certain anatomic criteria have to be met: primary entry tear >20 mm below the left subclavian artery and >20 mm above the celiac trunk, proximal and distal landing zone diameters for stent graft and bare stent (measured from outer wall to outer wall on a sectional image) >24 mm and <38 mm.

The STABLE trial showed that TEVAR is an effective way of treating complicated acute TBD, with 77% of patients treated for impending rupture or malperfusion, and only a 5% 30-day mortality rate, 12.5% of renal events and 7.5% of retrograde aortic dissection [13]. The endovascular stent-graft repair strives to seal the entry tears while avoiding coverage of more than 20 cm of aorta, to lower the risk of spinal cord ischaemia [14]. However, even after successful thoracic stent-graft sealing of the entry tear, the distal abdominal aorta fails to remodel in 50% to 80% of cases [15]. It is strongly suspected that distal re-entry sites between the TL and FL associated with the flapping motion of the lamella prevent FL thrombosis. Sustained FL flow and pressurisation exposes patients to increased risks of progression of the dissection and organ malperfusion, as well as late aneurysmal degeneration and rupture [16-19]. To promote TL expansion and FL thrombosis, extended bare stent scaffolding of the dissection beyond the stent-graft and down to the distal aorta has been developed. It helps to reposition and fixate the distal lamella, along with preserving blood flow to all abdominal side branches. The first report of an adjunctive measure to a primary stent-graft insertion was made by Mossop et al. in 2005 [20]. A year later, Nienaber et al. reported a series of staged procedures with provisional stent-graft extension by distal bare metal stents and introduced it as the PETTICOAT technique (Provisional ExTension To Induce COmplete ATtachment).

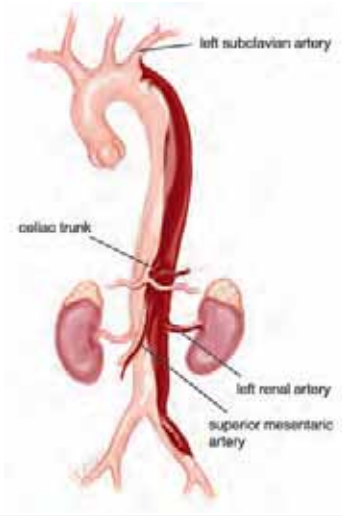
In the literature, successful entry closure was possible in 85-100% of cases. Since most primary entry tears begin immediately distal to the left subclavian artery, intentional coverage of its origin with expectant management was commonly used. Successful entry tear coverage induced complete or partial FL thrombosis in 85 to 100% of patients. A significant immediate increase (98%) in the TL volume was achieved in both the thoracic (115%) and abdominal aorta (63%) with immediate postoperative resolution of all cases of dynamic malperfusion and TL collapse. Retrograde dissection was observed in 5% of cases. Progressive remodeling of TL (increase of 131% at 1 year and 140% at 2 years) was recorded over time, with reduction of the FL volume mainly in the thoracic segment (35% at 1 year and 38% at 2 years) [22].

However, some studies report up to 35% of FL expansion during follow-up, despite successful entry tear coverage [23]. FL perfusion and absence of aortic remodeling are associated with extremely high mortality rates [24]. Solutions consisting of the occlusion of the FL in expansion have been proposed, such as the "cork in the bottleneck" [25] (with coils and occluders but limited to a 24 mm diameter), the "candy plug technique" [26] (with a thoracic endograft ligated on its middle and a plug) or the "knickerbocker technique" [27] (with a compliant thoracic graft more inflated in its mid portion). The hypothesis is that the separation of the FL compartments will result in FL thrombosis. Moreover, it does not restrict further distal techniques like fenestrated EVAR. The primary results are promising and their future role still has to be defined.

Initial results are encouraging. TEVAR should be the treatment of choice for acute complicated TBD with dynamic obstruction. Moreover, in acute and sub-acute uncomplicated TBD, TEVAR appears to have long term benefits for aortic remodeling and reduces aorta-specific mortality. The PETTICOAT technique appears to be feasible and safe, with no risk to side branches fed from either the TL or FL, and could be beneficial to improve aortic remodeling of both TL and FL in the thoracic and abdominal aorta. Unfortunately, the literature often mixes outcomes from applications in different clinical contexts in terms of age of dissection, extent of disease, and presence of complications. Most techniques proposed in this field are still new and further follow up is still needed to assess the efficacy and proper role of each of them in daily practice.

Table 1: The DeBakey and Stanford Classification Systems of Aortic Dissection [1,2]

	Type	Characteristic
DeBakey (1965)	*I*	*Originates in the ascending aorta, but extends distally and involves the descending aorta*
	II	*Originates in and is confined to the ascending aorta*
	III	*Originates in and involves the descending aorta*
Stanford (1970)	*A*	*Involves the ascending aorta irrespective of the site of origin*
	B	*Involves the descending aorta exclusively*



Eric Ducasse
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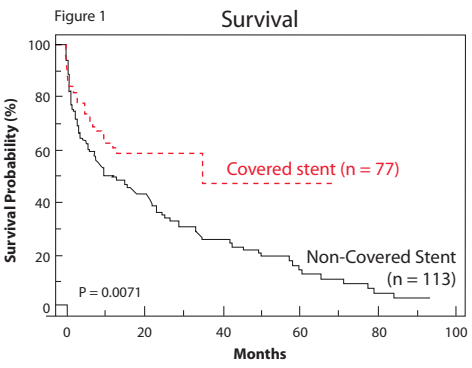
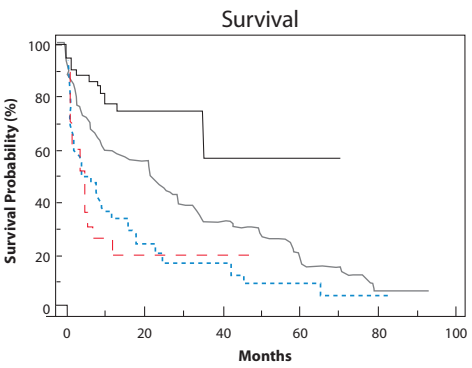
Unmatched Data, Unsurpassed Patency and Superior TIPS Performance

Figure 1



Survival after TIPS placement for refractory ascites: covered versus non-covered stent. The overall survival is significantly better in the cs-TIPS patients (p = 0.0071)[2]



Survival according Child-Pugh and MELD scores system after TIPS placement for refractory ascites. The survival gain in favour of covered stent occurred in the group of patients with MELD score < 16 (p < 0.0001)[2]

MELD < 16 in Covered stent (n = 54)
MELD < 16 in Non-covered stent (n = 70)
MELD > 16 in Covered stent (n = 23)
MELD > 16 in Non-covered stent (n = 43)

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GORE® VIATORR® TIPS Endoprosthesis Compared to Bare Metal Stents

In a randomized prospective trial, Bureau, *et al.*, found the actuarial rates of primary patency in the GORE® VIATORR® Device group and bare metal stent group were 76% and 36%, respectively, at 2 years ($p = 0.001$ – log-rank test)[1].

In a retrospective analysis of cirrhotic patients with refractory ascites, Maleux, *et al.*, found that TIPS using the GORE® VIATORR® Device offers better symptomatic control of the ascites at one year follow-up and a better overall survival, compared to bare metal stents [2]. (Figure 1)

GORE® VIATORR® TIPS Endprosthesis Compared to Endoscopic Band Ligation (EBL)

In a randomized, controlled clinical trial with TIPS performed within 72 hours after diagnostic endoscopy and a 1-year follow up, results demonstrated an 86% actuarial survival in the early-TIPS group versus 61% in the pharmacotherapy – EBL group ($p < 0.001$)[3]. The 1-year actuarial probability of remaining free of failure to control bleeding and of variceal rebleeding was significantly higher in the early-TIPS group than in the pharmacotherapy – EBL group (97% vs. 50%; absolute risk reduction, 47 percentage points; 95% confidence interval [CI], 25 to 69; number needed to treat, 2.1 patients; 95% CI, 1.4 to 4.0).

The conclusion was that patients with cirrhosis who were hospitalized for acute variceal bleeding and at high risk for treatment failure, the early use of TIPS was associated with significant reduction in treatment failure and in mortality.

TIPS Compared to Large Volume Paracentesis (LVP)

Although randomized comparisons of the GORE® VIATORR® Device vs. LVP are in progress, data from bare metal stents provide evidence of the effectiveness of the TIPS procedure compared to continued LVP in ascites patients. In a meta-analysis of individual patient data, it was reported that bare metal stent – TIPS significantly improves transplant-free survival of cirrhotic patients with refractory ascites[4]. The cumulative probability of developing the first episode of hepatic encephalopathy (HE) was similar between the groups ($p = .19$).

Figure 2

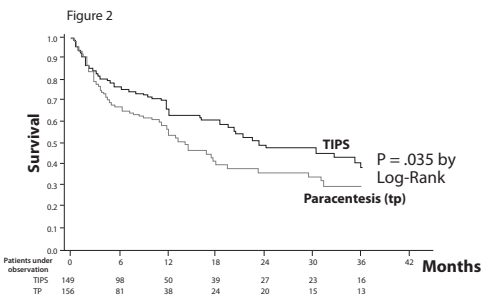

Figure 2 Cumulative Probability of Transplant-Free Survival According to Treatment with TIPS or Total Paracentesis[4]

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The average transplant-free survival at 12, 24 and 36 months of follow-up was 63.1%, 49% and 38.1% for patients allocated in the BMS-TIPS group and 52.5%, 35.2% and 28.7% for patients allocated to large volume paracentesis (LVP), respectively. (Figure 2)

Health Economic Benefits

Bureau *et al.* reported that TIPS with bare metal stents has been less cost effective than other procedures. This is mainly owing to the monitoring and the revisions required to maintain shunt patency. It has been shown that the use of covered stents could result in cost reduction because of decreased clinical relapses and decreased need for shunt revisions[1].

TIPS is a safe intervention that reduces the need for LVP. Careful calibration allows satisfactory relief of ascites with a low incidence of HE. It has been demonstrated that extremely low complication rates and exceptionally high patency rates can be achieved with the use of GORE® VIATORR® TIPS Endoprosthesis. In the United Kingdom, health economic data favoured TIPS with a cost of £500 per month of patient follow-up for TIPS and £3,500 per month of patient follow-up for paracentesis. Careful patient selection for this procedure has demonstrated significant health economic benefit in favour of a dedicated TIPS endoprosthesis [5].

Conclusion

A large body of published data demonstrate numerous clinical advantages of GORE® VIATORR® TIPS Endoprosthesis in treatment of patients with refractory ascites and variceal bleeding. Furthermore, GORE® VIATORR® TIPS Endoprosthesis may be associated with decreased patient-care costs compared to other therapies. Considering these results, the role of GORE® VIATORR® TIPS Endoprosthesis in the management of portal hypertension should be considered. The improvement of TIPS patency by using ePTFE-covered stents is maintained over time with a decreased risk of hepatic encephalopathy and a decreased risk of death. Furthermore, data demonstrate the clinical advantage of GORE® VIATORR® TIPS Endoprosthesis in treatment of patients with variceal bleeding and refractory ascites. Finally, GORE® VIATORR® TIPS Endoprosthesis has demonstrated a decrease in associated patient-care costs. Considering these results, the role of GORE® VIATORR® TIPS Endoprosthesis in the management of portal hypertension should be considered.

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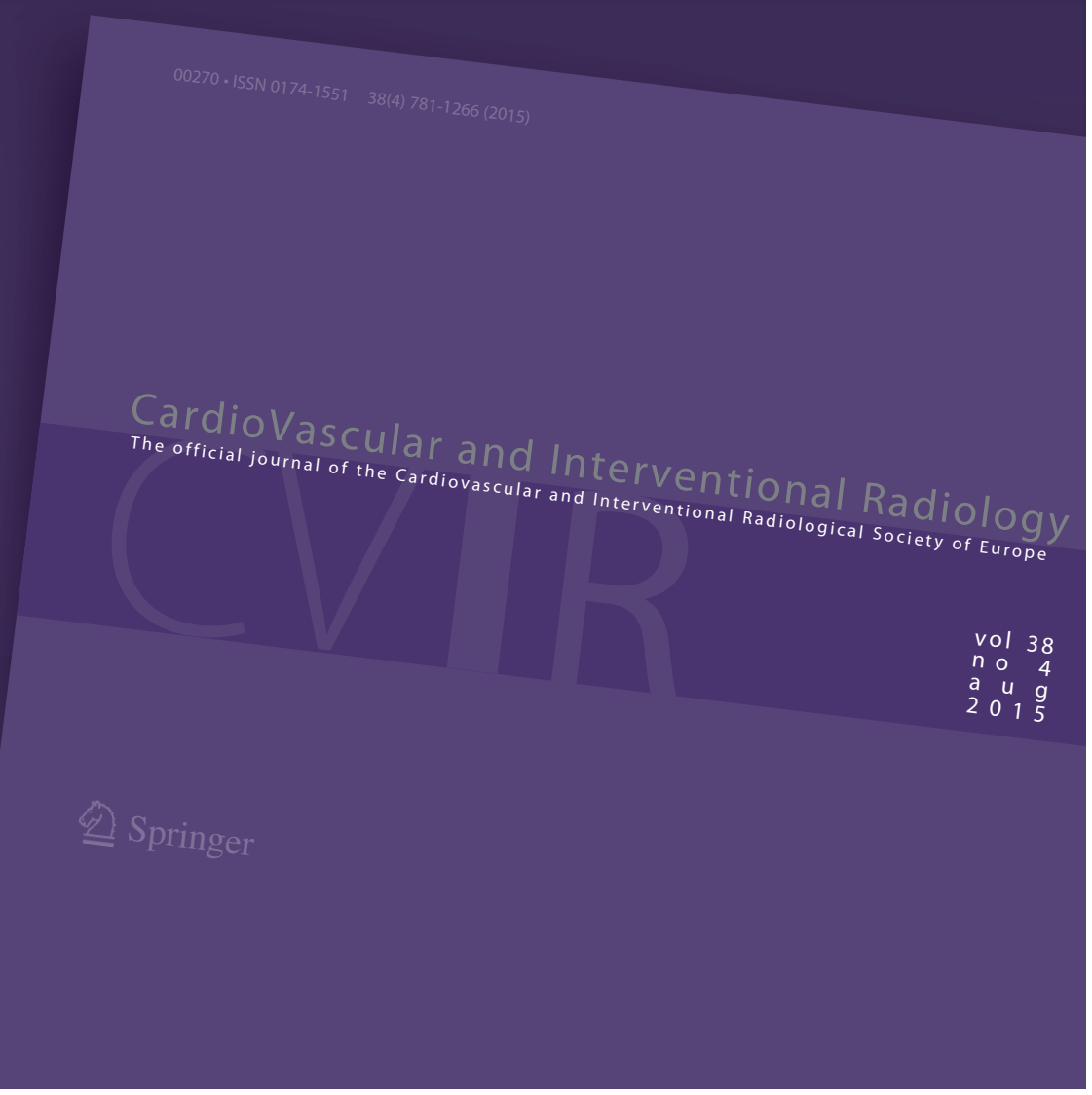

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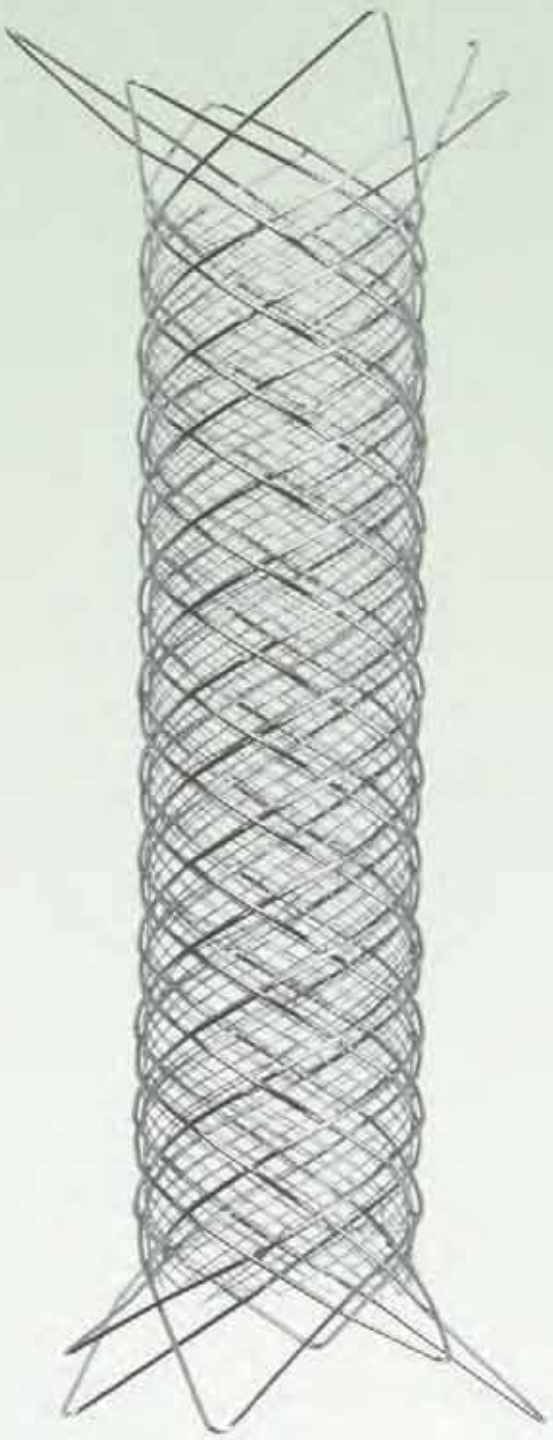

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