How To Reduce/Prevent Iodinated Contrast during AAA Repair

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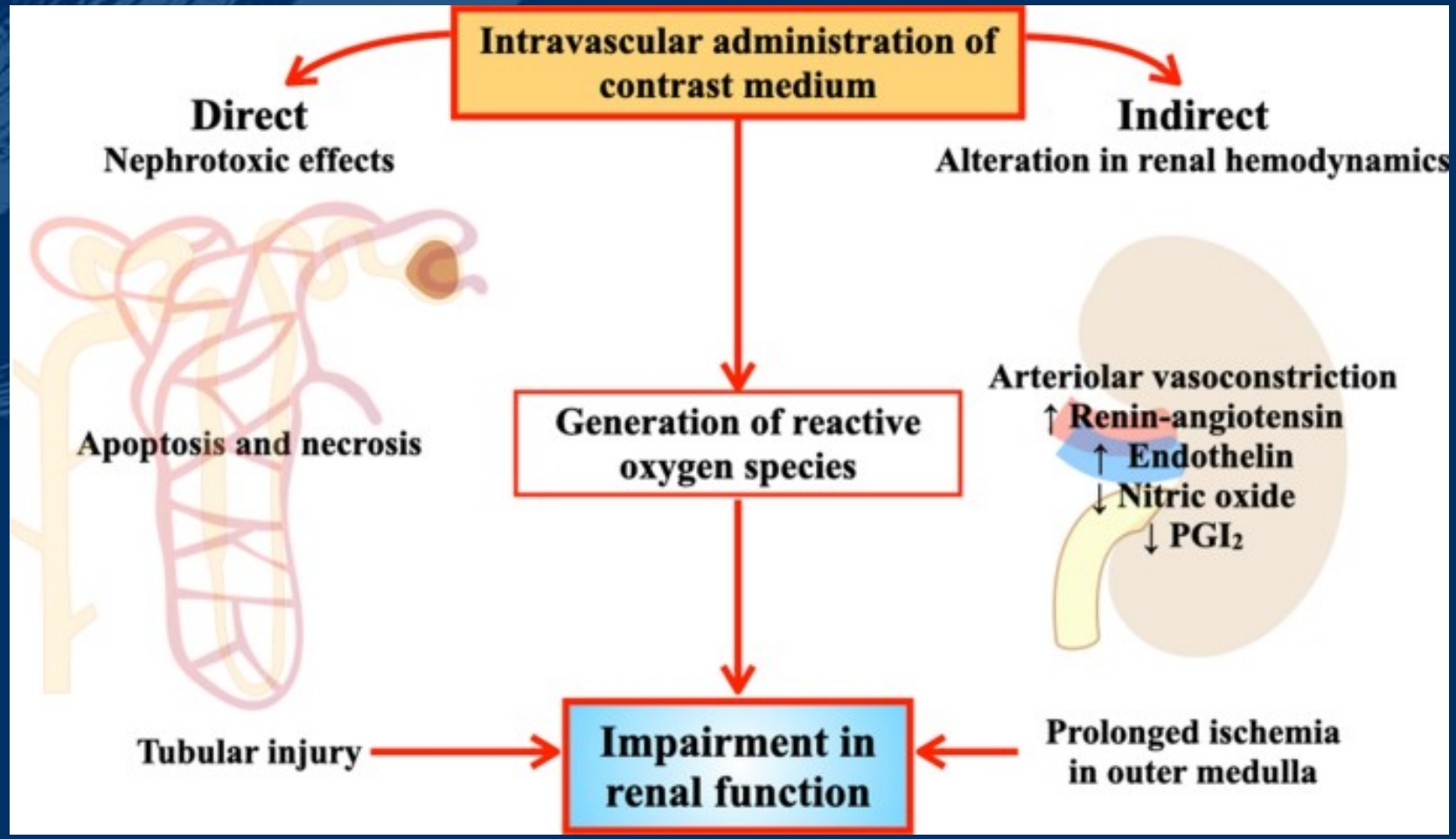
Common problem facing endovascular interventionists



Abdominal aortic aneurysm repair

Contemporary management of AAA

- Depends largely on endovascular interventions (EVAR)
- Planning requires CT Aortography using 150ml of contrast
- Contrast use during the intervention may exceed 200-300 ml
- Follow up CTAs!!!

Renal impairment!

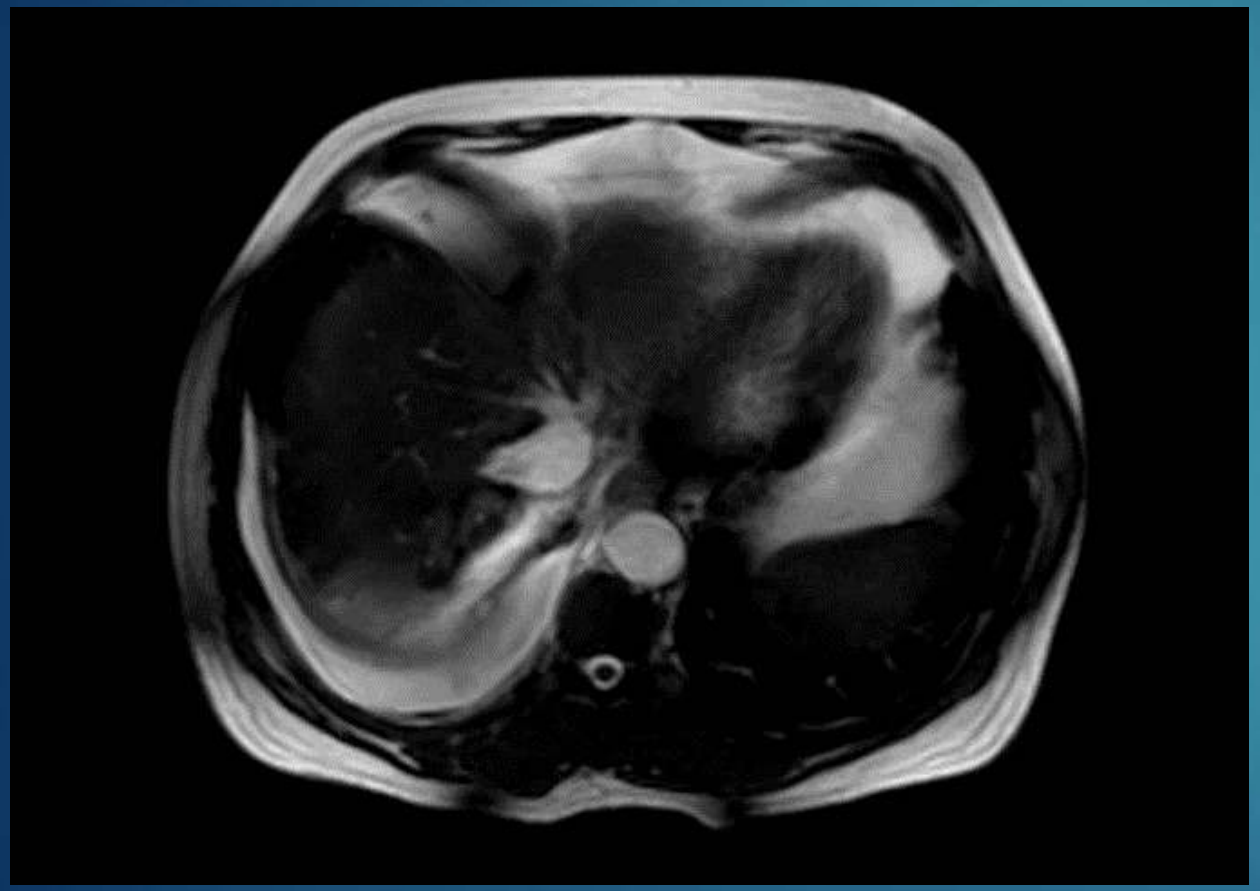
Go to open surgery whenever feasible.

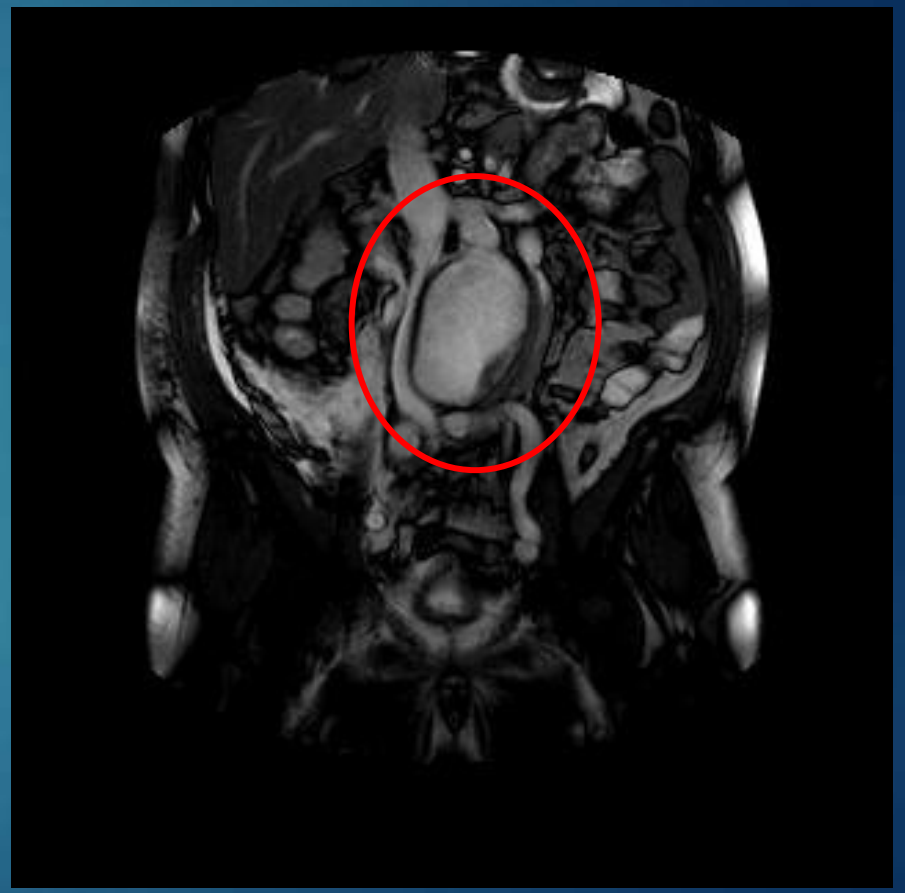
Case scenario

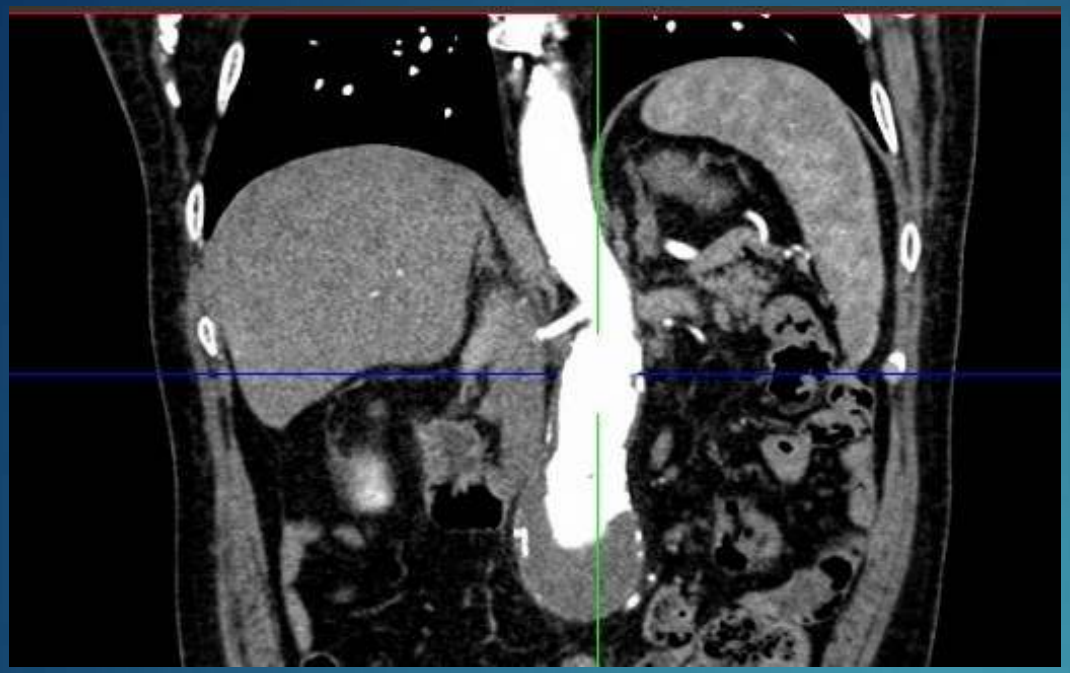
- **58 yr old DM**
- **Obstructive uropathy from an 8cm diameter AAA by U/S**
- **Ureteric stents inserted**
- **3 hemodialysis sessions**
- **But serum Cr: 3.5 mg/dl**
- **Dilated cardiomyopathy**

1. Modality to reduce/prevent CM

MRA without contrast

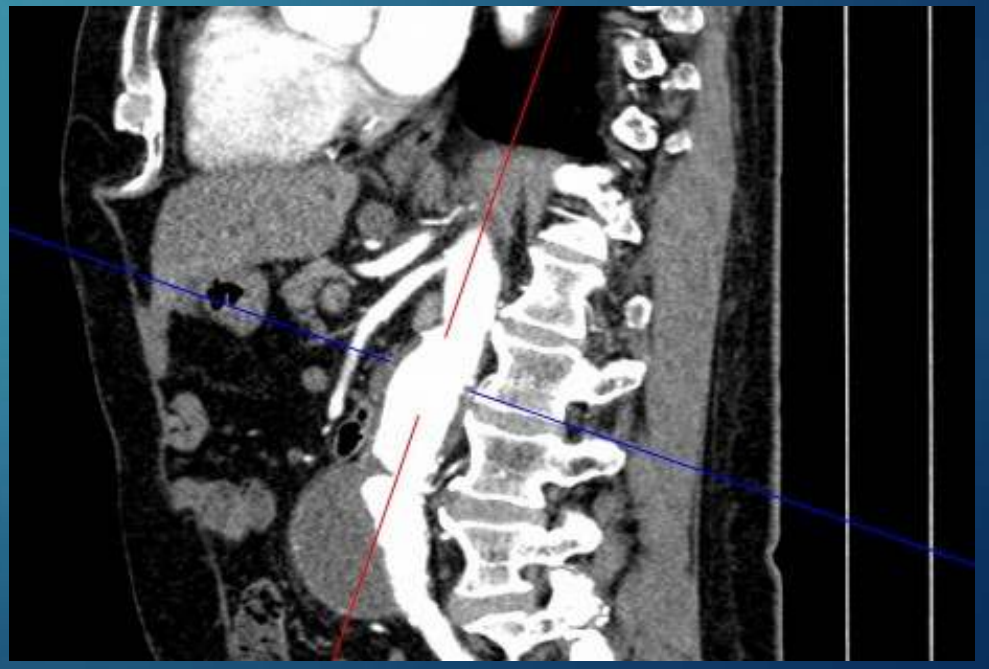


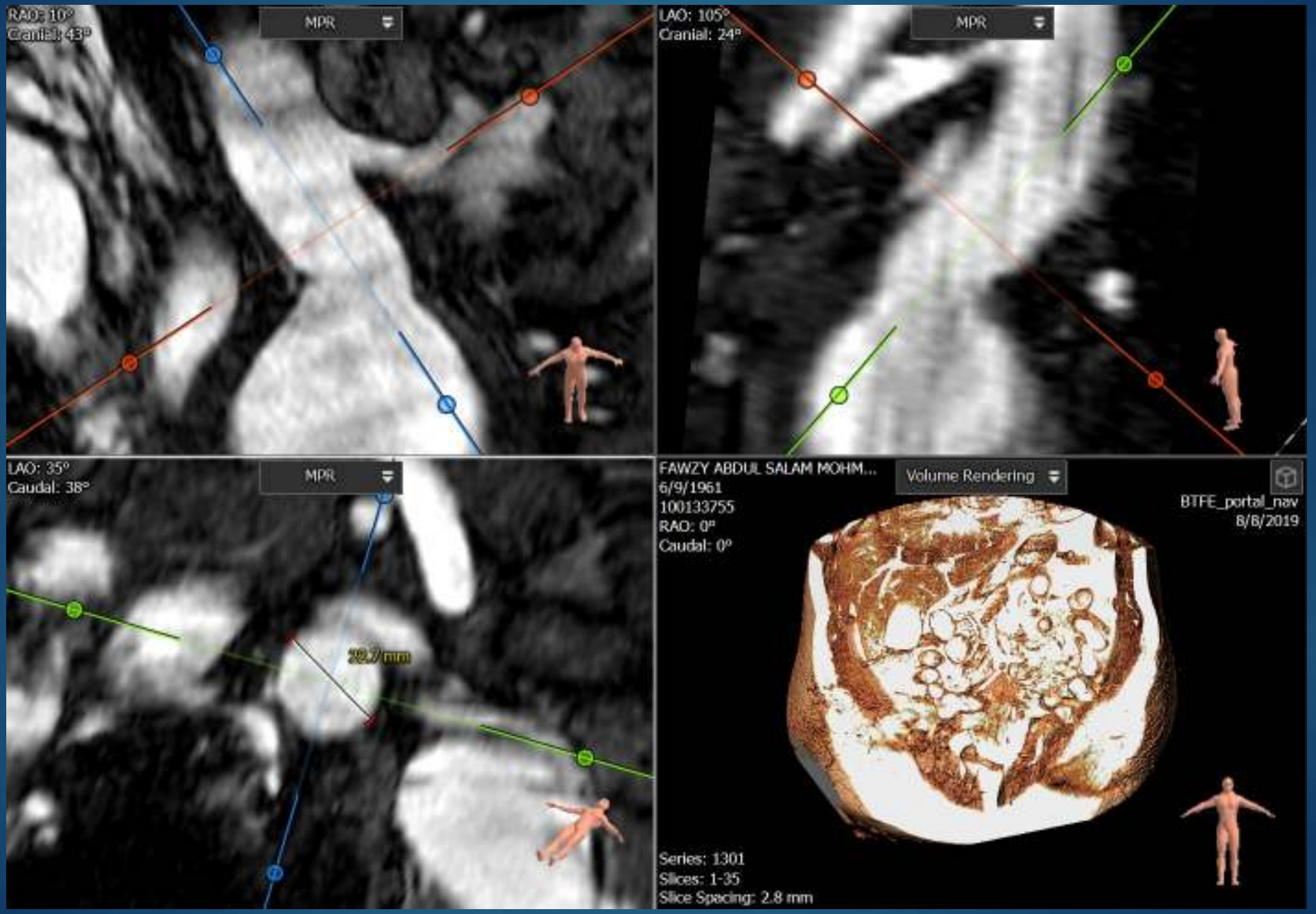


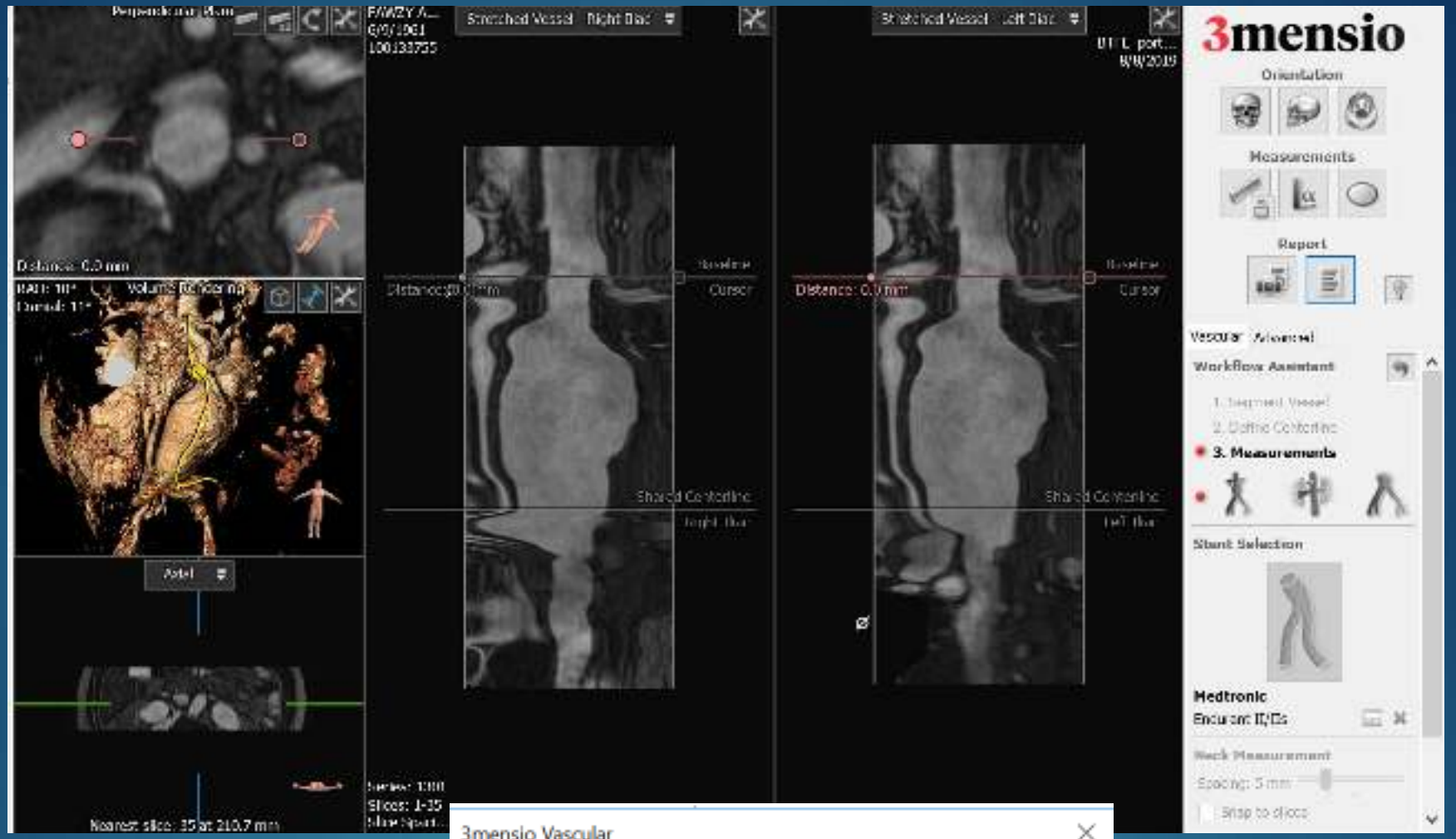


Planning for EVAR CT Aortography

- FROM THORAX TO PELVIS
- 1 MM CUTS
- MORE THAN 64 MSCT
- 150 ML OF CONTRAST MEDIUM




RAO: 10°
Cranial: 43°
MPR
LAO: 105°
Cranial: 24°
MPR
LAO: 35°
Caudal: 38°
MPR
22.7 mm
FAWZY ABDUL SALAM MOHM...
6/9/1961
100133755
RAO: 0°
Caudal: 0°
Volume Rendering
BTFE_portal_nav
8/8/2019
Series: 1301
Slices: 1-35
Slice Spacing: 2.8 mm


3mensio
Orientation
Measurements
Report
Vascular
Workflow Assistant
3. Measurements
Stent Selection
Medtronic
Distance: 0.0 mm
Stretched Vessel
Cursor
Shared Centerline
Axial
3mensio Vascular
3mensio Vascular is designed to handle CTA datasets.
For the current imaging modality results can be unexpected, or analysis may fail unexpectedly.
OK

Comparative Study > Acta Radiol. 2003 Mar;44(2):177-84. doi: 10.1034/j.1600-0455.2003.00029.x.

Measurements before endovascular repair of abdominal aortic aneurysms. MR imaging with MRA vs. angiography and CT

L Engellau [1], U Albrechtsson, N Dahlström, L Norgren, A Persson, E-M Larsson

Affiliations – collapse

Affiliation

1 Department of Radiology, Lund University Hospital, Lund, Sweden. lena.engellau@drad.lu.se

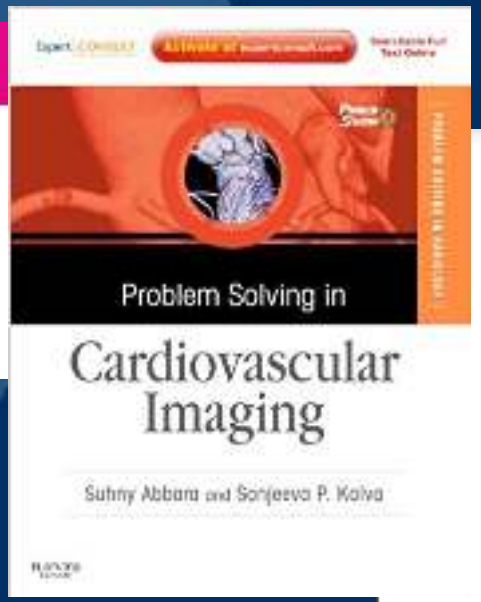
Results: Significantly shorter lengths were obtained with MRA-MIP than with DSA. Three out of six diameter measurements were significantly smaller on MRI/CE MRA than on DSA and CT. No significant differences were found between the observers. One diameter measurement was significantly smaller on MIP than on VRT, while the other measurements showed no significant differences.

Conclusion: The length measurements obtained with MRA-MIP were probably more correct than those with DSA. For more reliable diameter measurements with CE MRA, improvements of the technique, including VRT reconstructions and a standardized determination of the vessel boundaries, are needed.

CHAPTER 8

Magnetic Resonance Angiography: Technique

Constantine A. Raptis, Kathryn J. Fowler, and Vamsi R. Narra



… interest in noncontrast MRA has been renewed, mainly because of the identification of the relationship between Gadulinium and NSF.

Magnetic Resonance Angiography Data Postprocessing

Postprocessing is a core component of MRA interpretation and is essential for conveying results to referring clinicians, most of whom do not have the time to assess the source images carefully. In addition, many referral clinicians are more accustomed to viewing conventional angiography or CTA images and thus are more comfortable reviewing postprocessed MRA images than the source images themselves. Before reviewing the different postprocessing techniques, any abnormality detected on the postprocessed images should be confirmed on the source images.

Subtraction

Subtraction images are routine components of MRA examinations and often are automatically performed by the scanner software. To obtain subtraction images, a precontrast mask 3-D GRE sequence is obtained with the exact parameters that will be used in the postcontrast CE MRA images. The mask data set can subsequently be digitally subtracted from the postcontrast data set to remove background signal and greatly improve the contrast-to-noise ratio. For example, subtracting the mask from the arterial phase can produce an image set that depicts essentially only the arteries. To depict the veins primarily, one would subtract the arterial phase from a later, more delayed venous phase. Subtracted images are beneficial in CE MRA because they allow the reader to focus primarily on the vasculature. The main problem with subtracted images is that they require consistent positioning to avoid spatial misregistration. This problem can be particularly significant in the chest and upper abdomen, where spatial misregistration can result from different breath holds. Finally, as mentioned earlier, findings depicted on subtracted images must be confirmed on the source data set.

Maximum Intensity Projection

The maximum intensity projection (MIP) provides a powerful means of presenting MRA data. In a MIP, the highest intensity voxel in each projection ray perpendicular to the viewing plane becomes a pixel on the final image. MIP images can be depicted in any projection, and a composite of multiple projections can be created to allow the reader to rotate the image. This feature is important because structures may overlap on MIP images in one projection, but they may be distinguished from each other in another projection.

vessel has as high or higher signal intensity than the vessel of interest. When this occurs, the unwanted signal not in the vessel of interest can be mapped to the projection image and causes an apparent discontinuity in the vessel of interest. Subvolume, or partial volume, MIP images can overcome this problem. In subvolume MIP images, the user selects only a certain thickness of the source images in the reconstructed volume. This approach allows the exclusion of structures in the background that may obscure visualization of the underlying vessels. The subvolume MIP images can then be scrolled through at the desired thickness to view the full volume.

Multiplanar Reconstruction

Multiplanar reconstruction (MPR) is an essential component of MRA interpretation. At the viewing workstation, the source data can be reconstructed in any plane, thus allowing the reader to gain a 3-D understanding of the imaged volume. Unlike MIP images, which are affected by overlapping structures, MPR data sets are not projections and provide thin, scrollable images for the reader. Oblique MPR data sets are essential when measuring vascular structures because they allow for measurements to be obtained orthogonal to the long axis of the vessel. For particularly tortuous vessels, curved MPR data sets can be obtained. In curved MPRs, the reader selects the midpoint of the vessel over its entire course, and the image is reconstructed along that axis. This allows a tortuous vessel to be visible to the reader on a single image. Curved MPR data sets are useful for obtaining complex sets of measurements in vessels, as are often used in planning aortic endovascular stent repair. MPR data sets in CE MRA examinations can suffer from distortion caused by the use of nonisotropic voxels. Although isotropic voxels are ideal for the purposes of MPR, they may not be possible in many cases in which compromise is often made by increasing slice thickness while maintaining high in-plane resolution to accommodate imaging a larger FOV within an acceptably short time frame. The longer intravascular residence of blood pool agents provides one potential means of overcoming this problem because these agents allow for longer, higher-spatial resolution sequences with isotropic voxels to be performed during the steady state after initial first-pass arterial images using faster sequences are obtained. MPR of the high-resolution steady-state sequences can be of particularly high quality as a result of the small source data set voxels and the absence of distortion.

Magnetic Resonance Imaging 60 (2019) 164–172

Contents lists available at ScienceDirect

Magnetic Resonance Imaging

journal homepage: www.elsevier.com/locate/mri

Original contribution

Non-contrast-enhanced magnetic resonance imaging for visualization and quantification of endovascular aortic prosthesis, their endoleaks and aneurysm sacs at 1.5 T

Results: QISS-MRA provided good visualization of endoleaks and comparable quantification of aneurysm size with respect to CE-CTA and DSA. The 4D-flow MRI provided additional information about the wall shear stress, which could not be determined using DSA. In contrast to CE-CTA, T_1- and T_2-mapping provided detailed information about heterogeneous areas within an aneurysm sac.

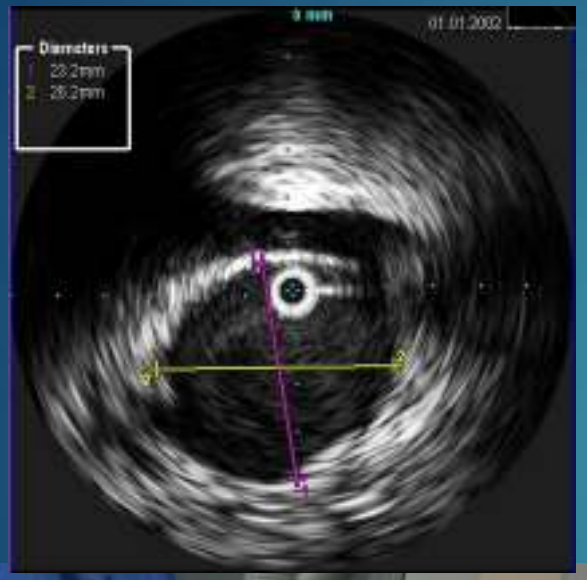
Conclusions: Compared to DSA and CE-CTA, the proposed MRI methods provide improved anatomical and functional information for various types of endoprostheses and endoleaks. In addition, hemodynamic parameters

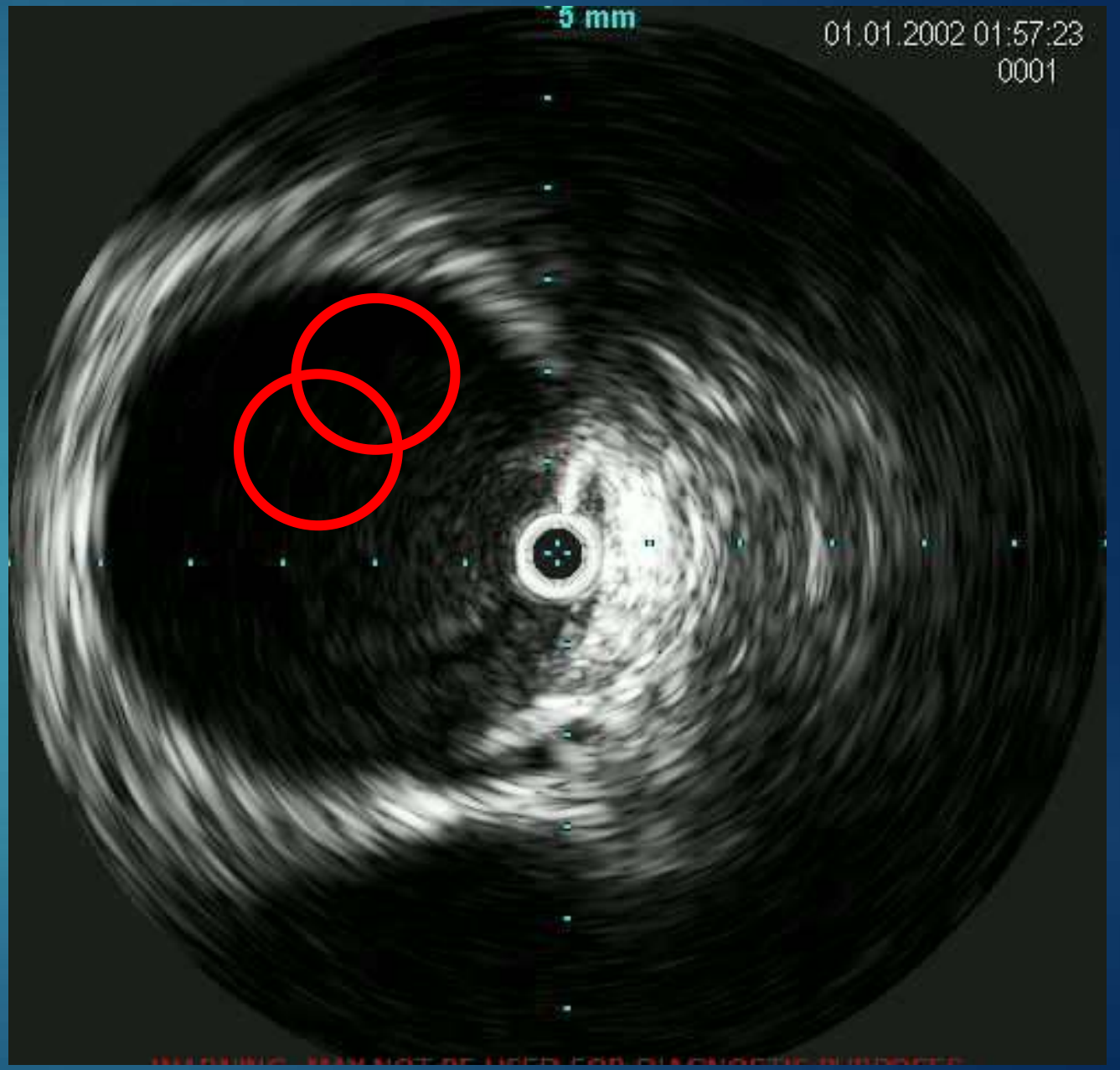
Intervention Imaging

2. Modality to reduce/prevent CM

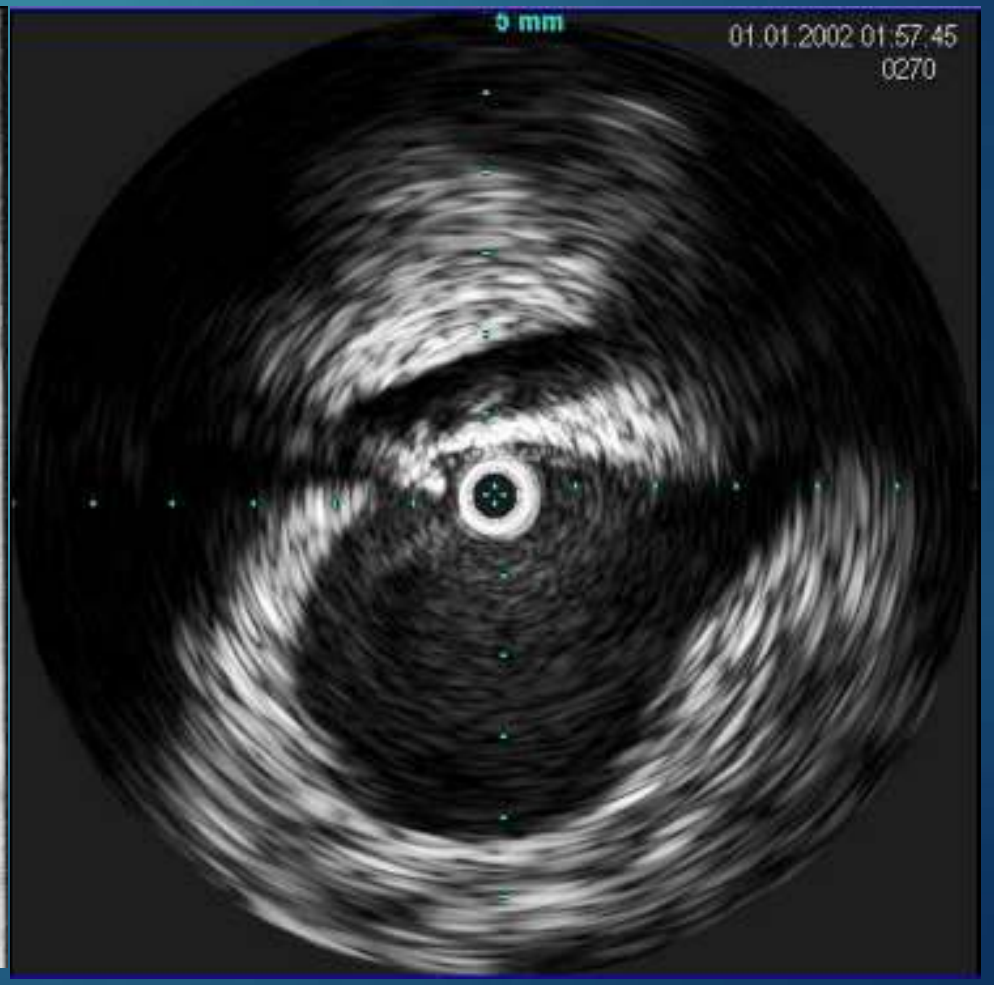
Intravascular Ultrasound (IVUS)

Localization of sites of aortic branches by IVUS





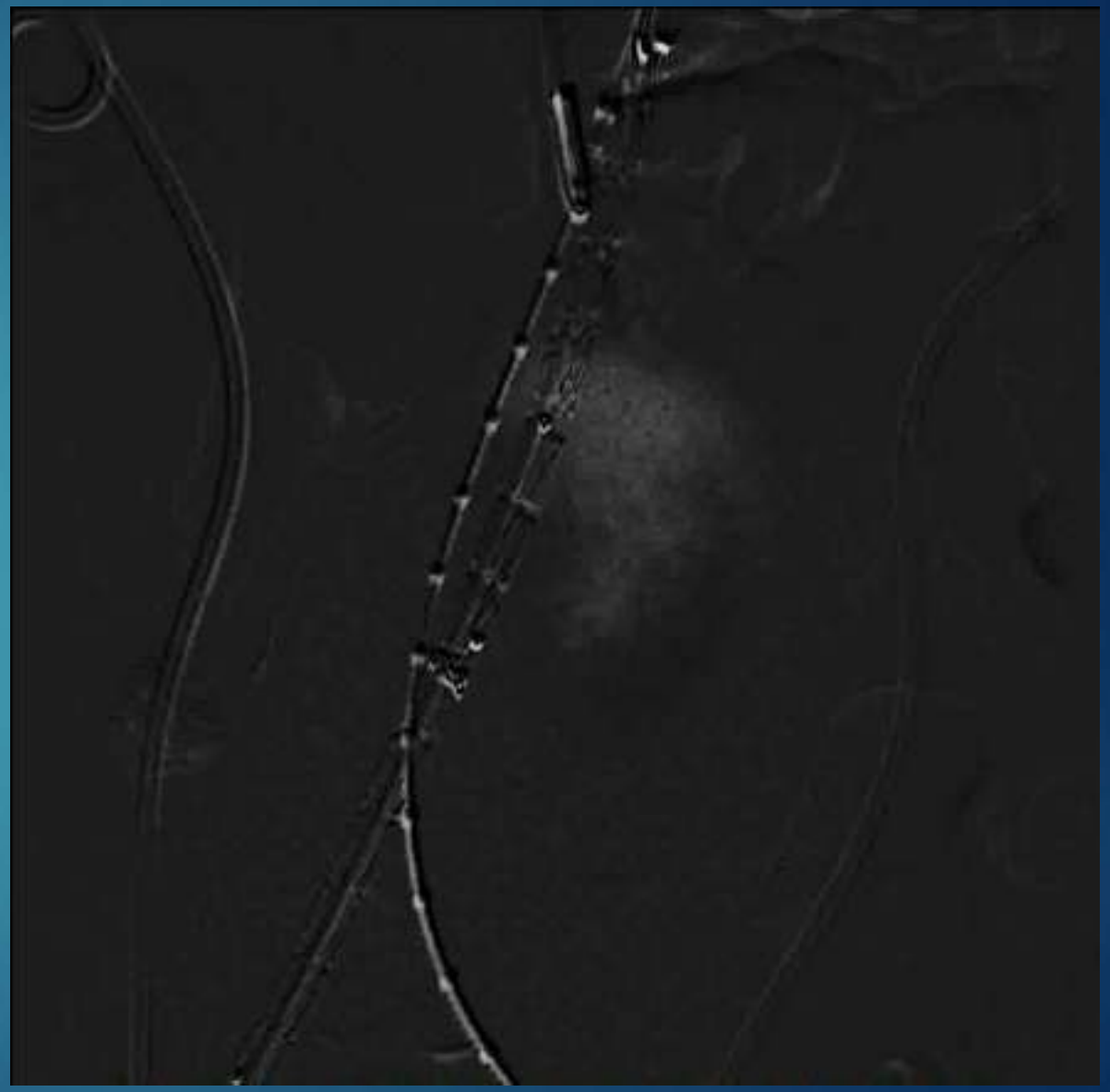
Adjustment of the device at the lowest renal under fluoroscopy marked by IVUS catheter



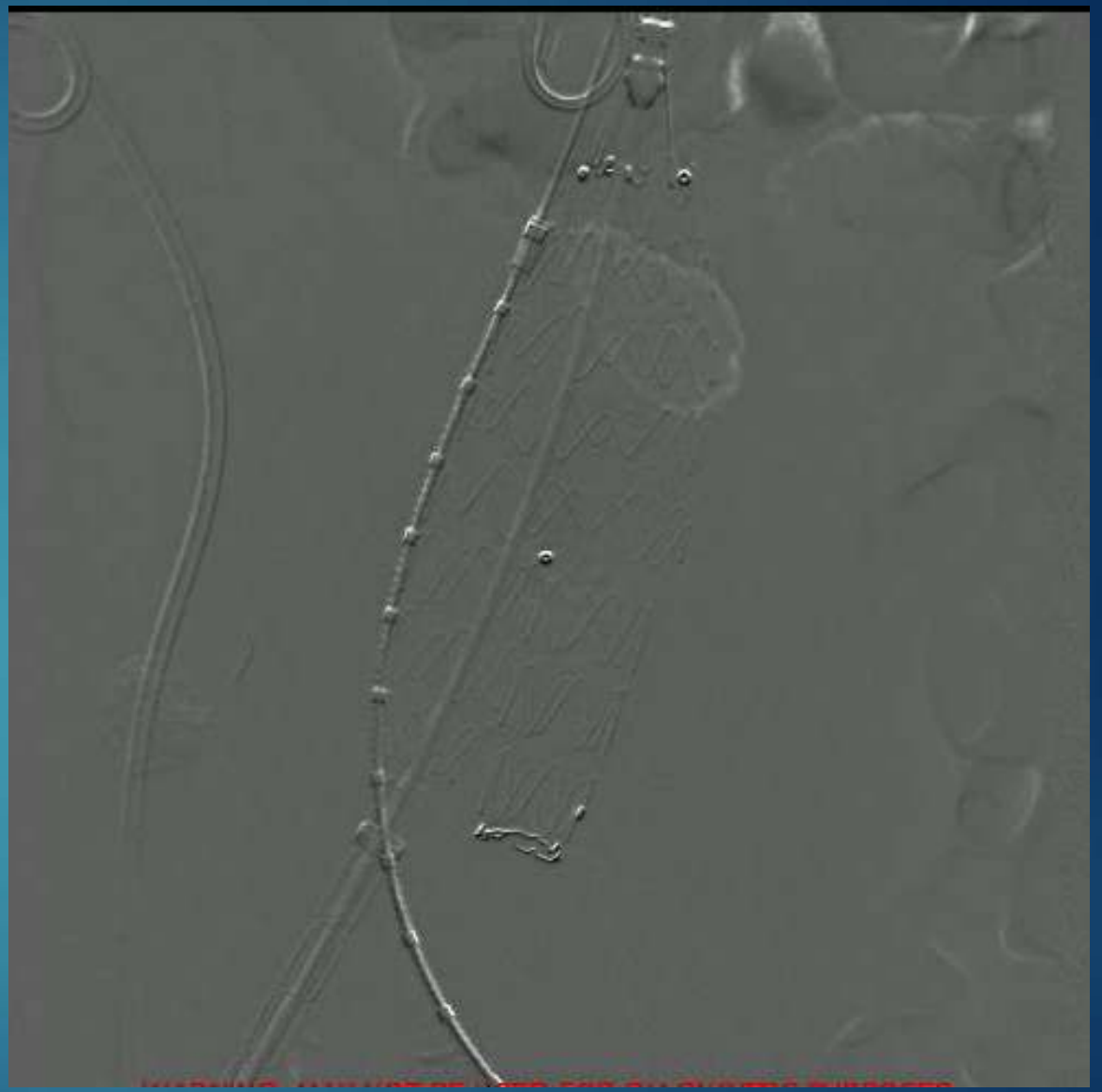
3. Modality to reduce/prevent CM

CO2 Angiography

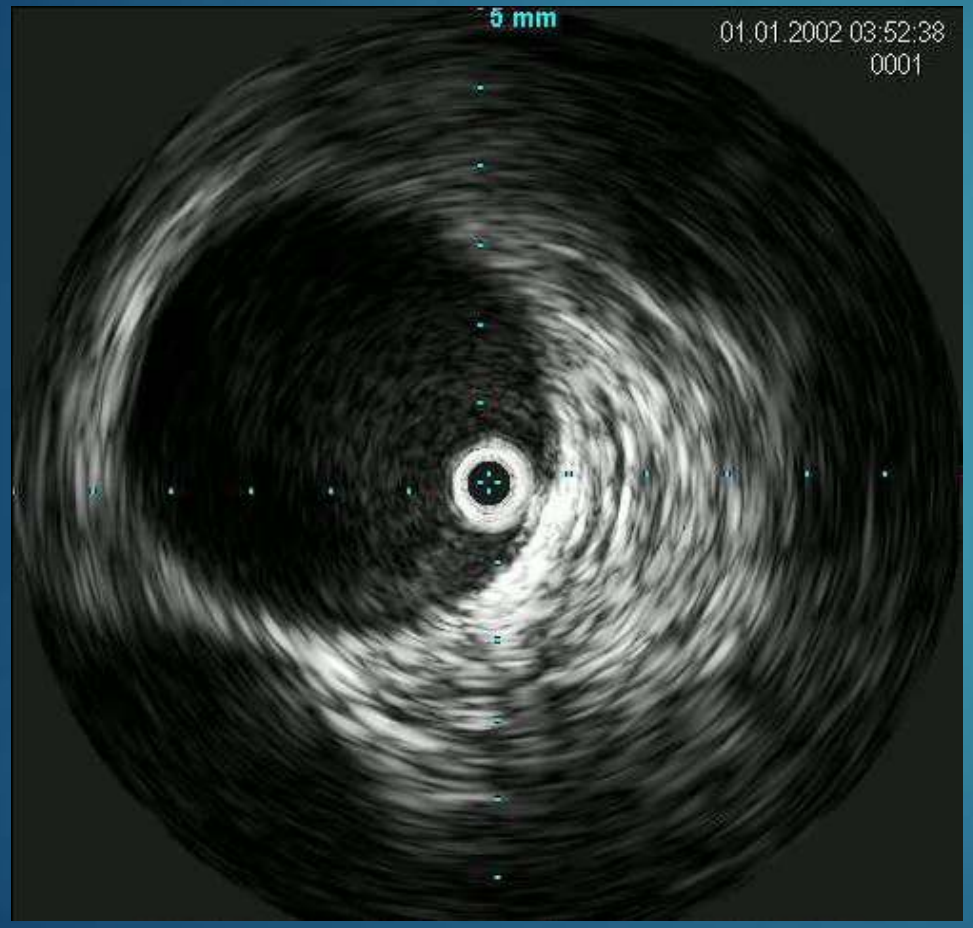
Confirmation of position by CO_2 angiography using angiodroid® injection system



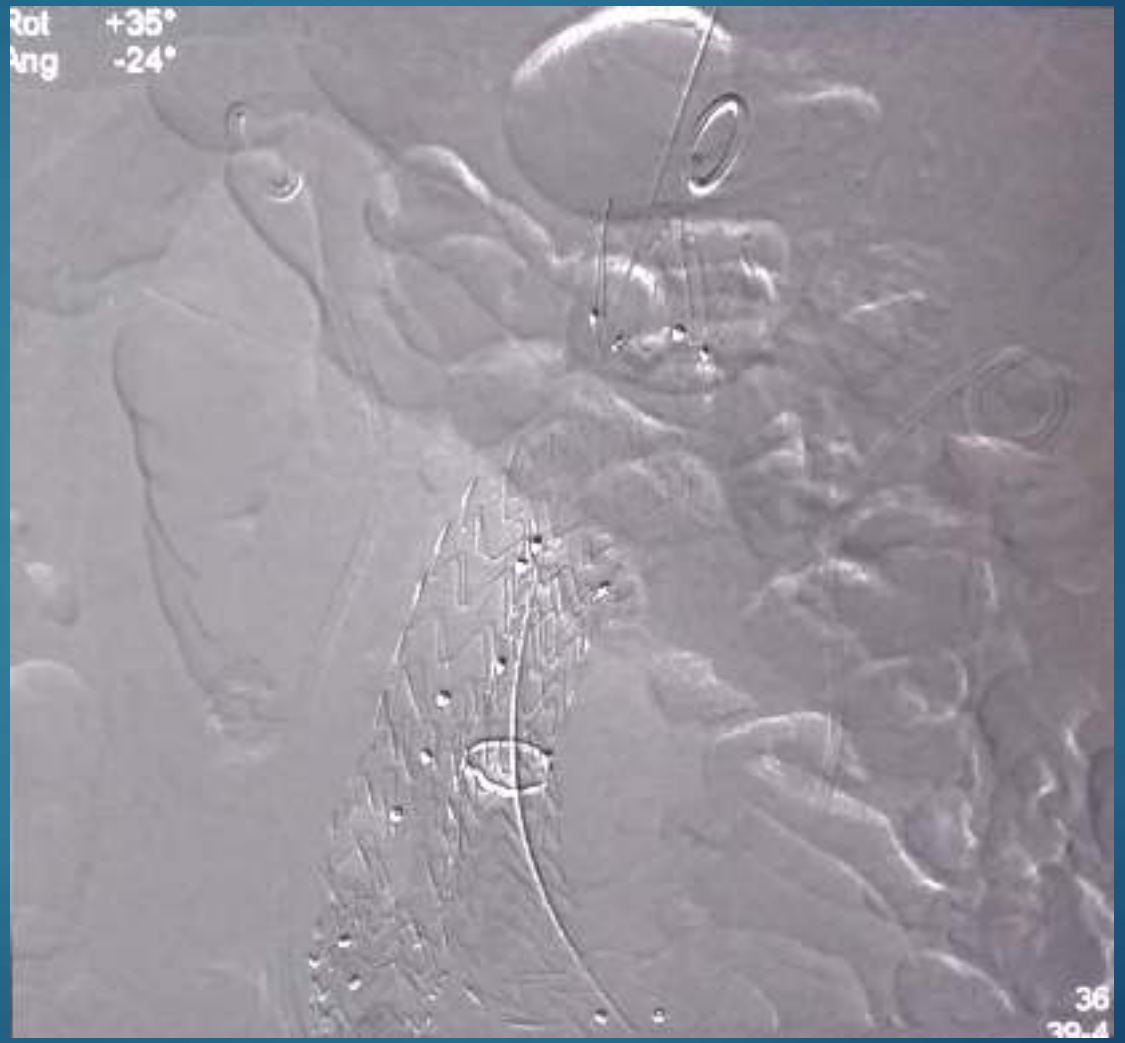
Control CO_2 angiogram prior to device release



Iliac bifurcation marking using IVUS



Ipsilateral iliac bifurcation marking


Rot +35°
Ang -24°
36

Control CO_2 angiogram after ballooning

Standardization of a Carbon Dioxide Automated System for Endovascular Aortic Aneurysm Repair

Chiara Mascoli, Gianluca Faggioli, Enrico Gallitto, Vincenzo Vento, Rodolfo Pini, Andrea Vacirca, Giuseppe Indelicato, Mauro Gargiulo, and Andrea Stella, Bologna, Italy

Ann Vasc Surg 2018; 51: 160–169

Conclusions: The injection of nontoxic CO_2 through an automated device allowed to perform EVAR procedures effectively, in the majority of cases. In some cases, a single injection of a minimum amount of conventional contrast medium can be used to overcome the lack of renal artery visualization by CO_2. ELIIs are more frequently visualized with CO_2 compared with standard contrast medium. Although the CO_2 injection technique needs further amelioration particularly in the renal arteries detection, this technique appears promising and possibly substitutive of the standard contrast medium, with significant benefit for the renal function.

Clinical Study

The Assessment of Carbon Dioxide Automated Angiography in Type II Endoleaks Detection: Comparison with Contrast-Enhanced Ultrasound

Chiara Mascoli, Gianluca Faggioli, Enrico Gallitto, Vincenzo Vento, Giuseppe Indelicato, Rodolfo Pini, Andrea Vacirca, Andrea Stella, and Mauro Gargiulo

Vascular Surgery, DIMES, University of Bologna, Policlinico S. Orsola-Malpighi, Bologna, Italy

detection. *Conclusion.* CO_2-A is safe and effective method for EI.II detection in EVAR, with a significantly higher agreement with CEUS if compared with ICM-A. This trial is registered with 155/2015/U/Oss.

ELSEVIER CrossMark

Midterm Outcomes of Endovascular Aortic Aneurysm Repair with Carbon Dioxide–Guided Angiography

Yuriko Takeuchi,[1] Noriyasu Morikage,[1] Yutaro Matsuno,[2] Tamami Nakam Makoto Samura,[1] Koshiro Ueda,[1] Takasuke Harada,[1] Yoshitaka Ikeda,[2] K Hiroshi Ito,[2] Kensuke Sakata,[2] and Kimikazu Hamano,[1] Ube and Shimon Japan

Ann Vasc Surg 2018; 51: 170–176

CONCLUSION

CO_2-EVAR is technically feasible and demonstrates a prominent protective effect on renal function. Our findings indicate that CO_2-EVAR is a promising treatment option for patients with severe renal dysfunction or IC allergy. However, it demands careful consideration of the status of the aortic lumen, which cannot be determined by CO_2 angiography and simple CT alone, to avoid severe complications.

Carbon Dioxide as Contrast Medium to Guide Endovascular Aortic Aneurysm Repair

Cynthia de Almeida Mendes,[1,2] Alexandre de Arruda Martins,[1,2] Marcelo Passos Teivelis,[1] Sergio Kuzniec,[1] Andrea Yasbek Monteiro Varella,[1] and Nelson Wolosker,[1] Morumbi, Jardim Ângela, São Paulo, and Brazil

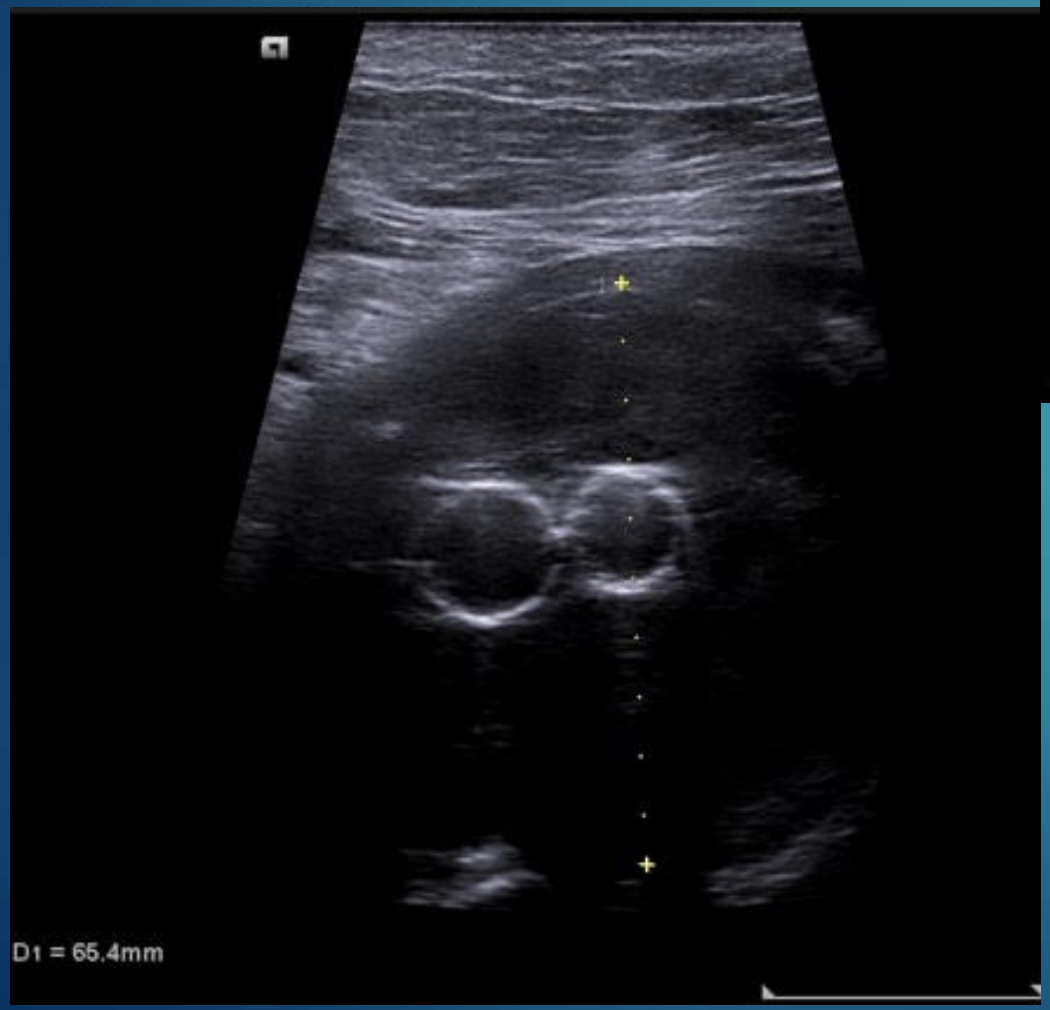
Ann Vasc Surg 2017; 39: 67–73

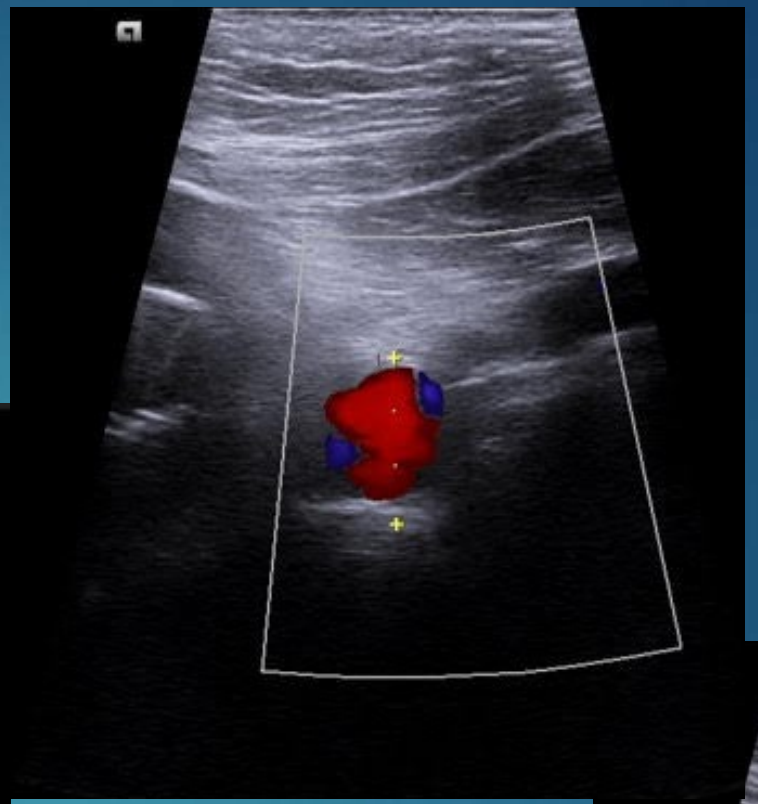
Conclusions: The use of CO_2 as a contrast medium for EVAR is an alternative in patients with no restriction for ICM, with similar outcomes when compared to ICM, regarding duration of surgery, duration of fluoroscopy, and endovascular material costs. Using CO_2, there were no changes in creatinine clearance and no risk of hypersensitivity reactions; moreover, there was a reduction in contrast-related costs for EVAR procedures. However, in our study, additional use of ICM to visualize the internal iliac artery was needed in most procedures.

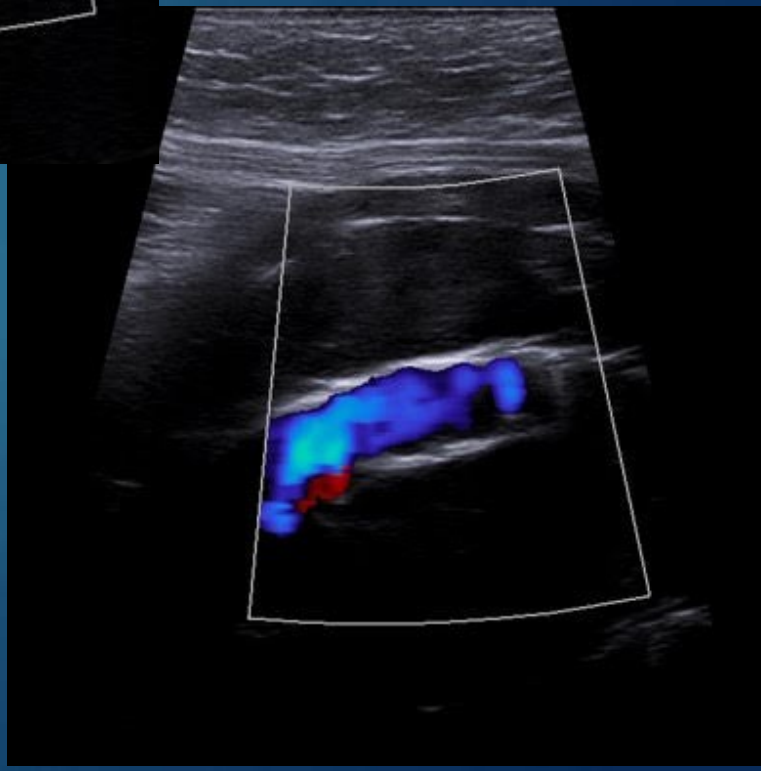
4. Modality to reduce/prevent CM

Duplex Surveillance

Duplex follow up







European Journal of Radiology 84 (2015) 1658–1665

Contents lists available at ScienceDirect

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

EVAR: Benefits of CEUS for monitoring stent-graft status

Vito Cantisani[a,*], Hektor Grazhdani[a], Dirk-André Clevert[b], Roberto Iezzi[c], Luca Aiani[d], Alberto Martegani[d], Fabrizio Fanelli[a], Luca Di Marzo[a], Andrea Wlderk[a], Carlo Cirelli[a], Carlo Catalano[d], Nicola Di Leo[a], Mattia Di Segni[a], Flavio Malpassini[a], Ferdinando D'Ambrosio[a]

In conclusion, CEUS in the post-EVAR surveillance is a safe and effective modality and in a well planned surveillance protocol, it should be integrated into institutional protocols for EVAR surveillance in order to avoid to the patients the nephrotoxicity of contrast agents, the radiation and cost burden of the repeated CTA-s.

PROGRESS IN CARDIOVASCULAR DISEASES 56 (2013) 2–12

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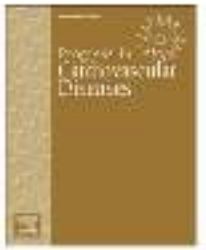

Advances in Imaging and Surveillance of AAA: When, How, How Often?

*Nung Rudarakanchana, Janet T. Powell**

Vascular Surgery, Imperial College, London, UK

When, how and how often summary

Ultrasonography remains the method of choice for aneurysm screening and surveillance. Previously, offering screening to men at age 65 years often coincided with retirement. The age for retirement is creeping upwards and soon will be at least

Summary

These 4 tools can help you to avoid/reduce the use of contrast , even in complex cases:

1. Good quality MRA dicom images can be used to replace CTA, even during EVAR sizing
2. CO_2 angiography
   - Needs training the eyes on CO_2 images. Prepare the abdomen well!
   - Good aortic images with the new software of Angiodroid® CO_2 generator.
3. IVUS is an excellent tool for marking of locations. Needs getting used to its images!
4. Ultrasound surveillance

Thank you for your attention