Subclavian steal syndrome: an underdiagnosed disease

Poster No.: C-0753
Congress: ECR 2017
Type: Educational Exhibit
Authors: R. O. Martins¹, M. C. Calegari², M. Lopes³, L. Santos³, L. Cruz³, R. Vasconcelos³, M. Natal³; ¹Brasília, Di/BR, ²Brasília, DF/BR, ³Brasília/BR

Keywords: Arteries / Aorta, Cardiovascular system, Head and neck, MR-Angiography, CT-Angiography, Ultrasound-Spectral Doppler, Education, Arteriosclerosis, Education and training, Hemodynamics / Flow dynamics
DOI: 10.1594/ecr2017/C-0753

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR’s endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method ist strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

The objective of this presentation is to review the teaching points of the subclavian steal syndrome (SSS); clinical findings and imaging features based on personal archive will be highlighted.

Background

Subclavian steal occurs due to the presence of subclavian artery stenosis before the emergence of the vertebral artery, most common in the origin of the aortic arch, leading to a retrograde flow through the ipsilateral vertebral artery and circle of Willis. When the steal is associated with neurologic symptoms is called "subclavian steal syndrome".

This diagnosis has to be suspected when there is a reduction of blood pressure on the affected arm by 15-20 mmHg.

Most common symptoms include arm claudication occurring at regular intervals, visual loss, vertigo, syncope, pulsatile tinnitus, hemianaesthesia or paresesis.

The main cause of SSS is atherosclerotic disease. However, other causes have an important role in the etiology of SSS like autoimmune inflammatory diseases (eg. Takayasu arteritis), vascular abnormalities, post surgical stenosis, and others.

Between diagnostic methods, the Doppler ultrasonography and the computed tomography (CT) stand as efficient tools to demonstrate reverse flow in vertebral arteries and stenosis location, respectively. Moreover, CT may eventually identify the stenosis' cause and complications. In the suspicion of SSS, magnetic resonance stands out as an important instrument analysis.

Findings and procedure details

1 - MRA - Magnetic Resonance Angiography

MRA methods, many of which are sensitive to direction of flow, offer an attractive alternative, for example, phase-contrast MRA methods inherently encode direction of flow and can show subclavian stenosis and reversal of flow in the vertebral artery.
TOF MRA does not possess inherent flow-encode information but can show flow direction, as flow from one direction can be suppressed by a saturation pulse that facilitates generation of selective arterial or venous MR images.

Although these techniques are suited to visualization of flow reversal in subclavian steal phenomenon, contrast-enhanced techniques have largely replaced noncontrast technic evaluation of the extracranial vessels in clinical practice.

The advantages of 3D contrast-enhanced technique including higher signal-to-noise ratio, higher contrast, higher spatial resolution and shorter scan times.

2 - Doppler US

The most common abnormal flow pattern seen is the retrograde vertebral flow. This is a simple diagnosis to make with duplex ultrasound when retrograde vertebral artery flow is seen throughout the cardiac cycle, although it is important not to confuse it with the normal vein flow.

As a secondary diagnostic finding in patients with SSS, it should also be possible to document abnormal flow velocity waveforms in the distal segment of the affected subclavian artery.

In cases of subclavian steal there may be a subclavian artery obstruction at its origin that is significant but not so severe as to cause a complete reversal of flow in the ipsilateral vertebral artery.

Although the proximal subclavian stenosis or occlusion may be difficult to image, particularly on the left, the vertebral artery waveform abnormality correlates with the severity of the subclavian disease.

3 - CT

Subclavian artery stenosis or occlusion are easily identified, delayed enhancement of ipsilateral vertebral artery and direction of flow in vertebral artery can not be determined.

Other intracranial or extracranial cerebral vascular lesions can also be identified.

4 - Angiography

In the past there was a gold standard to SSS diagnosis, nowadays it is performed at the time of endovascular intervention (treatment), the subclavian artery stenosis or occlusion are easily identified. Delayed filling of ipsilateral vertebral artery (which fills retrogradely), other intracranial or extracranial cerebral vascular lesions can also be identified.
Fig. 1: 72 year-old female presented with dizziness, Axial gradient echo time of flight (TOF) angiography technique MR images with desaturated descending flow (A) and desaturated ascending flow (B), with left vertebral demonstrate a lack of sign in A and high sign in B (circle), showing retrograde arterial flow in this artery. Calcified plaque at the origin of the subclavian artery was seen on CT.

Fig. 2: 35 year-old female with Takayasu arteritis, presenting ischemic stroke in vertebral territory. Longitudinal spectral Doppler US shows left vertebral artery with reversal flow, ipsilateral subclavian artery shows high-grade stenosis.
**Fig. 3:** Doppler scan ultrasonography waveforms.

© Núcleo de Radiologia do Hospital de Base, Hospital de Base do Distrito Federal - Brasília/BR
Fig. 4: Volume rendering technique of aortic arch shows interruption of the left subclavian artery. Women with 25 year-old with Takayasu arteritis.

© Núcleo de Radiologia do Hospital de Base, Hospital de Base do Distrito Federal - Brasília/BR
Fig. 5: Sagittal maximum intensity projection (MIP) of cervical CT angiography shows left subclavian artery flow interruption (green arrow).

© Núcleo de Radiologia do Hospital de Base, Hospital de Base do Distrito Federal - Brasília/BR
Fig. 6: 72 years old female. Digital subtracted angiography (DSA), showing a high grade stenosis at the origin of left subclavian artery (arrow).

© Núcleo de Radiologia do Hospital de Base, Hospital de Base do Distrito Federal - Brasília/BR
Fig. 7: Same patient showing retrograde filling of left vertebral artery and left subclavian artery through anterior communicating artery.

© Núcleo de Radiologia do Hospital de Base, Hospital de Base do Distrito Federal - Brasília/BR
Conclusion

In the past years the SSS has been an under diagnosed disease, but with the technology evolution and increased radiologist experience a higher number of cases have clearly raised the prevalence data. Early diagnosis can prevent drastic complications and highlight the importance of proper evaluation of the exam.

Personal information

References


