Jugular Venous Reflux: Respiration- and Position-Induced Changes and their Clinical Application

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This study describes hyperintensity of dural venous sinuses due to jugular venous reflux (JVR) and their respiration- and position-induced changes, and discusses the significance of this phenomenon in endovascular treatment.

Keywords ➤ jugular venous reflux, respiration, magnetic resonance angiography, transvenous approach

In healthy individuals, the left dural venous sinuses may be delineated as hyperintense areas, and their differentiation from arteriovenous shunt disorders, such as dural arteriovenous fistula, is necessary. This hyperintensity has been ascribed to jugular venous reflux (JVR) due to compression of the left brachiocephalic vein between the sternum and aortic arch.1,2 While JVR and dural arteriovenous fistula are occasionally difficult to differentiate by plain MRI alone, they can be differentiated by modalities including contrast-enhanced CT, contrast-enhanced MRI, and DSA.

Respiratory change in JVR has also been reported previously.2,3 It is caused by elevation of the thorax during inspiration and consequent relief of compression on the left brachiocephalic vein (Fig. 1). Compression on the brachiocephalic vein may also be relieved by changing the body position. The sternum can be elevated via the clavicles when the scapular arch is flexed by bilaterally inserting shoulder pillows. Since the relief of pressure is maintained by this method, the evaluation by plain MRI becomes possible, and the presence of JVR can be demonstrated indirectly by confirmation of the disappearance of sinus hyperintensity on time-of-flight (TOF) imaging (Fig. 2).

In endovascular treatment, knowledge about this phenomenon is particularly important in transvenously approaching the left side (Fig. 3). In imaging of the access route in the venous phase by intra-arterially injecting the contrast medium, delineation of the left side is sometimes obscured, and JVR is often responsible for this phenomenon. The left internal jugular vein to the brachiocephalic vein can be visualized more clearly by imaging during breath-holding after deep inspiration, permitting confirmation of the accurate access route. In addition, in approaching the left internal jugular vein, passage of the guidewire or catheter may be blocked near the midline, and this is often caused by narrowing of the brachiocephalic vein. Passage through this narrowed area may be facilitated by breath-holding after deep inspiration.

Endovascular surgeons are required to have knowledge about JVR and its respiratory and positional variation.

Disclosure Statement

Neither the first author nor any of the coauthors have any conflicts of interest to disclose concerning this paper.
Fig. 1 This patient was referred to us as dural arteriovenous fistula was suspected on head MRI. On head MRA, structures including transverse sinus, sigmoid sinus, inferior petrosal sinus on the left side, and basilar plexus were delineated as high-intensity areas (A) arrows. Thoracic time-of-flight MRA showed compression of the left brachiocephalic vein between the sternal and aortic arch (B) arrowheads. When DSA was performed by injecting the contrast medium via a peripheral intravenous route of the left median cubital vein, the antegrade flow was obstructed in the brachiocephalic vein, and blood flowed retrogradely in the internal jugular vein, through the intracranial venous sinuses, and antegrade in the contralateral internal jugular vein (C; 1, 2). In addition, when DSA was performed during breath-holding after deep inspiration, the retrograde flow disappeared, and antegrade venous flow was observed (D; 1, 2).

Fig. 2 This patient showed hyperintense venous sinuses on screening head MRI. In the usual position, the left venous sinuses were visualized as high-intensity areas on TOF-MRA (A; 1, 2) arrowheads. When head MRI was performed again by flexing the scapular arch using bilateral shoulder pillows, hyperintensities of the venous sinuses disappeared (B; 1, 2) arrowheads. TOF: time-of-flight
Fig. 3 Access route imaging in the venous phase by intra-arterial contrast injection for establishing a transvenous approach (A and B). On usual imaging, stasis in the left internal jugular vein and poor delineation of the left side occurred (A) arrows. Delineation of the left internal jugular vein to the brachiocephalic vein may be improved by imaging during breath-holding after deep inspiration (B). Also, if the brachiocephalic vein is compressed, passage of the guidewire or catheter may be difficult near the midline in approaching the left internal jugular vein (C). Passage of devices through this compressed area may be facilitated by breath-holding after deep inspiration.

References

