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Heuber Maneuver in Evaluation of Direct Carotid-Cavernous Fistula

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Summary

Carotid-cavernous fistulas are abnormal communications between the carotid system and the cavernous sinus. Elevated venous pressure produces congestion in the orbit with resultant transudation of fluid and increased intraocular pressure, thereby leading to secondary glaucoma which may result in visual loss. Immediate treatment is hence, warranted in these cases. The planning of endovascular management is dependent on many parameters, the most important of which are the size and location of the fistula. Since these are high-flow fistulas, assessment requires certain manoeuvers. Heuber manoeuver is one of the manoeuvers used to demonstrate the size of the fistula.

MeSH Keywords: Carotid-Cavernous Sinus Fistula • Cerebral Angiography • Endovascular Procedures • Glaucoma

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Dear Editor,

Carotid-cavernous fistulas (CCFs) are abnormal communications between the carotid arterial system and the cavernous sinus. CCFs have been categorised into several types according to the etiology, hemodynamic features and the angiographic arterial architecture. The anatomical-angiographic classification proposed by Barrow et al. classifies CCFs into four types, with type A shunt having direct communication between the intracavernous internal carotid artery and the cavernous sinus and the other three types are associated with indirect fistulas [1]. Type A CCFs are usually associated with high flow rates. Type B fistulas, which are uncommon, have communications between dural ICA branches to the cavernous sinus. Type C fistulas have their supply only from the dural branches of ECA. Type D fistulas, with communications between dural ICA and ECA branches, and the cavernous sinus, are the most prevalent type. Tomsick subclassified type D CCFs into type D1 or D2 depending on the presence of unilateral or bilateral arterial supply [2].

CCFs can be spontaneous or post-traumatic, with the post-traumatic CCFs being the most commonly type A, showing a direct single communication between the ICA and the cavernous sinus. Blunt and penetrating head trauma may lead to direct CCFs, as well as iatrogenic causes like trans-sphenoidal surgery. The most common site for such fistulas is the proximal segment of horizontal intracavernous segment of ICA in the vicinity of the inferolateral trunk. The other sites are the junction of the horizontal and intracavernous ascending segments, posterior ascending segment, junction of the anterior ascending and horizontal intracavernous segments, and the anterior ascending segment [3]. A spontaneous rupture of an intracavernous ICA aneurysm can also result in type A fistula. Spontaneous fistula can conform to the angiographic characteristics of any of the four types, with multiple small fistulas within the cavernous sinus wall and multiple dural feeders.

Severe intracranial haemorrhage can occur along with ocular symptoms due to the high-flow shunt seen with direct CCFs. This requires making a diagnosis as soon as possible and offering immediate treatment. The gold standard of treatment is endovascular therapy [3].

Planning of endovascular intervention in CCFs is done with cerebral angiography, which is also the gold standard for definitive diagnosis. The most important information that is obtained by the initial angiographic evaluation is the size and location of the fistula. The size and location of the fistula is important to determine the technique of endovascular therapy and the hardware that might be required during the procedure. Angiography also helps in differentiation of

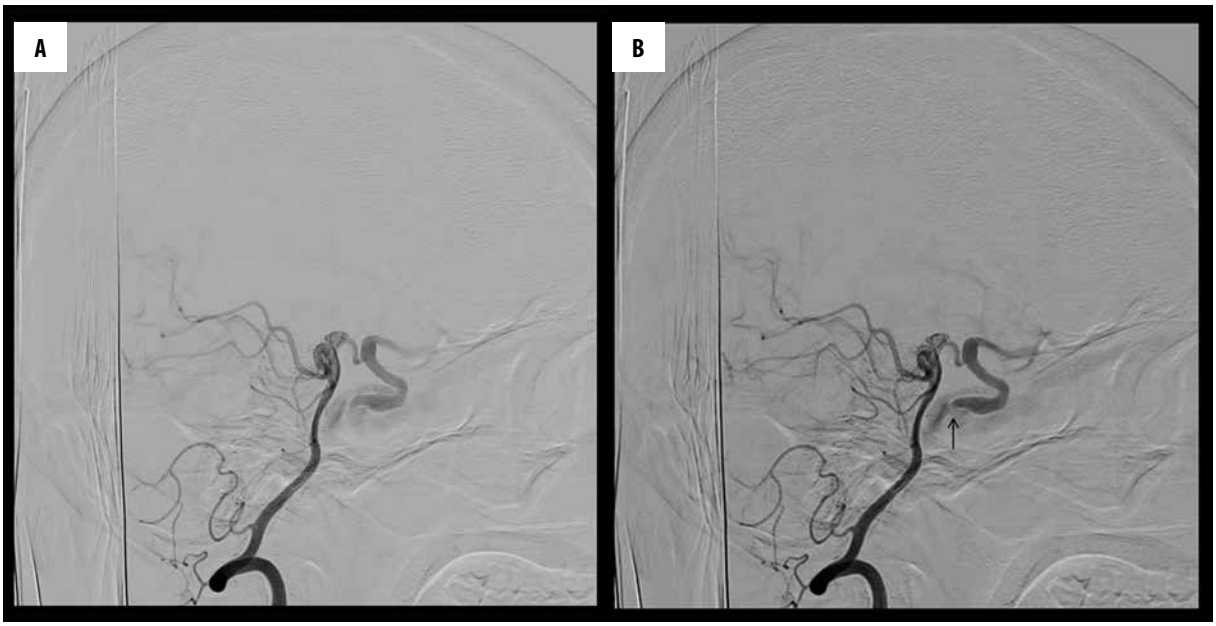

Figure 1. (**A, B**) Lateral angiograms of a twenty-six-year-old female patient with a direct right CCF, right vertebral injection with ipsilateral CCA compression (Heuber manoeuver) to demonstrate the fistulous point (arrow in **B**).

direct from indirect lesions as well as to identify the presence of any associated cavernous carotid aneurysm. It is also essential in the assessment of the global cortical arterial circulation, collateral flow through the circle of Willis, and presence of complete or partial steal phenomena. In endovascular therapy, it is important to first accurately identify the fistulous point, but this is often difficult because of the high-flow shunt.

Often, the fistulous point in a direct CCF can be difficult to identify because of the high-flow shunt. High-frame-rate imaging (5 frames/s) and rapid rates of injection of contrast (8 mL/s) are used. Many manoeuvers have been described for identifying the fistulous point.

Manual compression of the carotid artery while injecting the vertebral artery is one of the maneuvers [3,4]. This was described by Heuber and is commonly used to demonstrate the dimensions of the fistula in our centre.

Injecting the ipsilateral ICA while compressing the ipsilateral CCA is another manoeuver used. This manoeuver is named after Mehringer and Hieshima. Filming at a slow frame rate using this manoeuver helps in better delineation of the fistula as this slows the rate of opacification of the fistula.

Another manoeuver consists of slow injection of a contrast agent from a balloon catheter, which closes off the internal carotid artery [5]. Microcatheter angiography with interruption of the internal carotid artery flow using a HyperGlide balloon can also be performed [6,7]. These techniques have been found to be useful in patients where the anterior communicating artery or posterior communicating artery is not patent.

Vertebral angiography while also performing manual aspiration from a balloon-guiding catheter, closing off the internal carotid artery, is a new technique that has been described when identification is difficult in patients with very rapid shunting from the collateral circulation [8]. The authors described this method with 3D-DSA which also helped to determine the working angle in their patient. This technique appears very useful for identifying the fistulous point because aspiration makes it possible to reduce early visualization of the cavernous sinus.

The other features which are noted are identification of high-risk features (e.g., cortical venous drainage, pseudoaneurysm, cavernous sinus varix), venous drainage patterns, determination of therapeutic route, associated vascular injuries (e.g., traumatic pseudoaneurysm, arterial dissection), identification of any dangerous collateral pathways and evaluation of carotid bifurcation before compression therapy.

We are also attaching images of a patient with direct right CCF in whom we used the Heuber manoeuver to demonstrate the fistulous point (Figure 1A, 1B).

Conflict of interest

None.

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