

# Transjugular Endoscopic Approach to Inframeatal Space: A Theoretical Approach

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## Dear Editor,

I have read with great interest the article by professor Samii and his colleagues about their initial experiences with the retrosigmoid approach to the inframeatal and infralabyrinthine spaces and possible promising implications of this approach, which was recently published in your journal (1). The inframeatal corridor extends from the internal auditory canal to the exit zone of glossopharyngeal nerve and is placed anteriorly to the petrous internal carotid artery and medially to the petrous apex (1, 2). This space is well known for its challenging approach, though it is of utmost importance regarding surgeries in the proximity of the petrous bone (1, 2).

Access to the posterior fossa skull base, including the above mentioned corridor, has been accomplished by a direct approach through the retrosigmoid area, while indirect endoscopic approach through jugular foramen is another possible, though hypothetical, approach to this area. Approach to the jugular foramen has long been performed especially for lesions located in or at the entry of the foramen (3), however the transjugular endoscopic approach has not been experienced before. Considering that the outer diameter of available flexible neuroendoscopes, is approximately 5 millimeter (mm), which can be navigated with electromagnetic navigation systems offering accuracy within 1.2 mm (4) along with the mean diameter of jugular foramen (11.22 and 9.52 mm anteroposteriorly and 16.52 and 16.02 mm mediolaterally in right and left sides respectively) (3), and the compressive potential and collapsible consistency of cerebral venous structures (5), the proposed transjugular endoscopic approach seems to be possible.

The disadvantage of the transjugular approach to the inframeatal space is possible compression of jugular foramen contents including cranial nerves 9, 10 and 11 along with jugular vein and sigmoid sinus compression, though vascular and neural compartments are generally separated by a bone projection (3). This may lead to complications like an increase in intracranial pressure, cerebral sinus venous thrombosis and cranial nerve palsies re-

ferred to as the Vernet's syndrome (6). In order to overcome this disadvantage, preoperative case selection is warranted. Those patients, who have large diameter jugular foramens and bilateral well-organized sigmoid sinuses, are the best candidates for this approach. These factors along with the use of endoscopes with small diameters would render this method safe. Furthermore, the capacity of cerebral venous drainage to tolerate foraminal compression can be functionally evaluated preoperatively. This may consist of Doppler estimation of contralateral jugular vein flow after selective compression of ipsilateral jugular vein by the aid of a sonographic probe.

The proposed technique would be the advance of a newly structured exploratory endoscope with the smallest possible diameter consisting of soft edges with the purpose of safe guiding through the bone-vein interface of foramen. The proposed endoscope has the capability to inflate and is coated with inflatable stent like devices similar to what is used in the field of vascular stenting. This allows the opening of the adjustable diameter corridor for passage of the second working endoscope with the guide provided by the exploratory endoscope (or simply using it as a guide on a dual mode set of endoscopes) up to the entry and through the foramen. The stent may contain pressure sensors for online monitoring of foramen pressure during surgery and is withdrawn at the end of surgery. Diversion of flow to the contralateral sigmoid sinus results in the collapse of ipsilateral veins, which decreases jugular foramen pressure and thereby opening the potential corridor of jugular canal, something that makes the procedure safe. This can be achieved either by direct compression on the ipsilateral transverse or sigmoid sinuses during surgical approaches in posterior fossa or by diversion of flow by means of intravascular venous approaches.

The main issue in performing this approach is the capability of advancing the exploratory endoscope safely through the jugular foramen without injury to vital structures, including lower cranial nerves and the venous structures. It is not clear how tightly the adventitia of jugular vein is attached to the periosteum of skull base and

whether the device, though delicate and exerting delicate manipulations, can be advanced without injury, which may be catastrophic leading to jugular vein dissection, venous type subarachnoid hemorrhage and cranial nerve palsies. In fact the literature is rather silent on this issue and it is a matter of further research. The advantages of this method are impressive, something that makes it worth research. These include access from neck, easy guide of endoscope to the entry of jugular foramen by the aid of carotid sheath, good accessibility of inframeatal corridor, no need for craniotomy and the fact that it can provide a route for tumor removal or simply an auxiliary tool assisting microsurgery as a second access.

Recently, the retrosigmoid approach was combined with endoscopic surgery for Jugular foramen tumors with successful results (7). This new approach can be further advanced by approaching the inframeatal space via the jugular canal using the advantage of this physiological corridor as a means for direct intracranial access. Furthermore, the access to the venous system in the retrosigmoid approach makes it possible to decrease jugular canal pressure by diversion of flow whether by surgical, mechanical or intravascular methods thereby collapsing the vein in the canal and increasing the safety of the transjugular approach. The challenging issue of safe passage through jugular foramen needs further assessment and research. However, according to the above-mentioned preoperative case selection and the high compliance of jugular vein rendering functional compression of the venous system pos-

sible and the possibility to modify the technique individually by computerized simulation before and during the operation, the question that can be proposed is whether the theory for endoscopic transjugular approach either as a main surgical approach or in conjunction with retrosigmoid approach for skull base surgery is practical or it can only be formulated on paper?

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