Endovascular Treatment for Dural Arteriovenous Fistula of the Anterior Condylar Confluence Involving the Anterior Condylar Vein

A Report of Two Cases

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Summary

Anterior condylar confluence (ACC) dural arteriovenous fistula (AVF) is a rare anomaly. We describe two cases of ACC dural AVF involving the anterior condylar vein that were successfully treated with selective transvenous coil embolization.

The first patient presented with headache and right pulse-synchronous tinnitus, and demonstrated abnormal flow medial to the jugular bulb within the right hypoglossal canal on source image of magnetic resonance angiography (MRA). Arterioangiography disclosed a dural AVF in this area, supplied mainly by the meningeal branches of the bilateral ascending pharyngeal artery.

We diagnosed ACC dural AVF involving the anterior condylar vein and transvenous embolization was successfully performed. The second patient presented with right pulse-synchronous tinnitus. Views of source image of MRA and arterioangiography were similar to the first case and, again, transvenous embolization was successfully performed.

ACC dural AVF is a rare condition and knowledge of the anatomy of the venous system around the craniocervical junction is required for successful treatment.

Introduction

Dural arteriovenous fistula (AVF) is an abnormal arteriovenous shunt located within the dura mater. Dural AVFs commonly occur in the cavernous sinus, transverse and sigmoid sinuses, but they can occur in any dural structure. Dural AVFs around the jugular foramen, such as dural AVF involving the inferior petrosal sinus, dural AVF of the marginal sinus, and hypoglossal dural AVF, have been reported¹⁻⁵. These AVFs all have similar shunt points and the venous complex involved in these AVFs has been shown to be the anterior condylar confluence (ACC). We present two cases of ACC dural AVF involving the anterior condylar vein, successfully treated by selective transvenous coil embolization.

Case Reports

Case 1

A 50-year-old man presented with headache and right pulse-synchronous tinnitus five months prior to admission and magnetic resonance angiography (MRA) revealed abnormal flow near the right internal carotid artery (ICA) (Figure 1A). Source image of MRA showed abnormal flow medial to the jugular

Figure 1 A1) MRA demonstrating abnormal flow (arrow) lateral-superior to the right side of the foramen magnum. A2-3) Source image of MRA showing the location of the fistulous pouch (white arrow) and anterior condylar vein (black arrow). B1-2) Anterior-posterior view of bilateral preoperative external carotid angiography (B1: right, B2: left.). The dural AVF was fed by meningeal branches of the bilateral ascending pharyngeal artery (B1 white arrow). The fistula was located in anterior condylar confluence (black arrow) to anterior condylar vein (arrowhead). C) Anterior-posterior view of right external carotid angiography following transvenous coil embolization confirming occlusion of fistula. D) CT after embolization demonstrating a coil mass located medial to jugular bulb within hypoglossal canal (white arrow).

bulb within the right hypoglossal canal (Figure 1A 2-3). Arteriography disclosed a dural AVF adjacent to the right jugular bulb, supplied predominantly by the meningeal branches of the bilateral ascending pharyngeal artery and dural branches of the bilateral vertebral artery (Figure 1B 1). The fistula drained through the anterior condylar vein into the vertebral venous plexus. A left external carotid artery (ECA) angiography clearly demonstrated the fistulous

point located inferomedial to the left jugular bulb (Figure 1B 2). We hypothesized that the pulse-synchronous tinnitus was caused by the dural AVF, that the headache most likely had no relation to the dural AVF, and that treatment of the dural AVF should be performed.

Embolization

Transvenous embolization was performed via the right femoral vein. Through a 5 French

Figure 2 A1-2) Anterior-posterior view (A1) and lateral view (A2) of right preoperative external carotid angiography (A1). The dural AVF was fed by meningeal branches of the bilateral ascending pharyngeal artery. The fistula was located in anterior condylar confluence (A1 white arrow). The dural AVF drained through the inferior petrosal sinus (A2 white arrow) into the cavernous sinus (A2 black arrow) in a retrograde fashion. B) Anterior-posterior view of left preoperative external carotid angiography. Fistula point was located in the ACC (asterisk). The dural AVF drained the anterior condylar vein (black arrow) into the suboccipital cavernous sinus (white arrowhead) in an anterograde fashion. Black arrow demonstrates the right inferior petrosal sinus. C) Lateral view of left preoperative vertebral artery angiography. The dural branch of the vertebral artery led to the right anterior condylar vein (white arrow). D) Lateral view of right external carotid angiography following transvenous coil embolization confirming occlusion of the fistula.

guiding catheter (Emboy; Cordis, Johnson & Johnson, Tokyo, Japan) positioned in the right jugular vein, a microcatheter (Rapid Transit; Cordis, Johnson & Johnson, Tokyo, Japan) was advanced over a 0.016-in guidewire (GT wire 45°, Terumo, Tokyo, Japan) into the fistulous pouch. Through the microcatheter, embolization was performed with the following: 1) Guglielmi detachable coils (Boston Scientific, Japan), 2) fibered platinum coils (Boston Scientific, Japan), and 3) the Micrus Microcoil system HELIPAQ (GOODMAN, Japan), resulting in complete occlusion of the fistula.

Postembolization course

Arteriography performed immediately after the procedure demonstrated complete obliteration of the dural AVF (Figure 1C). Computed tomography (CT) performed following the

procedure demonstrated a coiled mass medial to the jugular bulb within the hypoglossal canal (Figure 1D). The patient's right pulse-synchronous tinnitus disappeared immediately and headache gradually disappeared. It is possible that headache was caused by stress secondary to the pulse-synchronous tinnitus. The patient had an unremarkable recovery without any further neurological deficits.

Case 2

A 65-year-old man presented with right pulse-synchronous tinnitus. MRA revealed abnormal flow adjacent to the foramen magnum, and source image of MRA showed abnormal flow medial to the jugular bulb within the right hypoglossal canal. Arteriography demonstrated a dural AVF located medial to the right jugular bulb.

Figure 3 Schematic drawing of normal veins and venous sinuses of skull base in the frontal (A), and lateral (B) view. The circles indicate the hypoglossal canal.

JB: jugular bulb, IJV: internal jugular vein, IPS: inferior petrosal sinus

ACC: anterior condylar confluence, SCS: suboccipital cavernous sinus

DCV: deep cervical vein, VVP: vertebral venous plexus, SS: sigmoid sinus

①: anterior condylar vein, ②: lateral condylar vein, ③: posterior condylar vein.

The dural AVF was fed mainly by meningeal branches of the bilateral ascending pharyngeal artery and dural branches of the bilateral vertebral artery (Figure 2A,1C). The dural AVF drained through the inferior petrosal sinus into the cavernous sinus in a retrograde fashion, and through the anterior condylar vein into the vertebral venous plexus in an antegrade fashion (Figure 2A,B).

Embolization

Transvenous embolization was performed via the right femoral vein. Through a 5 French guiding catheter (Emboy; Cordis, Johnson & Johnson, Tokyo, Japan) positioned in the right jugular vein, a microcatheter (Rapid Transit; Cordis, Johnson & Johnson, Tokyo, Japan) was advanced over a 0.016-in guidewire (GT wire 45°, Terumo, Tokyo, Japan) into the fistulous pouch. Through the microcatheter, embolization was performed with a Guglielmi-detachable coil (Boston Scientific, Japan), a Trufill DCS (Cordis, Johnson & Johnson, Japan), and a Detach-18 (COOK), resulting in complete occlusion of the fistula.

Postembolization course

Arteriography performed immediately after the procedure demonstrated complete obliteration of the dural AVF (Figure 2D). Pulse-synchronous tinnitus disappeared within four days following the procedure and the patient had an uneventful recovery.

Discussion

Venous structures around the craniocervical junction are complex and exhibit numerous variations. Successful transvenous embolization of a dural AVF of the craniocervical junction, however, requires precise catheterization to the fistulous point, based on accurate anatomical knowledge. Several authors have evaluated the venous structures around the craniocervical junction, and they have shown the constant presence of a venous confluence located inferomedial to the internal jugular bulb^{6,7}. This venous confluence is called the ACC or petrosal confluence.

The ACC offers multiple connections with

the dural venous sinuses of the posterior cranial fossa, the jugular bulb and the vertebral venous system. The inferior petrosal sinus connects with the jugular bulb through the ACC. The anterior condylar vein that originates from the ACC allows for connections with the vertebral venous plexus through the hypoglossal canal. The lateral condylar vein originates from a branch between the ACC and jugular bulb and connects with the suboccipital cavernous sinus, the venous plexus around the V3 segment of the vertebral artery. The posterior condylar vein originates from the ACC and connects with the deep cervical vein through the posterior condyloid canal. The vertebral venous plexus connects with the deep cervical vein through the suboccipital cavernous sinus (Figure 3).

Symptoms of dural AVFs depend on the pattern of venous drainage. Dural AVFs of the ACC typically drain into the internal jugular vein, so the first symptom is usually pulse-synchronous tinnitus³. In cases that have retrograde flow to the IPS, palsy of the oculomotor nerve or abducens nerve, and ocular symptoms such as proptosis, chemosis, secondary glaucoma, and diplopia are likely to be seen with cavernous sinus dural AVF⁸. Hypoglossal nerve palsy is seen when dural AVF drains mainly within the anterior condylar vein⁹.

We present two cases of ACC dural AVFs involving the anterior condylar vein. Their arteri-

al supply was predominantly from meningeal branches of the bilateral ascending pharyngeal artery, and contralateral external carotid arteriography was most useful in identifying the location of the fistula in the transvenous embolization. Source images of MRA revealed abnormal flow medial to the jugular bulb within the hypoglossal canal and demonstrated that the fistulous point of the two cases was the ACC involved anterior condylar vein. CT scan after embolization demonstrated a coil mass medial to the jugular bulb within the hypoglossal canal. Ernst R et Al reported that overpacking in the anterior condylar vein could cause hypoglossal nerve palsy¹⁰. Some reports emphasize the usefulness of contralateral external carotid angiography and source image of MRA for localizing the fistulous point of this location^{2,3,10,11}.

Conclusions

In conclusion, ACC dural AVFs are rare and cause pulse-synchronous tinnitus, palsy of the oculomotor nerve or the abducens nerve, and ocular symptoms. We described our experience with two cases of ACC dural AVFs involving the anterior condylar vein. Selective transvenous coil embolization with careful assessment of coil location, using source image of MRA and contralateral external carotid angiography was an effective treatment.

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