A traumatic carotid-jugular fistula with or without a pseudoaneurysm is rare, and generally occurs after a penetrating trauma rather than after blunt trauma. A bypass graft and sacrifice of the involved carotid artery was originally the treatment of choice until the advent of endovascular method. Currently, a traumatic carotid-jugular fistula can be treated using endovascular methods such as ballooning, coiling, stent-graft deployment and stent assisted coil embolization. The authors present two cases of traumatic carotid-jugular fistula that were treated using endovascular methods.

Case Report

Case 1

A 6-year-old boy was admitted to our hospital with the chief complain of progressive headache, pulsating mass, and a hard thrill immediately below the right mandible angle for a 3 month duration. He had suffered a deep penetrating neck injury 9 months earlier. 3D CTA and DSA revealed an arteriovenous fistula between the right facial artery to the right retromandibular vein, which drained to the right internal jugular vein (Figs. 1A, B). The patient was treated with coil embolization. The second patient suffered a gun shot injury to the neck. 3D CTA and DSA revealed a common carotid-jugular fistula and a pseudoaneurysm. The common carotid-jugular fistula was treated with coil embolization in the fistula and the pseudoaneurysm was treated with stent assisted coil embolization.

Index words : Fistula, arteriovenous
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After the blood flow through the fistula had decreased, a total of eleven Tornado platinum coils (A Cook Group Company, Bloomington, IN) were deployed. The total length of the inserted coils was 120 cm. After embolization, a small amount of the blood flow through the arteriovenous shunt was remained but the right intracerebral vascular structures were well visualized (Fig. 1C). Embolization was stopped due to the expected spontaneous regression of the fistula. After 3 months, the right carotid angiogram revealed an increased arteriovenous shunt from the right facial artery to the internal jugular vein (Fig. 1D). Therefore, an attempt was made to embolize the arteriovenous fistula through the arterial approach. The microcatheter was inserted into the dilated fistula through the facial artery and embolized with GDCs (18 mm×30 cm, 20 mm×30 cm) and Tornado platinum coils (Total length 54 cm) until the abnormal venous drainage had disappeared (Fig. 1E). There was no evidence of a fistula during the 12-month follow up.

Case 2
A 22-year-old man was admitted due to neck swelling from a gun shot injury. He had no neurologic deficits. 3D CTA and DSA revealed a high flow fistula between

![Fig. 1. Case 1. A, B. 3D CTA (A) and DSA (B) show a fistula between the dilated retromandibular vein (white arrows), which drained to the internal jugular vein (IJV) and facial artery (black arrows). C. DSA after embolization of the fistula. Early venous drainage (arrow) through the arteriovenous fistula (arrow head) still remained between the facial artery and internal jugular vein. D. DSA of 3 months follow up. ECA angiography shows a more aggravated shunt between the facial artery and the IJV. E. Complete resolution of the fistula was achieved by obliterating the facial artery with additional coil embolization (arrow).]
the distal common carotid artery and the internal jugular vein (Figs. 2A, B) and a pseudoaneurysm in the distal common carotid artery immediately above the fistula site (Fig. 2C). The plan was to embolize the fistula and then perform surgery. Using the venous approach, the fistula was treated successfully with four GDCs (Total length 115 cm). However, the surgery failed due to severe adhesion adjacent to the common carotid artery. Stent assisted coil embolization was then performed instead of a graft stent due to the uncertain long-term patency and freedom from a restenosis of the graft stent.

First, a microcatheter was placed in the pseudoaneurysm and then 8 mm×3 cm sized Easy Wallstent (Boston Scientific/Schneider, Minneapolis, MN) was deployed. A total of four GDCs (Total length 35 cm) were inserted into the pseudoaneurysm through the microcatheter until dense coil packing had been achieved (Fig. 2D). After the procedure, the pseudoaneurysm and fistula disappeared and the left internal carotid artery flow was well preserved until the 12-month follow up.

Fig. 2. Case 2. A, B. 3D CTA [A] and DSA [B] reveal a fistula (arrows) between the distal common carotid artery and IJV. C. DSA after coil embolization of fistula. The fistula was obliterated by coil embolization (arrow), but the pseudoaneurysm still remained (arrowhead). D. DSA after the stent assisted coil embolization shows complete obliteration of the pseudoaneurysm.
Discussion

Penetrating objects such as a bullet or knife passing through or near the neurovascular bundles of the neck can easily damage the blood vessels [1]. These injuries can cause acute hemorrhage, complete major vessel obstruction and the formation of a traumatic aneurysm or arteriovenous fistula [2]. If left untreated, the pseudoaneurysm can cause compressive symptoms and embolic phenomena, and a carotid-jugular fistula usually enlarges and causes severe high output heart failure and obstructive symptoms [3]. Conventional angiography is traditionally used to diagnose the injured vessel. However, a rapid and noninvasive diagnosis of major vessel injuries can be made using helical CT angiography with a high sensitivity and specificity [4]. The aim of a carotid-jugular fistula including a pseudoaneurysm is to occlude the fistula and pseudoaneurysm whilst preserving the parent artery. Traditionally, surgery by an excision of the fistula with vascular reconstruction was the treatment of choice for carotid-jugular fistula and pseudoaneurysm. Recently, the development of new devices and techniques has enabled the use of endovascular treatments for surgery. These endovascular methods include balloon occlusion [5] and coil embolization for a fistula [6], stent assisted coil embolization for a pseudoaneurysm and stent-graft insertion either for a fistula and pseudoaneurysm [3, 7-10]. These methods have their own advantages and disadvantages. Surgery is a definite method for achieving proximal vascular control of the common carotid artery by isolating the parent artery from the fistula or pseudoaneurysm. However, the procedure carries potential risks, such as cranial nerve injury and sternostomy [10]. Stent assisted coil embolization for the treatment of a pseudoaneurysm allows a good packing density compared with simple coiling because the stent prevents the migration or bulging of coils into the parent vessel lumen. On the other hand, there is potential risk of recanalization of the sac due to incomplete exclusion by the vessel lumen [10]. In the case of a carotid-jugular fistula combined with a pseudoaneurysm, a stent-graft is a promising technology for obliterating a fistula and pseudoaneurysm, and preserving the parent artery with relatively safely [8]. However, the long term patency and freedom from a restenosis of the stent-graft are still unknown. Hence, close observation is needed [9]. In the case of an external carotid-jugular fistula, the treatment options are limited to surgery, simple coiling and balloononing. In our case, the external carotid-jugular fistula was treated successfully using detachable coils and multiple fibered coils. In our case of a common carotid-jugular fistula combined with a pseudoaneurysm, the common-carotid jugular fistula was obliterated using detachable coils and then the pseudoaneurysm was excluded by stent assisted coil embolization. Both patients suffered no recurrence during a 12 months follow up.

In conclusion, coil embolization or stent assisted coil embolization can be considered the first line treatment for a traumatic carotid-jugular fistula with or without a pseudoaneurysm.

References

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