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Original Investigation

Endovascular Treatment of Rare Vascular Complications of Percutaneous Balloon Compression for Trigeminal Neuralgia

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ABSTRACT

AIM: To present the clinical features and outcomes of rare vascular complications of percutaneous balloon compression (PBC) for trigeminal neuralgia. These complications were treated by the endovascular technique.

MATERIAL and METHODS: In this retrospective study, 5 patients with trigeminal neuralgia were treated by PBC, who complicated vascular incidence between December 2000 and May 2011. The complications included 3 internal carotid cavernous fistulae (CCF) and 2 external carotid artery system fistulae. These complications were treated by endovascular coil embolism and balloon occlusion techniques.

RESULTS: Five patients (100%) had pain free after the PBC. All the complications were cured and symptoms were gradually improved. There was no recurrence of trigeminal neuralgia or vascular complication symptoms during the follow-up period (mean 20 months, range 7-52 months).

CONCLUSION: Endovascular treatment is effective and safe for the rare iatrogenic vascular complications of the PBC procedure. Neurosurgeons should be made aware of this complication. Timely diagnosis and expedient treatment should be ensured as early as possible in order to decrease further danger.

KEYWORDS: Vascular complication, Percutaneous balloon compression, Trigeminal neuralgia, Endovascular treatment

ABBREVIATIONS: PBC: Percutaneous balloon compression, **CCF:** Carotid cavernous fistula, **TN:** Trigeminal neuralgia, **MRI:** Magnetic resonance imaging, **CT:** Computed tomography, **MAVF:** Maxillary artery venous fistula, **DTAVF:** Deep temporal artery venous fistula, **BO:** Balloon occlusion, **PCE:** Platinum coils embolism

INTRODUCTION

Trigeminal neuralgia (TN) is defined by the International Association for the Study of Pain as "sudden, usually unilateral, severe, brief, stabbing, recurrent episodes of pain" in the distribution of one or more branches of the trigeminal nerve (11, 20). TN has an annual incidence of 4-5 per 100000 (20). However, some studies (4,5) revealed much higher incidences of 26.8 and 28.9 per 100000, respectively.

Percutaneous balloon compression (PBC) is widely performed to treat TN, especially in elderly patients, due to the high success rate, technical simplicity and relative safety (1,2,7,8,13,14,15,17,19). Nonetheless, the surgical procedure has risks, most notably dysesthesia and masseter muscle weakness (2,3,18). However, vascular complications associated with percutaneous procedures are rare.

In this study, we report 5 patients treated via endovascular techniques that complicated the rare vascular incidence.

MATERIAL and METHODS

Between December 2000 and May 2011, 7359 patients

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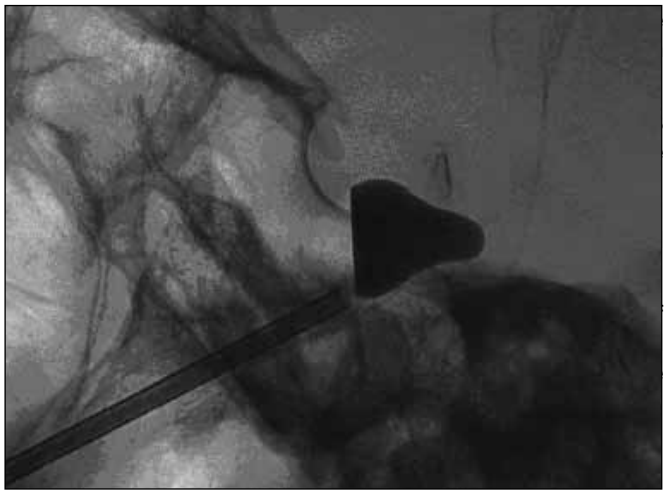

Figure 1: Fluoroscopic image revealing the typical pear shape of the Fogarty balloon in the Meckel cave.

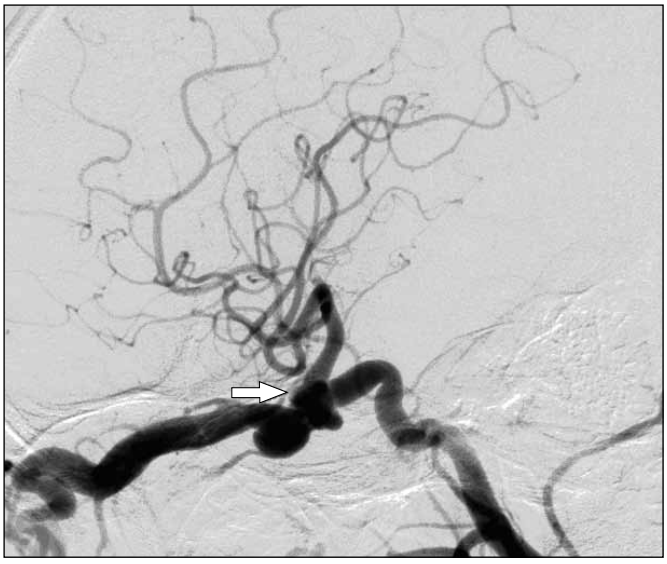

Figure 2: Angiogram demonstrating the flow of contrast agent into the cavernous sinus. The arrow points to the lacerum segment.

Access was made about 2-3 cm lateral to the corner of the mouth (14). A 14 gauge cannula needle was passed to the coronoid process and aimed toward the foramen ovale under lateral fluoroscopic imaging towards the petroclival angle.

A balloon catheter was inserted through the 14 gauge cannula. Then, the catheter was advanced to the desired location close to the TG. Lateral view X-ray images were used as a guide for the location (14). The balloon was slowly inflated with 0.7-1.0 ml contrast material. A pear-shaped balloon was obtained (Figure 1). The duration of compression was 2-4 minutes. Then the balloon was deflated. The endovascular procedure was performed under general endotrachea anesthesia or local anesthesia. Transarterial access was obtained via the transfemoral artery. The 6 French guide catheter was then placed into the right internal carotid under fluoroscopic guidance (14). The angiogram showed the feeding artery into the fistula, the internal carotid artery (Figure 2) and maxillary artery (Figure 4), respectively. The veins drained into the cavernous sinuses and maxillary veins, respectively. Under the roadmap guidance, microcatheter was positioned at the lacerum segment. Several detachable patinum coils (Micro-plex and Hydro-coil) and balloon were deployed for the maxillary arteriovenous fistula (MAVF) and CCF, respectively. Complete occlusions of these fistulae were noted on the final right internal carotid follow-up angiogram (Figures 3, 5). The procedure was finished safely without complications, except one patient with haematoma at the puncture site.

■ RESULTS

The five patients were pain free after the PBC. All the clinical symptoms secondary to the complications such as tinnitus, chemosis, proptosis and souffle were present at day 1 to 7 post PBC procedure. In case 3, case 4 and case 5, the symptoms disappeared immediately without any residual effects. At the postoperative routine follow-up duration, the symptoms of case 1 and case 2 gradually improved. In case 1, the eye chemosis and proptosis had improved significantly at the follow-up 6 weeks post procedure. There was no recurrence of trigeminal neuralgia and vascular complication symptoms within the follow-up period.

Table I: Information of the Five TN Patients that Underwent PBC and Endovascular Treatment

Case	Sex	Age (years)	Symptoms of the complication	Duration of onset after PBC (days)	Type	Treatment method	Symptom relief	Other complications
1	M	67	tinnitus chemosis proptosis blurred vision	7	CCF	BO+PCE	good/ gradually	None
2	M	56	chemosis tinnitus	2	CCF	BO	good/ gradually	None
3	F	52	tinnitus	1	DTAVF	PCE	excellent/ immediate	puncture point haematoma
4	F	42	souffle	1	MAVF	PCE	excellent/ immediate	None
5	F	56	tinnitus	1	CCF	BO	excellent/ immediate	None

CCF: *Carotid cavernous fistula,* ***MAVF:*** *Maxillary artery venous fistula,* ***DTAVF:*** *Deep temporal artery venous fistula,* ***BO:*** *Balloon occlusion,* ***PCE:*** *Platinum coils embolism,* ***M:*** *Male,* ***F:*** *Female.*

DISCUSSION

Percutaneous balloon compression is widely performed, especially in elderly patients, due to the high success rate, technical simplicity and relative safety.

There are many complications associated with PBC, including dysesthesias (5-20%), facial numbness (15-20%) and masseter muscle weakness (20-25%)(2,15) because the percutaneous treatment creates a permanent lesion and compression on the trigeminal ganglion (TG) by the balloon (14).

However, vascular complications related to PBC are rare. Lichtor and Mullan (9) described a case in their series with a small dural arteriovenous malformation draining into the cavernous sinus. They also mentioned another case of extracranial fistula after PBC but declining endovascular treatment. Lobato (10) has reported an intracranial fistula and Revuelta et al. (16) have mentioned an extracranial fistula, which all resolved spontaneously. Niu (14) and Langford (6) have reported 2 cases of CCF following PBC in a delayed fashion 4 and 8 months post procedure, respectively. They hypothesized the complication was linked to PBC. These authors suspected these fistulae occurred as a complication of PBC, but they were not entirely sure of the likelihood that the surgical procedure can result in fistulas. Carotid cavernous fistula is thought to have occurred as the result of an injury to the internal carotid artery when the 14 gauge trocar advances deeper. It is difficult to exactly define the location of the trocar tip on the lateral projection image. The frontal projection image should therefore be optional to detect the right location and the trocar tip should be exactly posted with the coronal X-ray image in the procedure to prevent it going intravascularly.

The majority of pterygomeningeal artery flow is directed extracranially to supply the anatomical structures located

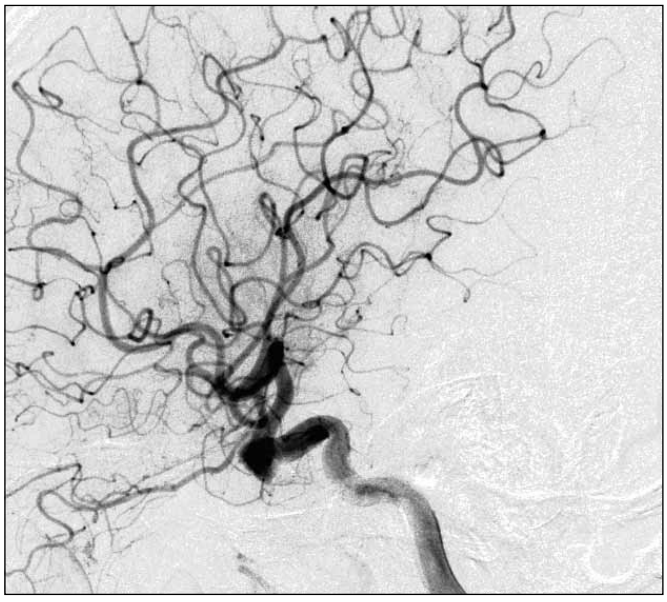

Figure 3: Angiogram obtained post-embolization depicting disappearance of the lacerum segment. The dilated superior ophthalmic vein is no longer seen. Complete occlusion of the CCF was noted.

Figure 4: Angiogram demonstrating the feeding artery, deep temporal artery (arrow) and the flow of contrast agent into the drainage vein.

Figure 5: Angiogram obtained postembolization depicting the platinum coils (arrow) and the distal of the artery is not feeling well.

in the superior pterygoid region. A significant intracranial branch is usually present. The branch usually traverses the foramen ovale, where it is inclined to be injured easily. Niu et al. (14) pointed out that the ophthalmological symptoms, which occur immediately post-procedure, can be a result of the sudden increase of intraocular pressure. This increase is usually caused by temporary compression of the ophthalmic vein drainage in the cavernous sinus (14). Spontaneously, the possible pseudo-cavernous sinus thrombosis should be differentiated from an acute direct CCF by performing an angiogram. If the 14 gauge trocar drifts off course outside while being advanced, the external carotid artery and its branches and related veins would be more prone to being injured. These vulnerable vascular structures include the maxillary artery and its branch the deep temporal artery, maxillary vein and pterygoid venous plexus. The maxillary artery lays inner mandibular neck and passes by the temporomandibular fossa between the lateral pterygoid muscles and leads to the pterygopalatine fossa. The pterygoid venous plexus lies in the pterygopalatine fossa between the lateral pterygoid muscle and temporal muscle. It drains into the maxillary vein. The deep temporal artery arises from the maxillary artery and lays inner temporal muscle and nourishes it. Based on the anatomy, if the aforementioned artery and vein are injured simultaneously an arteriovenous fistula tends to develop. Langford et al.(6) also pointed out that if the patients had accepted a previous procedure (radiofrequency, alcohol block) it would be possible for some scar tissue to be left near and around the vessel which held the vessel firmly in the way of the advancing trocar so that the vessel would be injured when the trocar advances. In the present study, it is unfortunate that all the patients did not undergo digital subtraction angiography again at follow-up.

CONCLUSION

In the present study, we have a comprehensive acquaintance with the puncture procedure to the foramen ovale through the diagnosis and treatment for the arteriovenous fistula. It is necessary to master the anatomy around the foramen ovale to decrease percutaneous balloon compression-related complications and especially arteriovenous fistula. Endovascular treatment is effective and safe for the rare iatrogenic vascular complication secondary to the PBC procedure. Neurosurgeons should therefore be made aware of this potential complication and prompt diagnosis and efficacious treatment should be provided in order to decrease the further danger.

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