

Simple Transposition Technique for Microvascular Decompression Using an Expanded Polytetrafluoroethylene “Belt”: Technical Note

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Abstract

Microvascular decompression (MVD) is a standard surgical procedure for treating vascular compression syndromes. There are two basic ways to perform MVD: interposition using a prosthesis and transposition. With the transposition technique, adhesions and granuloma around the decompression site are avoided, but the required operation is more complex than that for the interposition method. We describe a simple, quick MVD transposition procedure that uses a small “belt” cut from a sheet of 0.3-mm-thick expanded polytetrafluoroethylene membrane. The belt has a hole at the wide end and the other end tapered to a point. The belt is encircled around offending vessels by inserting the pointed end into the hole. The pointed end is then passed through a dural tunnel over the posterior wall of the petrous bone and is tied two or three times. This method avoids the risks involved in handling a surgical needle close to the cranial nerves and vessels.

Key words: microvascular decompression, hemifacial spasm, transposition, expanded polytetrafluoroethylene

Introduction

Microvascular decompression (MVD) is a widely used surgical procedure for treating hemifacial spasm and trigeminal neuralgia.¹⁾ Two different techniques for shifting the offending vessel have been used: the interposition method and the transposition method. The interposition procedure involves insertion of a prosthesis between the vessel and nerve or brainstem. The transposition technique was developed primarily for transposing a torturous vertebral artery.^{2–7)} However, it is also used in peripheral arteries, such as the anterior and posterior inferior cerebellar arteries (PICA),^{5,8,9)} to prevent adhesion and granuloma around the decompression site.¹⁰⁾ The specific transposition procedures that have been reported are more complicated, more time consuming, and more hazardous than interposition techniques because they require suturing with a needle in the vicinity of the brainstem. We describe a simple, quick transposition method that uses a small “belt”

cut from a sheet of expanded polytetrafluoroethylene (ePTFE) membrane material.

Methods and Results

A 0.3-mm-thick ePTFE surgical membrane (GORE® PRECLUDE® PDX Dura Substitute, WL Gore & Associates, Flagstaff, Arizona, USA) is trimmed with surgical scissors to create a belt that is 4 cm long, tapered to a point at one end, and 2 mm wide at the other end (Fig. 1). A 1-mm hole is made in wide end of the belt. For the MVD procedure, a standard suboccipital craniotomy is created, through which the offending vessel is gently dissected off the root entry zone of the facial nerve. The pointed end of the belt is passed under the offending artery and grasped so that it encircles the vessel. Endoscopic observation of a hidden side of vertebral artery is recommended to avoid damage to perforating arteries before passing the ePTFE belt under the vessel. The pointed end is then inserted into the hole at the wide end (Fig. 2A, B). A micro-knife or fine forceps is used to create a small dural tunnel on the posterior

wall of petrous bone, lateral to either the porus acusticus or the jugular foramen, depending on the required direction of the transposition (Fig. 2C). The pointed end is passed through the dural tunnel and pulled to achieve appropriate transposition of the vessel (Fig. 2D). The degree of transposition is adjusted by pulling or releasing the belt through the dural tunnel. After all adjustments have been

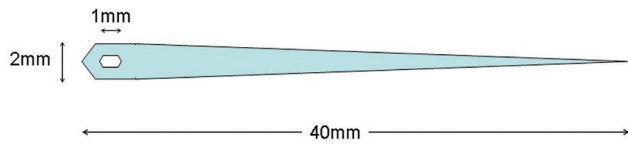


Fig. 1 Diagram of belt made of expanded polytetrafluoroethylene (ePTFE) membrane.

made, the pointed end is tied two or three times at the dural tunnel and the knots are secured with fibrin glue (Fig. 2E, F).

In the past 4 years, this transposition method was used to achieve MVD in 20 patients with hemifacial spasm. In 3 of these patients, a torturous vertebral artery was transposed; in the remaining 17, the anterior or PICA was transposed. Fixation of offending vessels with absorbable surgical cotton and fibrin glue was added in two patients. The total time required for manipulation of the ePTFE belt in the surgical field usually did not exceed 3 min. There were no complications related to the procedure. In 19 of the 20 patients (95%), hemifacial spasm disappeared within 3 months. Moreover, none of these 19 patients had recurrence of spasm during a mean follow-up period of 17 months.

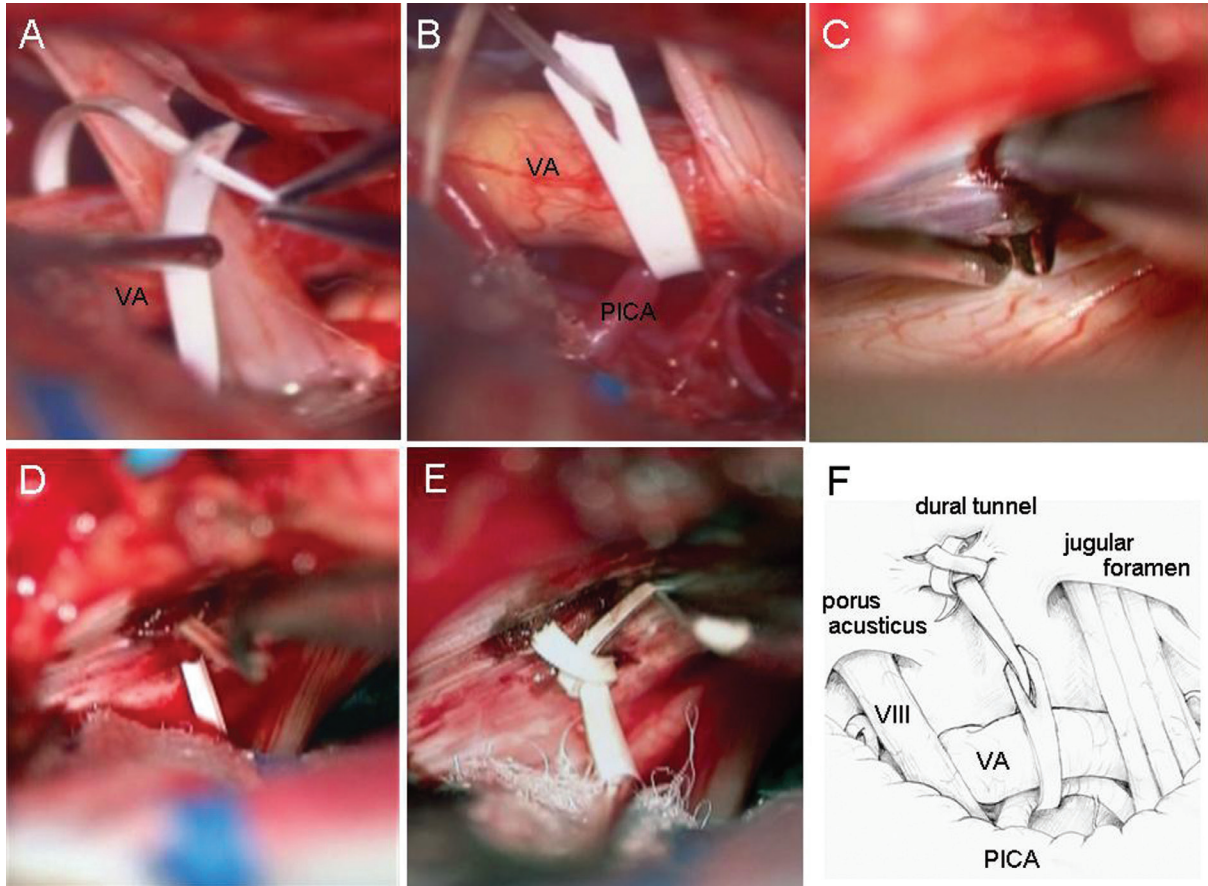


Fig. 2 Intraoperatively obtained photographs (A–E) and a drawing (F) of transposition of offending arteries using an ePTFE belt. A, B: An ePTFE belt is positioned encircling the vessel. A pointed end of the ePTFE belt is then inserted into a hole at the wide end. C: Microforceps with curved tips are used to create a dural tunnel. D: A pointed end of the belt is passed through the dural tunnel and pulled to achieve appropriate transposition of the vessel. E: The belt is tied twice at the dural tunnel. ePTFE: expanded polytetrafluoroethylene, VIII: auditory nerve, PICA: posterior inferior cerebellar artery, VA: vertebral artery.

Discussion

Our transposition method is a modification of previously reported techniques. The first description of a transposition for treating hemifacial spasm was that by Fukushima,⁸⁾ who used PTFE (Teflon) tape. Since then, various materials have been employed in transposition procedures, including strips of dura³⁾ or fascia,¹¹⁾ sutures,^{2,4)} and tape or a tube made of silicone (polydimethylsiloxane)^{5,6)} or ePTFE.^{4,9)} We selected ePTFE membrane for our belt because of the elasticity and ease of handling of this material. MVD using ePTFE tape was previously described by Ogawa et al.;⁴⁾ in the case they reported, the vertebral artery was wrapped with the tape and then pulled with 6-0 nylon suture to achieve transposition.

Most neurosurgeons who employ the transposition method for MVD attach the end of the synthetic or autologous tape to the dura of the petrous or clival bone and to the tentorium by using sutures. Our technique involves creation of a tiny dural tunnel instead of suturing. This avoids both the risk of injury from a surgical needle and excessive cerebellar retraction. Use of a dural tunnel in transposition was first described by Suzuki et al.,⁷⁾ who fastened the ends of a vascular tape with hemoclips after passing the tape through the tunnel. Similarly, Kyoshima et al.³⁾ employed an aneurysm clip to affix a dural belt. Our transposition method requires neither a surgical needle nor clips and is therefore less complex and less hazardous—and perhaps quicker—than previously reported techniques.

We found that thickness and elasticity of an ePTFE belt are very suitable for transposing offending vessels, because excessive fastening of arteries has not been encountered during the procedure. If kinking or stenosis of transposed vessels is suspected, indocyanine-green video angiography is helpful to verify their patency. We consider that late-on set strangulation of the transposed vessels does not occur because ischemic complication of the brainstem and cerebellum has never been experienced during the postoperative follow-up periods.

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Conflicts of Interest Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the

findings specified in this paper.

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