Teflon-induced granuloma following treatment of trigeminal neuralgia by microvascular decompression

Report of two cases

ISHWAR C. PREMSAGAR, M.S., M.CH., TIMOTHY MOSS, M.B.Ch.B., PH.D., F.R.C.PATH., AND HUGH B. COAKHAM, F.R.C.P., F.R.C.S.

Department of Neurological Surgery and Neuropathology, Frenchay Hospital, Bristol, England

The authors report two cases of Teflon-induced granuloma occurring as a result of microvascular decompression using Teflon wool for the treatment of trigeminal neuralgia (TN). Teflon, which is used to separate a compressing vessel from the root entry zone (REZ) of the trigeminal nerve at the brainstem, is presumed to be an inert material. In the two cases reported here, however, Teflon induced a foreign body reaction at the REZ, causing recurrence of TN. The patients’ pain was cured by complete decompression or partial sensory rhizotomy of the trigeminal sensory root at reoperation. Teflon-induced granuloma has occurred in 1.3% of the authors’ series of 155 patients with TN treated using microvascular decompression. Recommendations for avoiding this complication are offered.

**KEY WORDS** • trigeminal neuralgia • Teflon • granuloma • microvascular decompression

MICROVASCULAR decompression (MVD) is a non-ablative procedure that is used to treat trigeminal neuralgia (TN); it yields good results in approximately 90% of cases without causing numbness to the face.1,5,10,11,14,16–18,24,27,29 Recently MVD has been used with increasing frequency to treat a variety of neurovascular compression syndromes, including hemifacial spasm,15,27 glossopharyngeal neuralgia,19 intractable tinnitus,26 disabling vertigo,25 torticollis,21 sudden hearing loss,30 and intractable hiccups.20 In an in vitro study of neural and glial tissue grown in the presence of Teflon fibers, Ammar, et al.,1 have shown that Teflon is relatively inert and have therefore advocated its use in MVD procedures. To achieve decompression, Teflon wool is widely used as an implant placed between the vessels and the nerve root.4,5,10,11,14,16–18,21,24,27 Fukushima9 recommends the use of shredded Teflon wool slings to keep the vessel in place against the dura, a technique that prevents contact between the Teflon and the trigeminal sensory root.

At Frenchay Hospital, Bristol, England, we have treated 155 cases of TN using MVD, producing a cure rate of 90% over long-term follow-up periods of up to 17 years (mean follow-up period 6.25 years). The only significant complications have been unilateral deafness or cerebrospinal fluid rhinorrhea, which have occurred in less than 2% of cases. Other complications that have been reported in the literature include cranial nerve palsies, intracranial hematoma, cerebellar infarction, and (on rare occasions) death.17

We now report two cases of Teflon-induced granuloma causing recurrence of TN after initially successful MVD procedures. Only three other cases of TN recurrence caused by Teflon-induced granuloma have been reported in the literature. Cho, et al.,6 in their series of 400 MVDs, performed reexploratory surgery in 31 cases of recurrent TN and found severe adhesions between the Teflon felt and the trigeminal nerve in four of these cases, although they found actual granuloma formation in only two. Megerian, et al.,23 reported on a patient with hemifacial spasm treated by means of MVD who presented 3.5 years later with a cerebellopontine angle mass caused by Teflon-induced granuloma. The incidence of this complication in our series of 155 MVD procedures for TN was 1.3%.

**Case Reports**

**Case 1**

This 77-year-old woman presented with bilateral TN.

History. The patient had undergone MVD in April 1994 for right-sided maxillary division TN. The superior cerebellar artery (SCA) was found at surgery to compress the root entry zone (REZ). The SCA was separated and shredded Teflon wool was interposed between it and the trigeminal nerve root. The vessel was repositioned and secured against the tentorium using Teflon wool strips.

In January 1996, the patient presented with recurrence of right-sided maxillary division pain of 3 months’ duration and consented to reexploratory surgery.
Teflon-induced granuloma in trigeminal neuralgia

Operation and Pathological Findings. During reoperation Teflon wool was found to be densely adherent to the trigeminal nerve REZ. The SCA was found to have remained separated from the REZ and was still positioned against the tentorium. The Teflon was gently separated from the REZ by sharp dissection and partially excised. A piece of Surgicel was left between the REZ and the remaining Teflon. On biopsy, Teflon fibers were found embedded in collagenous connective tissue with a striking foreign body giant cell reaction. The microscopic appearance of the specimen was identical to that seen in Case 1 (Fig. 1b).

Postoperative Course. In the postoperative period the patient was relieved of pain but developed mild hypesthesia in the lower part of her face. She has remained free of pain thus far.

Case 2

History. This 61-year-old man with an 18-month history of TN in the mandibular division had undergone MVD in July 1995. The trigeminal vein and the SCA were found at that time to be compressing the REZ of the trigeminal nerve. The vein was coagulated and divided; the artery was dissected away from the REZ and secured against the tentorium using Teflon wool strips. The patient’s pain recurred 7 months after surgery. It was controlled with a regimen of 400 mg carbamazepine administered twice daily, but the drug caused mild drowsiness; this was not acceptable to the patient, and he requested a second operation.

Operation and Pathological Findings. On reoperation in June 1996 Teflon was found to be densely adherent to the REZ, separating it from the SCA. The Teflon was gently separated from the REZ by sharp dissection and partially excised. A piece of Surgicel was left between the REZ and the remaining Teflon. On biopsy, Teflon fibers were found embedded in collagenous connective tissue with a striking foreign body giant cell reaction. The microscopic appearance of the specimen was identical to that seen in Case 1 (Fig. 1b).

Discussion

Since the first reports of decompression of the trigeminal sensory root, a variety of materials have been used as implants in the procedure; these include muscle, fascia, Gelfoam, Ivalon sponges, cotton gauze, and Teflon wool.4,5,12,24,29 Teflon wool, which is teased from cardiovascular patch grafts (USCI, Billerica, MA), has excellent handling properties, is durable and adherent, and is also thought to be inert.1 It has therefore been our implant material of choice.

Teflon (polytetrafluoroethylene) is used most commonly by otolaryngologists, who inject it into paralyzed vocal cords for improvement of phonation.2,3 It is also used in the treatment of urinary incontinence,4 vesicoureteral reflux,5 temporomandibular joint disease,6 and facial irregularities.33 However, use of this material has not been free of complications. Dedo and Carlsson7 described pathological progression in Teflon-induced granuloma removed from human vocal cords 4 weeks to 16 years after Teflon implantation. On examining a surgical specimen 4 weeks postimplantation, the authors found Teflon fibers surrounded by histiocytes. At 3 months postimplantation, they found strands of fibrous tissue bridging the Teflon fibers, as well as abundant foreign body giant cells. Six months after surgery, the Teflon fibers were found to be encased in dense collagenous tissue with numerous giant cells containing intracytoplasmic Teflon particles. For the next 10 years the granuloma displayed continuous enlargement with no pleomorphic changes. In their case of Teflon-induced granuloma removed 3.5 years post-MVD, Megerian, et al.,23 found intact Teflon particles, foreign body giant cells, and dense collagenous tissue in the surgical specimen.

We found similar histopathological changes in our two cases. In the first case the Teflon was removed almost 1.5 years after surgery and showed spicules of Teflon embedded in neural tissue surrounded by multinucleated giant cells. In the second case, in which Teflon was removed almost 1 year after surgery, Teflon fibers were found on biopsy to be embedded in collagenous connective tissue with striking foreign body giant cell reaction.

In both these patients Teflon wool was densely adherent to neural tissue and was difficult to separate from it. Despite the reported lack of neural tissue reaction in experimental studies of Teflon, these two cases together with the three cases reported previously show that Teflon can

![Fig. 1. Photomicrographs. a: Case 1. A high magnification view of the Teflon-induced granuloma, showing refractile Teflon spicules engulfed by multinucleated foreign body giant cells. b: Case 2. Teflon particles embedded in cellular, granulomatous connective tissue. The particles take the form of elongate, refractile spicules, which have an irregular ovoid outline when cut transversely. H & E, original magnification × 400.](image-url)
TABLE 1
Surgical reexploration of MVD failures: findings and results

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age (yrs)</th>
<th>First MVD</th>
<th>Time to Relapse</th>
<th>Second Procedure</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69</td>
<td>SCA</td>
<td>2 mos</td>
<td>MVD (vein)</td>
<td>cure</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
<td>SCA</td>
<td>immediate</td>
<td>MVD (SCA)</td>
<td>cure</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>SCA</td>
<td>8 mos</td>
<td>MVD (vein)</td>
<td>no relief</td>
</tr>
<tr>
<td>4</td>
<td>57</td>
<td>SCA</td>
<td>12 mos</td>
<td>MVD (vein)</td>
<td>no relief</td>
</tr>
<tr>
<td>5</td>
<td>54</td>
<td>SCA</td>
<td>immediate</td>
<td>partial sensory rhizotomy</td>
<td>cure</td>
</tr>
<tr>
<td>6</td>
<td>44</td>
<td>SCA</td>
<td>6 mos</td>
<td>partial sensory rhizotomy</td>
<td>cure</td>
</tr>
<tr>
<td>7</td>
<td>58</td>
<td>SCA</td>
<td>7 mos</td>
<td>Teflon-induced granuloma</td>
<td>cure</td>
</tr>
<tr>
<td>8</td>
<td>77</td>
<td>SCA</td>
<td>18 mos</td>
<td>Teflon-induced granuloma</td>
<td>cure</td>
</tr>
</tbody>
</table>

Indeed, the Teflon felt is widely used today in MVD procedures for a variety of cranial nerve syndromes, and Teflon certainly cannot be held responsible for all cases of recurrence after these procedures. In the majority of MVD reexplorations, a second vessel is found to be compressing the nerve fibers or there is no obvious neural contact at all; in the latter case a partial sensory rhizotomy is performed.

In long-term follow-up studies of patients with TN treated by MVD, the rate of significant recurrence is reported to range from 12 to 31%. In our own series of 155 patients with TN treated by MVD and followed for as long as 17 years (mean 6.25 years), the recurrence rate has been 10%. In eight of these cases (5%), reexploratory surgery was performed. (The findings and results in these cases are presented in Table 1.) Only two patients in the entire series have continued to suffer significant pain.

It seems probable that prolonged pulsatile compression causes segmental demyelination in the trigeminal sensory root. On this assumption, the logical treatment is complete decompression of the sensory root, leaving no material in contact with nerve fibers. In early series of MVD, surgery was performed using interposed muscle, Ivalon sponges, or Teflon wool. Following the work of Fukushima, we always attempt complete decompression while repositioning the compressing vessel (usually the SCA) upward against the tentorium, to which it is secured using Teflon wool teased into thin strips to form slings. The Teflon fibers display remarkable adherence, enough to decompress most arteries. If the offending vessel is large and “springy,” the Teflon sling can be reinforced by means of fibrin tissue glue. In cases in which the compressing vessel is a large dolichoectatic loop of basilar or vertebral artery, Silastic sling fixation can be used.

References


Whenever possible, we perform complete decompression, leaving the trigeminal sensory root isolated from any contact with artificial material. Microvascular decompression in the two cases reported here seems to have failed because the Teflon was not sufficiently teased and was consequently too bulky, causing it to remain in contact with the nerve fibers. Also, no Surgicel was laid over the Teflon. We now recommend that pieces of Surgicel be placed and “smoothed over” the Teflon to isolate it from any possible contact with neural tissue.

This report is not intended to deter neurosurgeons from using Teflon; its purpose is simply to warn them of the possibility of granuloma formation. It is hoped that our recommendations will reduce the incidence of Teflon-induced granuloma leading to recurrent TN after MVD. Although Teflon wool strips have many advantages, perhaps it would be worthwhile to investigate the use of new materials.
Teflon-induced granuloma in trigeminal neuralgia


Manuscript received September 25, 1996.
Accepted in final form January 23, 1997.
Address reprint requests to: Hugh B. Coakham, F.R.C.P., F.R.C.S., Department of Neurological Surgery, Frenchay Hospital, Bristol BS16 1LE, England.