The Surgical Treatment of Trigeminal Neuralgia

Whilst drug therapy remains the first line of treatment for trigeminal neuralgia (TN), many patients do not achieve sufficient pain relief or suffer from side-effects. Furthermore, increasing numbers of patients are questioning the safety of long term medication. For these cases modern surgical treatments offer a safe and effective option with emphasis on microvascular decompression, a procedure which is reconstructive rather than destructive.

Prior to the late 1970s surgical approaches were not without risk or side-effects. The standard approaches then were neuro-destructive, consisting of Gasserian ganglion alcohol injection, percutaneous radiofrequency thermocoagulation (RFL) and fractional section of the sensory root – now known as partial sensory rhizotomy (PSR), carried out via a posterior fossa approach in the retro-mastoid region.[1]

By contrast, the early 1980s saw the introduction of non-destructive procedures; retrogasserian glycerol injection[2] and microvascular decompression[3]. Microvascular decompression (MVD) has not only resulted in improved results but has led to a better understanding of the pathophysiology of TN. Importantly, the non-destructive procedures do not usually cause facial numbness.

There is still a place for RFL, glycerol injections and PSR which will be described. However the good results and safety of MVD indicate that this procedure should no longer be thought of as a last resort.

The injection techniques have a 50% recurrence rate at one to seven years depending on technique used and are now used in treating patients unfit for open surgery due to co-morbidity or age.

Radiofrequency lesion or thermocoagulation (RFL)

Under brief general anaesthetic (GA) a needle electrode is passed through the foramen ovale under x-ray control and is adjusted until the tip lies just behind the ganglion within the sensory rootlets. A series of heat lesions are then made which result in variable sensory loss depending on the lesion intensity. Sensory loss is the common side effect, but corneal anaesthesia and dysaesthesia can occur, with pain relief lasting for five to seven years on average. RFL is generally used in patients with pain involving maxillary and mandibular divisions since attempts to treat ophthalmic TN are either unsuccessful or result in loss of corneal sensation

Retrogasserian glycerol injection

This technique is similar to RFL but after needle insertion the patient is repositioned with the head inclined downwards and a small amount of glycerol is injected into Meckel's cave around the sensory rootlets. The result is 'milder' than RFL with only a minimal risk of numbness or dysaesthesia but there is a shorter period of pain relief, 50% recurrence of neuralgia at one year in the author's experience.

Glycerol injection is ideal for treating ophthalmic TN when microsurgery is not possible. It is also useful as emergency treatment for severe cases whilst planning for MVD.

Patho-physiology

Neurovascular compression (NVC) is found in about 90% of TN cases who are not suffering from multiple sclerosis or have a causative lesion eg tumour, cyst or AVM. Jannetta pioneered the MVD operation in 1966 and hypothesised that the compression caused localised demyelination and this led to ephaptic transmission which results in the electric shock-like paroxysms of pain.[3,4] This theory was first proved by nerve biopsy studies in Bristol[5] and later confirmed by others.[6,7] However, there remains a small group of patients (about 10%) where no NVC exists and the cause of neuralgia in these cases remains unexplained. Some of these represent the initial symptom of multiple sclerosis (MS) despite the MRI being normal (personal observation).

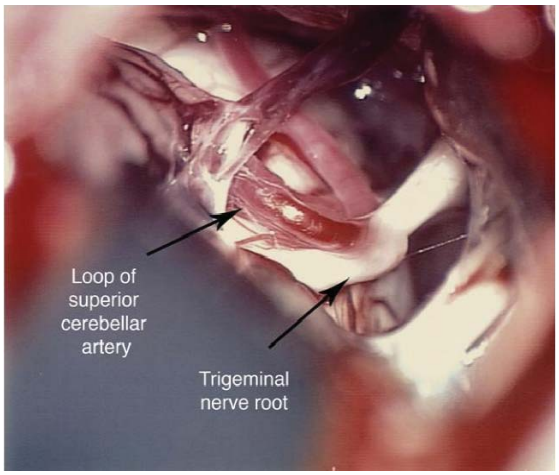
Microvascular decompression

Investigations

Imaging is necessary to detect a possible structural lesion or underlying MS. Also the presence of NVC can now be detected with high accuracy using appropriate MRI sequences.[8,9] Though NVC at the pontine root entry zone (REZ) is the commonest finding, NVC anywhere along the cysternal path of the nerve must be taken seriously and dealt with.[4]

Pre-operative consent

On the basis of results from the Frenchay Hospital/BUPA Hospital database patients are advised that there has been no mortality or serious neurological morbidity and that the commonest complications are CSF leak, unilateral hearing loss and dysaesthesia, all with less than 2% incidence.[10] In cases when no NVC appears on the MRI the patients are asked if they wish the surgeon to proceed to a PSR if there is no convincing NVC found at surgery. In the light of our follow-up studies reported here they are counselled about the risks and benefits of a PSR. This does not apply to patients with ophthalmic division TN (V1) which is unlikely to respond to a PSR. However fortunately the majority of patients with V1 TN have neurovascular compression and can be treated with MVD (personal observation).



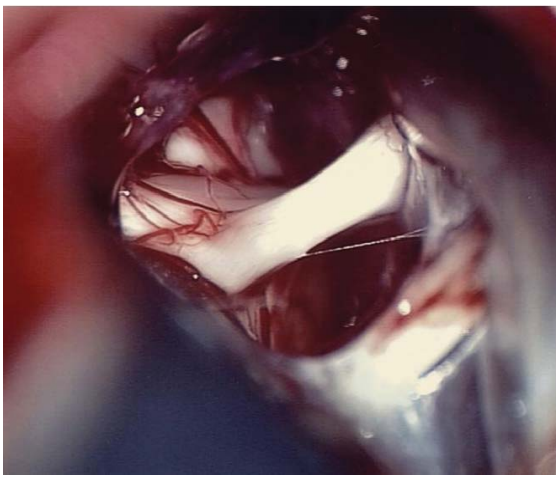


Figure 1a (top): Compression of the right trigeminal sensory root by a loop of the superior cerebellar artery.
Figure 1b (bottom): The artery has been fixed to the tentorium by a teflon wool sling resulting in total decompression. Note that the appearance of the nerve has already returned to normal.

Professor Coakham qualified at UCH London then trained in neurosurgery at the Guys-Maudsley Unit and was a fellow at Massachusetts General Hospital, Boston, USA. He was appointed as consultant to Frenchay Hospital and awarded the first Personal Chair in Neurosurgery by the University of Bristol. He developed an early interest in surgery of the skull base and cranial nerves. In the UK he has pioneered microvascular decompression for trigeminal neuralgia, hemifacial spasm and glossopharyngeal neuralgia. He has been involved in new operative approaches for skull base tumours and has taught on skull base dissection courses in the UK and USA. Neurophysiological intraoperative monitoring and hearing preservation in vestibular schwannoma surgery have been a particular interest.

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Abbreviations
TN - trigeminal neuralgia
RFL - radiofrequency thermocoagulation
PSR - partial sensory rhizotomy
MVD - microvascular decompression
NVC - neurovascular compression
MS - multiple sclerosis
AVM - arteriovenous malformation

Support group for patients:
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PO Box 413,
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T. 020 8462 2478.
W. www.tna.org.uk
Registered Charity No. 1093022.

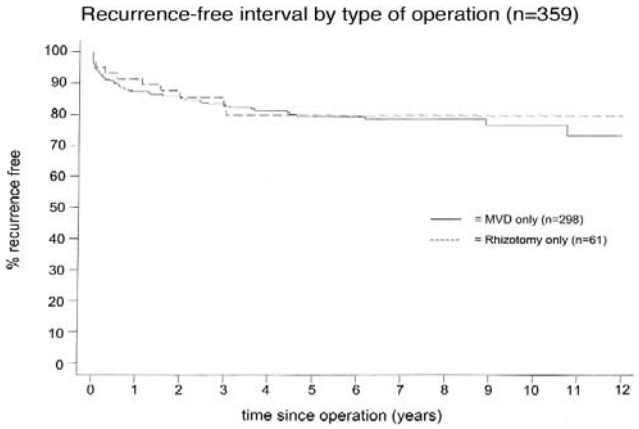

Figure 2: A Kaplan-Meier plot showing neuralgia cure to be close to 80% at 12-year follow-up of 359 cases. Results of MVD and PSR are almost identical.

Table 1: Patients' views on their surgical outcomes after microvascular decompression or partial sensory rhizotomy.
Primary group = no previous invasive therapy.
Non-primary group = previous therapy by glycerol injection, RFL or peripheral nerve block. (Reference 15)

	Primary group		Non-primary group	
	MVD	PSR	MVD	PSR
Satisfaction with current situation	96%	75%	76%	64%
Would have preferred earlier surgery	78%	65%	71%	52%
Result better than expected	82%	60%	59%	52%
Would have same surgery again	80%	59%	66%	52%
Would have drug therapy again	2%	0%	0%	0%

Microvascular Decompression - Procedure

Under GA a keyhole retromastoid craniotomy is performed and the upper cerebellopontine angle is entered. Sufficient retraction is necessary to visualise the whole intracysternal nerve root since compression can occur anywhere. Occasionally neuro-endoscopy is helpful, especially if the petrous bone anatomy is anomalous.[11] The commonest compressive vessel is a loop of medially placed superior cerebellar artery (Figure 1) but in about 25% of cases multiple vessels are responsible and all must be carefully identified and dealt with.[4] Veins are diathermied and divided, arteries are dissected free of neural contact. Following Jannetta's technique, many surgeons then interpose a pledget of Teflon wool between artery and nerve.[4] Following the teaching of Fukushima[12] we prefer to carry out a 'total decompression' using sling retraction in which small Teflon tapes and Tisseel glue are used to tether the offending vessel to a distant structure, either the tentorium or dura.[13]

Headache and nausea may occur for 12 to 24 hours but rapid recovery usually follows with the average discharge being on the third post-operative day. Many patients are fully recovered in about one month.

Partial Sensory Rhizotomy - Procedure

The approach is identical to MVD but when no NVC is present a 50% to 75% incision is made in the caudal part of the root entry zone. This sounds radical but it has long been observed that subsequent sensory loss is less than would be expected and total anaesthesia of the lower face is rare.[14] In our own patient survey only 48% reported numbness.[15]

Long-term results of MVD and PSR

These results were analysed by the surgical team as an observational study. The same patient data was then independently analysed by means of a separate patient survey.

Observational study

The Frenchay Hospital/BUPA Hospital results were prospectively entered on to a database managed by two nurse practitioners over a 15-year period. Annual mail or telephone follow-up was carried out. Results are shown as a Kaplan-Meier plot in Figure 2 which demonstrates a 5-year cure rate of 80% falling slightly by 12 years.[10]

Patients surveyed by questionnaire

For the first time to our knowledge, the surgical database was transferred (with patient consent) to an independent group led by Prof JM Zakarzewska, Physician in Oral Medicine specializing in facial pain, St Barts and the London Hospitals. All patients were sent a detailed questionnaire and results analysed according to operative procedure and whether or not previous intervention had occurred (designated 'primary' and 'non-primary').[15] This patient-orientated study revealed an overall 5-year cure rate of 79%, better for primary cases (84%) and worse for non primary cases (70%). 96% of primary MVD patients were satisfied with results as opposed to 64% of non primary patients who required PSR. Most patients answered that they should have had the surgery sooner and that the results exceeded their expectations. Drug therapy was surprisingly unpopular, however this was a selected group that had failed on medication and therefore been referred for surgery (Table 1).

Finally, it should be pointed out that this study confirms other reports that patients who have previously received ablative/destructive treatment do not respond so well to MVD.[16,17] Obviously patients who are too elderly, unfit or reluctant to undergo open surgery would be offered Gasserian injections either with glycerol or radiofrequency thermocoagulation.

Conclusion

MVD is now established as a safe and effective treatment for TN in patients where medication has failed. Our objective, patient-orientated review has indicated that MVD should be offered earlier and preferably as first- line treatment before any injection therapy which can adversely affect the operative success rate. Partial sensory rhizotomy still remains a good back-up procedure for those patients without vascular compression and gives a long-term cure rate similar to MVD. Meticulous surgical technique is essential and experience helps; it has been confirmed that surgeons performing high numbers of MVD procedures achieve better results.[18]

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