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Research

Percutaneous Radiofrequency Neurotomy for Chronic Neck Pain: Outcomes in a Series of Consecutive Patients

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ABSTRACT

Background. Randomized controlled trials in research settings have demonstrated the efficacy of percutaneous radiofrequency neurotomy of the medial branches of the cervical dorsal rami in the palliation of chronic zygapophysial joint pain, a common cause of chronic neck pain, but one that is under-recognized in some quarters.

Aims. This study aimed to determine the outcomes of radiofrequency neurotomy in usual clinical practice for patients with established cervical zygapophysial joint pain.

Methods. The study was conducted in a public hospital, incorporating the private practice and public clinic elements of a single physician. All patients who underwent radiofrequency neurotomy had a diagnosis of cervical zygapophysial joint pain established by controlled cervical medial branch blocks. The primary outcome of duration of pain relief was determined for all consecutive procedures performed during a two-year period. Data were collected by chart review and telephone contact by an independent assessor.

Results. Forty-seven procedures were performed on 35 patients. Two patients were lost to follow-up. Twelve patients had two procedures. Thirty-six of 45 assessable procedures (80%) achieved significant pain relief. These 36 procedures achieved a mean duration of pain relief of 36 weeks, with a median of 35 weeks. Repeat procedures usually achieved reproducible pain relief. Most patients had significant postprocedural pain for about one week. Only one serious adverse event (local superficial infection) was reported.

Conclusion. Radiofrequency neurotomy is an effective palliative treatment for chronic cervical zygapophysial joint pain when performed in routine clinical practice.

Key Words. Neck Pain; Radiofrequency Neurotomy

Background

Percutaneous radiofrequency (RF) neurotomy of the medial branches of the cervical dorsal rami is a palliative, pain-relieving intervention for patients with demonstrated cervical zygapophysial joint pain. The technique has been demonstrated to be efficacious in a formal, randomized, placebo-controlled clinical trial [1]. Systematic reviews have lamented the paucity of literature on RF neurotomy for the treatment of neck pain [2,3]. They have found only one acceptable study [1]. Although this study did show a profound effect greater than that of placebo, reviewers have concluded that in the absence of other studies its results cannot be generalized.

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Generalizability is an important feature of any therapeutic procedure. It is a measure of the extent to which others can achieve the same outcomes as those of the original authors. In practical terms, generalizability is reflected by the extent to which practitioners in conventional practice can reproduce results obtained in academic, research studies.

One means of providing evidence of generalizability might be to conduct another placebo-controlled trial. However, in the case of RF neurotomy, ethical consideration would restrict such a trial to the minimum number of patients necessary to achieve statistical significance. Such a small trial would not provide the type of data usually required to demonstrate generalizability.

Another approach is to conduct a thorough audit of outcomes achieved in a substantial series of patients. Such a study would demonstrate whether the same or similar outcomes can be achieved in conventional practice as have been reported in research studies. In particular, such a study would show whether a procedure works in the hands of others.

The present study was undertaken to answer the call for evidence of generalizability of RF neurotomy for neck pain [4]. It was a comprehensive audit of all consecutive patients, eligible for RF neurotomy, who presented to a single specialist in conventional, hospital practice. The primary outcome was duration of clinically useful pain relief, as assessed by the patient.

Methods

Setting

The study was conducted at Concord Hospital in Sydney, Australia, which is a teaching hospital of the University of Sydney. All patients in the study were referred to the private rooms or public clinics of the author for the further evaluation of chronic neck pain.

Patients

The study cohort consisted of all, consecutive patients who had undergone percutaneous RF neurotomy between June 1998 and July 2000. All patients undergoing RF neurotomy had completed diagnostic workup using multiple cervical medial branch blocks, including placebo injections for levels below C2–3. To be eligible, patients had demonstrated definite or complete relief of pain with both anesthetic agents and no response to placebo under double-blind conditions, using the protocol of Lord et al. [5].

Blocks were performed in accordance with the pattern of innervation of the target joints. At typical cervical levels both medial branches that innervated the target joint were blocked. For the C2–3 joint, only the third occipital nerve was blocked, for it is the sole source of articular branches to this joint. Technical details on the execution and validation of cervical medial branch blocks have been reported elsewhere [6,7].

Technique

All the RF neurotomy procedures in this series were performed by the author. They were performed in an angiography suite using a motorized C-arm fluoroscope that allowed the operator to accurately position the camera himself. A Radionics RRE electrode was used with an RFG 5 RF generator. The electrode positioning was performed in accordance with the protocol of Lord et al. [1,8]. After skin preparation, and under aseptic conditions and fluoroscopic control, the electrode was introduced percutaneously. It was then directed to lie parallel and immediately against the target nerve. For the C2–3 joint the third occipital nerve was the target. For joints below C2–3 both medial branches that innervated the joint were targeted. For each nerve the electrode was introduced twice; once along a parasagittal path to reach the nerve as it crossed the lateral aspect of the ipsisegmental articular pillar, and again at a 30° angle to the sagittal plane in order to reach the nerve over the anterolateral aspect of the pillar. At each location two or three lesions were made (depending on the size of the articular pillar) to accommodate possible variation in the course of the nerve. Lesions were created at 80°C for 90 seconds.

Outcome

The objective of the treatment was to provide complete relief of pain. The primary outcome was the duration of this relief. The end point adopted in this study was the return of any of the patient's usual neck pain. Secondary outcomes were the duration of any postoperative pain and any other adverse effects. Outcomes were determined by an independent assessor who had no prior knowledge of the patient and no involvement in the treatment or routine follow-up of patients. Where there was insufficient information in the patient's chart to determine the duration of any pain relief, the assessor attempted to contact the patient by telephone. A deliberately conservative approach was adopted. Where there was incomplete follow-up,

the patient was assumed to only have had pain relief until the last recorded observation where pain relief had been noted. If pain relief was anything other than complete, the duration of pain relief was assessed as zero.

Previous studies have noted that RF neurotomy at C2–3 (third occipital neurotomy) appears to be less effective than at lower levels [8]. Other interest has focused on whether an active compensation claim influences outcome [9]. To study the effects in the present cohort, a post hoc analysis was performed using survival analysis to assess the effects of these variables on the duration of pain relief. The duration of pain relief was determined before compensation status was ascertained and without reference to the treated level, effectively blinding the assessor to these variables. In this context, compensation claim means involvement in legal procedures against workers' compensation or third party motor vehicle accident insurers.

Results

During the enrollment period, 35 patients were identified as having cervical zygapophysial joint pain through meeting the above criteria. Forty-seven procedures were performed on 35 patients. Although this number may appear small to some practitioners, it reflects the nature of the author's practice, which focuses on general rheumatology, and allows only one day per week for interventional pain medicine.

The characteristics of the patients are shown in Table 1. Twelve patients had two procedures because of either failure of the initial procedure or the return of pain. Follow-up data were not available on two patients for any of their procedures, despite numerous attempts to contact them. The two most commonly treated levels were C2–3 and C5–6 (Table 2).

Radiofrequency neurotomy failed to produce relief in seven of the 33 patients at the initial attempt. Three of these patients underwent a second attempt. One failed again to obtain relief, but two obtained relief (Figure 1). The other four patients chose not to try repeat treatment.

Table 1 Characteristics of the patients treated with cervical radiofrequency neurotomy

Patient Characteristics	
Number	35
Age, mean (SD)	48.4 years (12.5)
Male : female	23 : 12
Duration of neck pain, median (range)	96 months (24–336)
Compensable (%)	40

Table 2 The number of radiofrequency neurotomies performed distributed by segmental level treated

Segmental Level	N
C2–3	23
C3–4	4
C4–5	4
C5–6	9
C6–7	4
C2–3, C3–4	1
C4–5, C5–6	1
C5–6, C6–7	1

The remaining 26 patients (74% of the original 35) obtained complete relief of their pain immediately after treatment. In these patients the median duration of ensuing relief was 36 weeks, with a mean of 35 weeks (Figure 1). Among the responders, five patients obtained relief for eight weeks or less. However, the other 21 (60% of the original 35) obtained complete relief for a period in excess of 12 weeks, median duration of 44 weeks (Figure 1).

The duration of relief following third occipital neurotomy for C2–3 joint pain was less than that following neurotomy at typical cervical levels and similarly compensable patients had shorter durations of relief than non compensable patients (Table 3). However, using a Cox regression analysis incorporating both variables neither compensability ($P = 0.059$) nor C2–3 ($P = 0.197$) was significantly related to the duration of pain relief.

Adverse Effects

Almost all patients reported significant postoperative pain. This ranged from no pain to aggravation of pain for three months in a single case. This latter procedure was not successful, but a subsequent repeat procedure has achieved profound and ongoing relief. Most patients had procedural pain for about one week. Only one serious adverse effect was noted, with a local wound infection following a third occipital nerve denervation. Computed tomography and labeled white cell imaging revealed the infection to be superficial, and it settled with oral antibiotics without sequelae. A subsequent procedure on the same patient has been accomplished without incident.

Discussion

The results clearly show that clinically useful pain relief can be achieved in the majority of patients

Table 3 Outcomes of patients treated by cervical radiofrequency neurotomy, tabulated according to compensation status and segment treated

	Duration of Relief (Weeks, Median, [Interquartile Range])		
	C2–3	Below C2–3	All Levels
Compensation	12 (1.5–16)	32 (18.5–44)	16 (4.5–41)
No compensation	44 (3–52)	30 (16–52)	32 (5–52)
All	16 (1–52)	30 (16–52)	

with demonstrated cervical zygapophysial joint pain in the setting of routine clinical practice. The results noted in this study echo those seen in previous studies, lending external validity to the primary work.

This study was performed in the setting of specialist practice in a teaching hospital. The author is known to have an interest in neck pain, and percutaneous RF in particular. Therefore, it might be argued that this practice constitutes a special case. Some might note that the author had been involved in the original randomized trial of this procedure [1]; but in that role he did not perform any of the procedures, and served only as an assessor and coinvestigator. Otherwise, he had previously performed no more than a small handful of cases reported elsewhere [10].

On the other hand it is just as reasonable to argue that the setting of the present study is an accurate reflection of conventional specialist practice, with referrals being directed to individuals or units with particular interests or skills. On balance, there is no reason to think that the patients in this study are any different from those encountered in most specialist practices dealing with neck pain.

The present study did not use a formal measurement of pain (such as visual analog scales or pain questionnaires) as an end point. This was due, in part, to a lack of resources, but also reflects the outcome tested. Patients were not required to quantify their pain. Partial relief, which would require a numerical measure, was not the objective. The outcomes were complete relief of pain and its duration. Patients were simply asked whether they had pain; and if not, how long they

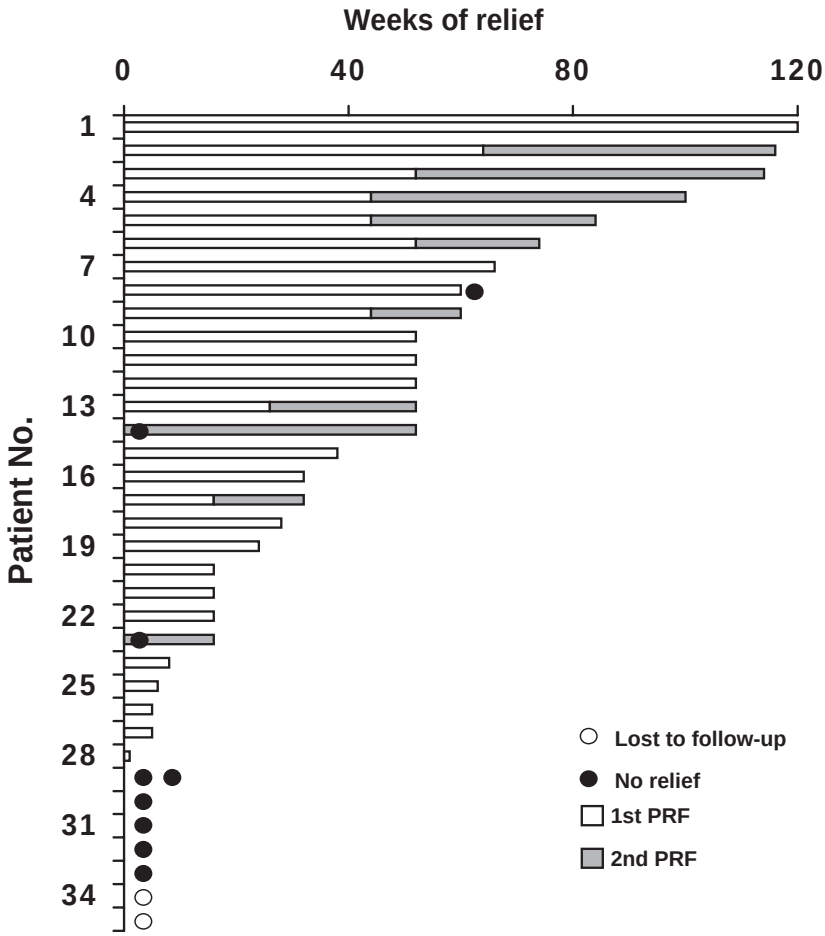

Figure 1 Graphical depiction of the duration of pain relief obtained by 45 consecutive procedures displayed by patient. The black dots represent procedures that were unsuccessful, resulting in no relief of pain. In two cases (patients 14 and 23) the first procedure failed to relieve pain whereas the second procedure on both patients was successful. PRF = percutaneous radiofrequency.

remained free of pain. Complete relief of pain, or not, is based on a categorical response by the patient that does not require quantification. With respect to determining duration of relief, a previous study has shown that patients are quite capable of recognizing return of pain, and their personal, quantitative estimates of its severity correlate closely with those of validated, quasiobjective, structured assessments [11].

The effect of having an active compensation case on the duration of pain relief has not been resolved by this study. It is possible that there is a type 2 error, with this study being insufficiently large to detect a significant difference. However, the question is whether the observed difference is sufficiently large for it to influence patient selection for RF neurotomy. On the basis of this and previous studies [9], there would seem to be no justification for excluding patients with compensable injuries from this intervention. They remain highly likely to obtain pain relief for clinically important periods of time.

The results at the C2–3 level in this study are gratifying. The improvement over the previous results [8] most likely reflects iterative improvements based on increasing experience with the technique. This is consistent with recent reports of the effectiveness of third occipital neurotomy for headache [12].

Although cervical RF neurotomy is not universally successful, it is the only intervention for neck pain that has been shown to be capable of providing patients with complete relief of pain, and is the only therapeutic procedure for pain stemming from the cervical zygapophysial joints. By echoing the results of the original research studies of this procedure, perhaps the results of the present study might encourage others to make this treatment available to their patients.

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