

Microsurgical spinothalamic chordotomy in the treatment of cancer pain

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Summary

Purpose: Advances in cancer treatment continue to lengthen survival among cancer patients. As patients live longer, the need for effective pain control has gained increased importance for improving quality of life. In patients who do not respond to all available conservative methods of therapy for cancer pain, surgical methods have been applied; one of them is the open high thoracic spinothalamic chordotomy.

Patients and methods: We present a group of 86 patients suffering from nociceptive cancer pain, caused by compression of lumbosacral plexus. All patients were treated by microsurgical open high thoracic spinothalamic chordotomy. These patients did not respond to any available conservative treatment.

Results: Immediately after surgery 68 (79%) patients had total pain relief. Of the remaining 18 (21%) patients,

significant pain relief was achieved in 9 (10%), while in the remaining 9 patients this procedure had no effect. After a 6-month follow-up, total pain relief remained in 62 (72%) and significant pain relief in 10 (17%) of the patients. From 62 of patients with well-defined unilateral pain treated by "moderately deep" chordotomy, total pain relief was achieved in 53 (85%), lasting for 6 months in 49 (79%) of them.

Conclusion: These results show that microsurgical chordotomy can achieve total control of intractable cancer pain in the majority (79%) of patients, especially in those with well-defined unilateral pain (85%), indicating the usefulness of this surgical approach in the treatment of nociceptive cancer pain.

Key words: anterolateral spinothalamic chordotomy, cancer pain, palliative care, quality of life

Introduction

Advances in cancer treatment continue to lengthen survival in cancer patients, so that the need for effective pain control has gained increased importance for improving the patients' quality of life. In patients who

do not respond to all available conservative methods of therapy for cancer pain, surgical methods have been applied; one of them is the microsurgical open high thoracic spinothalamic chordotomy.

The spinothalamic or anterolateral chordotomy includes section of fibers in the spinothalamic tract situated in the ventrolateral segments of the spinal cord (Figure 1) [1]. Successful section results in anesthesia for pain and temperature on the opposite side of the body at the level of one to two segments below the section area. The spinothalamic tract decussates either within one or several segments rostrally from their cell bodies into the dorsal spinal horn. The sensation of touch vibration and position is preserved [2,3].

Typical unilateral anterolateral chordotomy severs spinothalamic, spinoreticular, spinothecal, and dorsal and ventral spinocerebellar long tracts at one side. This results in degeneration in nuclei ventralis posterior lateralis, parafascicularis and centralis latera-

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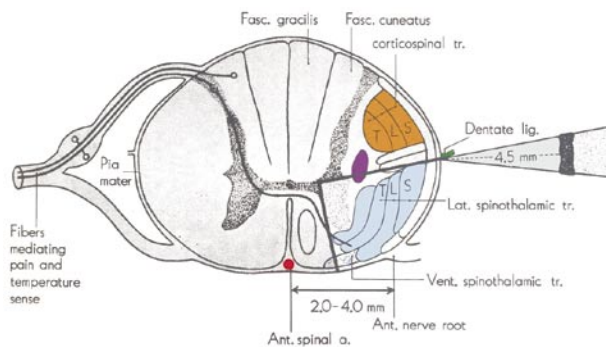


Figure 1. Simplified schematic representation of the techniques and objectives of anterolateral open chordotomy [1].

lis. Simultaneously, targeted are nucleus cuneiformis, the periaqueductal gray in the midbrain, and reticular nuclei in the lower brain stem [4].

If the bilateral procedure is performed, chordotomy on the opposite side is done at the level of one or two segments above or below the previously sectioned side.

Recent studies by positron emission tomography (PET) demonstrated reduced cerebral blood flow in the contralateral hemithalamus without cortical difference in blood flow in patients who had unilateral cancer pain. After chordotomy and the resulting decrease of neuronal activity projecting to thalamic synapses, blood flow is restored to normal [5].

For a long time spinothalamic chordotomy, unilateral or bilateral, was carried out without magnification, as a classical neurosurgical procedure under naked eye. Postoperative results were not so favorable, so that the microsurgical procedure has been introduced. The microsurgical technique provides not only a correct identification of anatomical structures, but also the very precise position, angle and depth of the chordotomy incision.

The aim of our study was to evaluate the advantages of microsurgical chordotomy compared to the classical, under naked eye, technique, and to register the type of cancer pain best responding to the microsurgical chordotomy.

Patients and methods

A group of 86 patients suffering from intractable nociceptive cancer pain, caused by compression of the lumbosacral plexus by different malignancies was included in the present study (Table 1).

These patients did not respond to any available conservative treatment of chronic pain. There were 48

Table 1. Etiology of pain according to the kind of malignancy

Localization	No. of patients	%
Uterus	18	21
Prostate	3	3
Bladder	8	9
Rectum	26	31
Colon	31	36
Total	86	100

females and 38 males; the patients' average age was 57 years (range 28-72).

In all patients we performed a high thoracic level (T1-T2 vertebral segments) microsurgical spinothalamic chordotomy under general anesthesia. According to the distribution of pain (Table 2) we performed different types of microsurgical techniques.

In 62/77 (80%) patients with well-defined and more laterally localized pain (lumbosacral, lumbar, lumbar/upper leg, and leg) unilateral chordotomy at the "moderate depth" of 3.5 mm was performed.

In 15/77 (20%) patients with unilateral, more medially localized pain (perianal/perigenital, sacral and sacroiliac) a "maximally deep" unilateral chordotomy was done.

In 9 patients suffering from bilateral lumbar or lumbosacral pain alone or median and bilateral perineopelvic pain we performed a bilateral high thoracic spinothalamic chordotomy in one stage.

Results

Total pain relief immediately after unilateral and bilateral chordotomy was achieved in 79% (68/86) of the patients. Significant decrease of pain was

Table 2. Distribution of pain

Region	Unilateral		Bilateral	
	No. of patients	%	No. of patients	%
Perianal/perigenital	4	5	1	1
Sacral	3	4	—	—
Sacroiliac	8	9	—	—
Lumbosacral	13	15	5	6
Lumbar	12	14	—	—
Lumbar/upper leg	17	20	—	—
Leg	20	23	3	3
Total	77	90	9	10

Table 3. Pain relief immediately after different types of microsurgical chordotomy

Type of chordotomy (n)	Degree of pain relief		
	Total n (%)	Significant n (%)	Non satisfactory n (%)
Unilateral to 3.5 mm (62)	53 (85)	6 (10)	3 (5)
Unilateral to 4.5 mm (15)	10 (67)	2 (13)	3 (20)
Bilateral (9)	5 (56)	1 (11)	3 (33)
Total (86)	68 (79)	9 (10)	9 (10)

obtained in 10% (9/86), while no effect was seen in another 10% (9/86) of patients. The best results were achieved in patients with well-defined unilateral pain requiring “moderately deep” chordotomy, in whom total pain relief was obtained in 85% (53/62) of them (Table 3).

After 6 months, total pain relief persisted in 72% (62/86), significant in 17% (15/86) and not satisfactory in 10% (9/86) of the patients. The number of patients with significant pain relief was reduced because of partial recurrence of pain in 6 patients from the group having total pain relief immediately after surgery (Table 4).

Postoperative neurological dysfunctions appeared as transient in 33% (34/86) and persistent in 11% (10/86) of the patients. Patients suffering from postoperative complications according to different types of chordotomy are presented in Table 5.

“Mirror pain”, a new pain on the ipsilateral side of chordotomy, appeared in 9 (10%) patients. Development of new pain on the contralateral side of chordotomy developed in 7 (9%) patients due to disease progression.

No patient died as a result of the procedure.

Table 4. Pain relief 6 months after different types of microsurgical chordotomy

Type of chordotomy (n)	Degree of pain relief		
	Total n (%)	Significant n (%)	Non satisfactory n (%)
Unilateral to 3.5 mm (62)	49 (85)	10 (10)	3 (5)
Unilateral to 4.5 mm (15)	9 (67)	3 (13)	3 (20)
Bilateral (9)	4 (56)	2 (11)	3 (33)
Total (86)	62 (72)	15 (17)	9 (10)

Table 5. Complications after different types of microsurgical chordotomy

Complication	Types of chordotomy		
	Moderately deep (n = 62)	Maximally deep (n = 15)	Bilateral (n = 9)
Transient			
Paresis of leg	5	3	3
Dysesthesia	7	4	3
Urinary dysfunction	3	2	3
Total	15	9	9
Persistent			
Paresis of leg	–	1	1
Dysesthesia	1	2	2
Urinary dysfunction	–	1	2
Total	1	4	5

Discussion

Total pain relief immediately after microsurgery was obtained in 79% of our patients. This result supports the advantage of this procedure over the classic under naked eye one, which enables the same effect in 64% of the patients [6]. Regarding both total and significant pain relief immediately after microsurgery, about 90% of all our patients benefited from this method of cancer pain control. Postoperative persistent complications after microsurgery were less frequent than after the classic technique. Persistent bladder dysfunction appeared in 3% of our patients, while in patients treated by the classic method it occurred in 28% [7]. Similarly, only 2% of our patients suffered permanent paresis of the leg, compared to 22% of patients after the classic procedure [7], indicating again the advantage of microsurgery.

Moreover, there was no mortality in our group of patients, which can reach up to 13% after the classic chordotomy [8].

The “mirror pain”, which appeared in 10% of our patients a few days or weeks after unilateral chordotomy, was weak or of moderate intensity. An explanation could be that the “mirror pain” was already present but masked by more severe contralateral pain and emerged as symptom after the main pain was eliminated by chordotomy. This phenomenon has been widely recognized to occur in 9-36% of patients [9]. Our results for mirror pain compare favorably among the best of the relevant literature, maybe because of good postchordotomy analgesia [10].

In our patients with laterally localized pain, requiring “moderately deep” unilateral chordotomy,

total pain relief was achieved in 53/62 (85%) of them. However, in patients with medially distributed pain in whom “maximally deep” technique was applied, immediate pain relief was obtained in fewer patients (10/15). Our experience by bilateral chordotomy was also less rewarding. This microsurgical technique resulted in total pain relief in 5/9 of our patients. This is in accordance with the results of classic bilateral chordotomy, which provides analgesia in 51% of the patients [11].

Although the patients treated by “maximally deep” and bilateral chordotomy were fewer than those treated with “moderately deep” technique, the differences in the therapeutic outcome might be due to the somatotropic organization of the spinothalamic tract [12]. When the pain is settled medially (perianal and perigenital regions) or bilaterally, a larger area is affected and the section has to be deeper than in unilaterally localized pain.

The differences in pain relief obtained after different types of microsurgery remained unchanged 6 months after the operation. Disease progression in 7 (9%) patients resulted in the development of new pain on the contralateral side, outside of the achieved analgesic level postchordotomy. These results confirm that chordotomy has to be considered in patients whose life expectancy is longer than 6 months.

Considering the postoperative complications, our results suggest that persistent neurological deficits are extremely rare in patients treated by “moderately deep” chordotomy. In the other two groups of patients they were more frequent, particularly after bilateral chordotomy.

Transient complications, as could be expected, appeared more often than persistent ones. The latter were more or less similar in all three groups of patients.

All these differences concerning the therapeutic outcome and postoperative complications among the three groups of patients could be attributed to the location of pain and, consequently, to the incision depth. Well-defined, laterally distributed pain may be totally eliminated by “moderately deep” incision, followed mainly by transient dysfunctions. On the contrary, for satisfactory relief of bilateral or more medially located pain, deeper cord incision is needed, but at the risk of more serious complications [13,14].

We conclude that our results confirm the advantages of the microsurgical technique over the classic chordotomy, both in terms of the therapeutic effects and postoperative complications. They also

indicate that the success of microsurgical techniques is dependent on the type of cancer pain. Nociceptive pain localized unilaterally in the lumbosacral, lumbar, lumbar/upper leg or leg regions can be eliminated in 85% of patients by unilateral “moderately deep” microsurgical chordotomy. Additionally, persistent postoperative complications are extremely rare.

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References

1. Kahn EA, Crosby EC, Schneider RC, Taren JA (eds). *Correlative Neurosurgery*. CC Thomas, Springfield, USA, 1969.
2. Brodal A (ed). *Neurological Anatomy in Relation to Clinical Medicine* (3rd edn). New York, Oxford University Press, 1981, pp 46-47.
3. Noordenbos W, Wall PD. Diverse sensory functions with an almost totally divided spinal cord; a case of spinal cord transection with preservation of one anterolateral quadrant. *Pain* 1976; 2: 185-195.
4. Di Piero V, Jones AKP, Iannotti F et al. Chronic pain: A PET study of the central effects of percutaneous high cervical chordotomy. *Pain* 1991; 46: 9-11.
5. Hardy J, Lecklerck TA, Mercky F. Microsurgical chordotomy by the anterior approach: Technical note. *J Neurosurg* 1975; 41: 640-643.
6. Mansuy L, Sindou M. La cordotomie spino-thalamique dans les douleurs cancéreuses. *Neuro-Chirurgie* 1976; 22: 437-444.
7. Sweet WH. Recent observations pertinent to improving anterolateral chordotomy. *Clin Neurosurg* 1976; 23: 80-95.
8. White JC, Sweet WH (eds). *Anterolateral chordotomy*. Ravena Press, New York, 1979, Vol 3, pp 911-919.
9. Nagaro T, Kimura S, Arai T. A mechanism of new pain following chordotomy; reference of sensation. *Pain* 1987; 30: 89-91.
10. Browsher D. Contralateral mirror-image pain following anterolateral chordotomy. *Pain* 1988; 33: 63-65.
11. Siegfried J, Khner A, Sturm V. Neurological treatment of cancer pain. Recent results. *Cancer Res* 1984; 89:148-155.
12. Wilkins HR (ed). *Neurosurgery*. McGraw Hill Book Co, 1985, pp 2439-2445.
13. Prithvi Raj P. Practical Management of Pain. *Cancer Pain* 2000; 3: 241-253.
14. Watkins ES. The Place of Neurosurgery in the Relief of Intractable Pain. In: Swerdlow M (ed): *Relief of Intractable Pain*. Excerpta Medica, Amsterdam, 1978, pp 257-260.