Surgical management of chronic pain

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Abstract

Pain is a common symptom and usually relieved by medication. It is generally a consequence of disease or injury although sometimes can develop without any obvious underlying pathology. When it is not relieved, despite high doses of opioids or other agents, and irrespective of its cause, it becomes necessary to consider physical interventions on the nervous system to obtain that relief.

The effects of division of the pain-transmitting pathway in the spinal cord, and of section of the trigeminal nerve root adjacent to the brain were published 100 years ago establishing the principles of surgery for pain relief. New techniques and modern imaging now add to our knowledge and to the procedures that we can use to control intractable pain.

Keywords Cordotomy; mesencephalotomy; myelotomy; nervous system; pain; pathway

Introduction

This article is not intended as an exhaustive compendium. Hopefully it will serve as a guide for those who must consider 'cutting for pain' and provide some insight into case and procedure selection for the uninitiated. In the main it will consider the pain of malignant disease but benign situations that demand surgical attention are also discussed.

Basic considerations

Some procedures carry significant risk and some may not anticipate disease progression adequately. A logical considered approach based on knowledge of the disease, knowledge of the patient, and knowledge of neuroanatomy allows bespoke intervention with predictable results rather than a series of random procedures which might not afford useful pain relief.

The disease

The source of pain should be identifiable, whether it is from tissue destruction, mechanical instability, compression of neural tissues, or some intrinsic neural hyperactivity. If there is a reasonable local procedure which will relieve the pain, perhaps decompression, stabilization of an unstable spine or radiotherapy, this should be undertaken before surgery directed at the symptom of pain alone.

When these options are no longer appropriate it is still relevant to know the state of the underlying disease as, especially in malignant disease, an intervention should anticipate disease and symptom spread. Little frustrates more than unilateral or segmental pain relief which is followed several weeks later by contralateral pain. Before cross-sectional imaging was so readily available this situation arose as analgesic reduction unmasked previously unrecognized disease.

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The patient

Knowledge of the patient's medical condition and of their expectations of the intervention will help direct any consultation. Complete pain relief may not be possible, perhaps because of the spread of disease or its nature or because it could only be achieved at the cost of producing or worsening an existing neurological deficit. The patient must comprehend the possible neurological consequences of a procedure before consenting.

In addition, honesty about the prognosis is essential when considering pain from malignant disease. Major procedures which might be very effective in some situations are inappropriate if the life expectancy is measured in weeks. The treating team, the interventionist and the patient and their family should all have broadly the same picture. Patients who are in severe pain will often blindly agree to anything that is proposed. Because of the emotional resonances of the underlying disease, the distress of living with intense pain, lack of sleep, and the effects of high doses of medication it is usually wisest to suggest a second interview as this allows a period of reflection and an opportunity to prepare questions or seek additional information. It also allows a reassessment of a situation which may have been masked by medication.

How to treat? Where to treat?

There is little value in trying to distinguish between neuropathic and nociceptive pain. Despite the common sense that suggests that destructive procedures should be avoided, these can be effective even for centrally arising neuropathic pain. The converse is also true, that augmentative procedures by electrical stimulation can be effective for centrally arising neuropathic pain and nociceptive pain alike. It is only possible to list below the anatomical targets that are accessible with brief notes about the indications, procedures and caveats that apply to each. For simplicity they are presented in anatomically hierarchical ascending order. Table 1 provides a brief overview. Figure 1 shows a typical thoracic spinal cord section with relevant tracts highlighted.

Ablative procedures

Some anatomical targets can be accessed percutaneously allowing real-time intraoperative physiological verification of the chosen target by stimulation at the proposed lesion site prior to the destructive procedure. Others may be deep seated and not lend themselves easily to such a procedure which then makes open surgery and 'blind' section to anatomical coordinates necessary.

Peripheral nerves

- Interruption of a peripheral nerve seldom proves effective. If the nerve has mixed function it will produce numbness and motor weakness both of which may be unacceptable. Complete anaesthesia permits unwanted tissue damage in

Overview of surgical pain management options

Pain location	Aetiology	Target	Technique	Side effects	Benefit
Unilateral localized	Local disease	Peripheral nerve Nerve roots	Avulsion Multiple section	Numbness Possible motor or proprioceptive loss	+
Lower body, unilateral	Cancer	Spinothalamic cordotomy	Open thoracic Perc cervical	Ipsilateral paralysis Nil/loss of effect	+++ ++
Lower body, bilateral	Cancer	Commissure	Open thoracic	Paralysis, proprioceptive loss, sphincter control	+++
Lower body	Deafferentation Paraplegia	Dorsal root entry zone (DREZ)	Open laminectomy	Proprioception	++
Upper body, unilateral	Cancer	Cordotomy	Percutaneous cervical Open cervical	Limited area Ipsilateral paralysis	++(+) +++
Upper body, bilateral	Cancer	Commissure	Stereotactic (awake)	Loss of effect	+/++/+++
Arm	Plexus avulsion	DREZ	Open laminectomy	Proprioception	++
Upper body and face	Cancer Stroke	Mesencephalon	Stereotactic (awake)	Gaze palsy	++/+++
Face deafferentation	Post-herpetic	Nucleus caudalis DREZ	High cervical laminectomy	proprioception	++
Face deafferentation	Trigeminal neuropathy	Motor cortex stimulation	Craniotomy	Cortical injury	+/++
Trigeminal neuralgia	Partial denervation Microvascular decompression	Trigeminal ganglion Nerve versus vessel	Percutaneous Posterior fossa surgery	Numbness Facial palsy, deafness	++/+++ +++
Face deafferentation	Trigeminal neuropathy	Motor cortex stimulation	Craniotomy	Cortical injury	+/++

Table 1

Typical cross-section of thoracic spinal cord

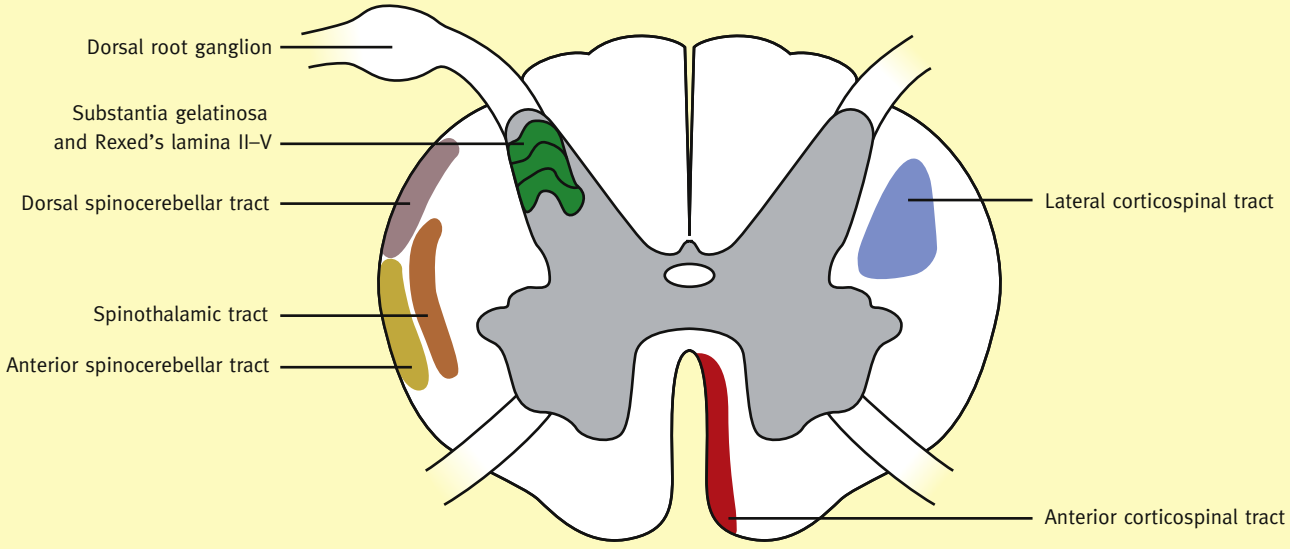

Figure 1