British Journal of Anaesthesia **101 (1):** 95–100 (2008)
doi:10.1093/bja/aen105 Advance Access publication May 20, 2008

BJA

Nerve blocks in palliative care

W. A. Chambers*

Department of Anaesthesia and Pain Management, Aberdeen Royal Infirmary, Foresterhill, Aberdeen, UK
**E-mail: wachambers@nhs.net*

Although between 85% and 90% of patients with advanced cancer can have their pain well controlled with the use of analgesic drugs and adjuvants, there are some patients who will benefit from an interventional procedure. This includes a variety of nerve blocks and also some neurosurgical procedures. Approximately 8–10% of patients may benefit from a peripheral nerve block and around 2% from a central neuraxial block. The most common indication is because opioid dose escalation is limited by signs of opioid toxicity but some patients will benefit from one component of their pain being relieved by a simple peripheral block. Most patients about to undergo these procedures are already taking high doses of opiods and obtaining valid consent may pose problems. The use of peripheral nerve blocks, epidural and intrathecal infusions, and plexus blocks is discussed.

Br J Anaesth 2008; **101**: 95–100

Keywords: anaesthetic techniques, regional; cancer; pain

Palliative care is concerned with the treatment of a patient's symptoms without necessarily affecting the underlying cause. However, although the primary aim is to enhance the quality of life and to neither hasten nor postpone death, the relief of distressing symptoms may well positively affect the course of illness. Much of the work of specialist palliative care physicians is concerned with terminal malignant disease, but their role in managing those with a variety of non-malignant conditions has increased in recent years.

Pain remains the most feared symptom of advanced malignancy in the minds of the public, despite the fact that other very distressing symptoms which occur near the end of life can be even more difficult to control. The prevalence of pain in cancer patients varies between 20% and 50% in the early stages of the disease. About three-quarters of patients with advanced cancer experience moderate to severe pain and most of these patients have pain in multiple sites.[17 43] Pain can be due to the cancer, its treatment, or to another condition. The use of a technique which will only treat one anatomical component of a patient's overall pain state may provide useful benefit. However, it is well to be clear before embarking on such a course that the overall benefit should outweigh not just the risks of treatment but the process of treatment which the patient will have to endure.

Pain can be well managed in between 80% and 90% of these patients with conventional analgesics and co-analgesics, which can usually be taken orally. Prescription should be according to the principles of the WHO analgesic ladder, although approximately 10% of patients have pain that remains difficult to manage and who may benefit from some form of interventional technique.[10]

Interventional techniques can be highly effective but also have the potential to produce significant adverse effects. They may also be uncomfortable and distressing for the patient to undergo and a careful balance has to be struck when considering what benefits are likely as opposed to what is the best possible outcome.

Patient assessment needs to be thorough and is time-consuming. Cancer pain syndromes have been well described and it is often helpful to note the site, nature, and characteristics of each component of the patient's overall pain state and attempt to ascribe the likely mechanism—for example, nociceptive or neuropathic pain, pain arising from bone, etc.[9]

This may assist in the decision-making about the most appropriate pathway for treatment. A survey of oncologists found that over three-quarters felt that poor assessment of pain was the major barrier to good pain management.[10] This concurs with the strong predictive value of the discrepancy between patient's and physician's assessment of pain and inadequate analgesia.

Although the underlying ethical principles for clinical practice in palliative care are no different from that in any other branch of medicine, the nature and complexity of the situation can make decision-making very difficult. The patient and his or her relatives and friends have the problems of dealing with impending end of life issues and there may be conflict between the patient's wishes and that of the family or indeed what is practically possible.

The patient who needs advanced pain management techniques will almost certainly be already taking significant doses of opioids and these have a major effect on cognition. In these circumstances, it can be difficult to judge when a patient is really competent to make an informed decision on what treatments they wish to receive. It may add to the patient's and relative's distress if arrangements are made under the Adult Incapacity Act, unless this is clearly necessary.

In most palliative care units in the UK, specialist advice on pain management is provided on an 'as required' basis with a referral request being made when a patient is deemed to need it. However, in some units there is a regular weekly joint working session where patient management can be discussed and patients seen and treated. This latter arrangement allows for the early discussion of possible intervention techniques and lets patients have time to consider what they would like done if their pain state worsens or does not respond to simpler measures. The introduction of such working patterns has been shown to result in a significant increase in the number of procedures being carried out.[28]

Central neuraxial blocks

Drug delivery by the epidural or intrathecal route was suggested in the 1980s after the identification of opioid receptors within the spinal cord.[45] Although this can provide excellent pain relief with the avoidance of opioid toxicity, it should only be used in patients in whom simpler methods have failed to provide adequate pain control. Depending on the population under consideration, these methods will be suitable in around 2% of patients. Drug delivery can be achieved with a percutaneous epidural or intrathecal catheter and an external syringe pump or a totally implanted intrathecal drug delivery (ITDD) system can be used. Limitations on the capacity of implanted pump reservoirs make these unsuitable for epidural use. The totally implanted system would normally only be used for patients with a life expectancy of more than a few months. Although percutaneous systems cause much more inconvenience to patients and their carers and are perhaps more suitable if life expectancy is between 1 and 3 months, they have been used successfully for considerably longer periods. It is possible for up to 50% of patients who have an epidural infusion to be cared for at home provided good support is available in the community. It has been suggested[40] that ITDD may be associated with prolonged survival, but this evidence can only be considered preliminary as it was not a primary end point in the study design and further work is required to confirm or rebut the hypothesis.

Careful patient selection and the education of those involved in the care of patients with such infusions are vital.[7 41]

Epidural analgesia

The techniques and use of epidural analgesia in palliative care is quite different from that in acute pain settings such as obstetrics and postoperative pain (Table 1). Many patient factors which would be considered a near absolute contra-indication to the use of epidural analgesia in the acute pain setting need to be looked at in a different light in palliative care, and careful consideration of the potential risks and benefits of the procedure in this patient group leads to practices which would not be considered reasonable in the management of acute postoperative pain. Most patients will be suffering from advanced malignant disease and have a degree of immuno-compromise. It may be necessary to insert a Tuohy needle a short distance from an infected skin lesion if the procedure is to be carried out at all. In some patients with impairment of coagulation, the risk of epidural haematoma may be outweighed by the potential benefits of epidural analgesia.

Access to the epidural space should be attempted as near as is practicable to the dermatomal level of the pain, but it is not essential to be immediately adjacent to it with the techniques commonly used. Small volume infusions in the region of 10 ml per day are effective and allow the use of compact infusion pumps. The principal drug used is an opioid but combining this with a local anaesthetic agent adds to the efficacy and this can often be further improved with the addition of clonidine. A number of different opioids have been used and investigation of their stability and compatibility made.[4 18–20] Overall, there is most experience of the use of morphine in intraspinal drug delivery, but if diamorphine is available this offers considerable advantages in ease of dose manipulation and infusion volume. Hydromorphone also has this advantage. However, the use of diamorphine for fully implantable systems is no longer recommended as pump failure has been reported in association with the use of very concentrated solutions. The normal starting dose of opioid for an epidural infusion can be estimated by first calculating the total oral or parenteral dose of opioid the patient is taking

Table 1 Differences between epidural infusions used in traditional areas such as acute postoperative pain and obstetrics compared with the palliative care setting

Traditional	Palliative care setting
Normal coagulation	May be abnormal
No septic focus	May have infected areas nearby
Strict aseptic technique for insertion	Insertion in bed in hospice
Frequent monitoring of vital signs	Monitoring less intense
Skilled resuscitators constantly available	Cardio-respiratory resuscitation very unlikely to be necessary
High volume, low concentration solutions	Low volume, high opioid concentration
A few days at most	May be used for months rather than days
Significant failure rate	Very high success rate provided catheter is in epidural space

(including doses for breakthrough pain) and then converting this to the equivalent dose of morphine. Dose equivalence for different opioid drugs is not an exact science and it is best to err on the side of caution when making the estimation. Although some clinicians have found that using an epidural dose of approximately 10% of the daily oral dose,[27 38] others have adopted a more conservative approach and started with 10% of the daily parenteral dose equivalent.[25] The use of small doses of a short-acting opioid for breakthrough pain can be continued, although if this is required more than once or twice per day it is worth increasing the opioid dose in the epidural. This regime usually provides significantly better analgesia than oral or parenteral opioids with fewer side-effects. However, if the effect is less than desired, it is seldom helpful to increase the volume of infusion.

Side-effects are surprisingly uncommon provided the catheter is in the epidural space and care is taken to ensure that the infusion is properly prescribed, dispensed, and the infusion run correctly. None of the patients receiving this form of treatment are opioid naïve and thus respiratory depression should be mild enough for early detection to allow simply reducing the opioid dose. Cardiovascular changes are very rare—the dose of local anaesthetic, clonidine, or both being used is not sufficient to cause significant hypotension unless it is inadvertently given intrathecally. Infection is potentially a major problem. Superficial infections around the catheter entry site at the skin are common and must be inspected on a regular basis. Deeper infection in the epidural space is less common and obviously more serious as the diagnosis may be delayed in view of the other pathological processes the patient is experiencing.

Epidural infusions can be used for considerable periods and individual epidural catheters have lasted as long as 9 months. Some patients have epidural catheters resited after they have become detached and been treated with this method for over a year. However, it will normally be more appropriate to use an implanted intrathecal system if this time frame is envisaged at the outset. Provided there is good community support, about 50% of patients with an epidural infusion are well enough to go home with the infusion.

Sudden disconnection or accidental removal of an epidural catheter which has been functioning well is not a medical emergency. If necessary, the patient can be treated with opioids by a more conventional route and the catheter replaced at a convenient time. A number of patients who have required epidural analgesia for acceptable pain control may return to gaining adequate analgesia from oral or systemic analgesia on ceasing the epidural infusion. There may be several reasons for this: including disease progression resulting in less rather than more pain, or possibly an effect on spinal cord pain processing from the continuous relief provided by the epidural. Whatever the reason, it is wise to allow enough time to assess the situation properly before resiting the line and restarting the infusion.

Intrathecal infusions

Percutaneous intrathecal infusions offer a number of advantages over epidurals, but this is at the cost of crossing the dura. The consequences of the introduction of infection are thus much greater, although some would argue that the diagnosis of meningeal infection is easier to make and the treatment more effective than for epidural infection. Local expertise and resources will contribute to the type of central neuraxial block chosen in combination with patient-related factors such as prognosis. Overall, ITDD provides improved pain control and fewer side-effects than epidural administration.[11 34] Access to the intrathecal space is usually attempted in the lower lumbar region below the termination of the spinal cord and if this is practicable it may well be easier than performing an epidural. However, if technical factors make the procedure impossible below the termination of the cord, it may be unwise to risk damage to the cord by attempting a more cephalad approach.

The volume of infusion and dosages of opioid required are much smaller than for the epidural route. An infusion of 1 ml per day with 1% (as opposed to the 10% for epidural) of the total daily morphine or morphine equivalent oral dose is the normal starting point.

Implanted ITDD pumps

For patients whose life expectancy is more than a few months, it is both safer and more convenient for the patient to have a fully implanted pump. This allows patients much more freedom in terms of personal care (e.g. having a bath is well-nigh impossible with an external system) and once implanted the risks of introducing infection are low. A number of types of pump are available commercially and these are either gas or battery powered. The gas powered units deliver a constant rate infusion (usually 1 ml per day) and any alterations in dosage have to be achieved by changing the concentration of the infusate. The reservoir in these pumps is in the region of 30–50 ml and thus they can be refilled approximately monthly. It is possible to empty the reservoir in order to change the concentration of the infusate. Patients with these devices require frequent review and specialist advice must be available when pain control becomes poorer or side-effects develop. Technical problems can occur (e.g. disconnection of the catheter from the pump or dislocation of the catheter end from the intrathecal space). Neurosurgical assistance may be required in these situations.

Battery powered pumps have a range of programming options and with telemetric control. The infusion rate may be altered (or may be programmed to vary at different

times of the day) and an on-demand bolus facility can be used. However, although battery-powered pumps are necessary for more complex cases of non-malignant disease (e.g. for baclofen infusions for spasticity), good pain control can usually be obtained in the palliative care setting with a simple gas-driven pump.

Intra-cerebro-ventricular drug delivery can be used for central administration of opioids. There are no randomized controlled trials of this technique, although it may be at least as effective as spinal delivery of opioids (either epidural or intrathecal). It is also a specialist neurosurgical procedure and as such will have limitations in terms of patient access.[1 2]

Spinal drug delivery is a very effective method of providing good pain control which does not respond to simpler measures and with careful patient selection and an appropriate choice of technique will significantly enhance patient care.[3 5]

Peripheral nerve blocks

Peripheral nerve blocks or plexus blocks can be used when pain occurs in the territory of one or more peripheral nerves. The pain may arise from primary or secondary tumour deposits or be the result of treatment (e.g. post-radiation pain) or secondary complications such as pathological fracture or vascular occlusion.

The role of a peripheral nerve block will very seldom be as the sole or even the principal treatment. Most patients will have pain in more than one site. However, when given in combination with other therapy including systemic analgesics, radiotherapy, and chemotherapy, their use may allow useful relief of one component of a patient's overall pain state and may also facilitate other treatment such as physiotherapy and lymphoedema care.

Traditional methods for peripheral nerve block mainly consisted of the use of neurolytic agents such as phenol or alcohol. Although this method can be useful for smaller peripheral nerves such as intercostal nerves, there is a significant incidence of neuritis and in patients in whom prognosis is several months or more this can result in symptoms which are more difficult to control than the original pain. In recent years, there has been more interest in the use of infusions of local anaesthetic agents and adjuvants and this has been greatly helped by the ready availability of suitable equipment. There are a number of techniques for siting a cannula or catheter. A cannula can be threaded over or through a needle and some kits allow the use of nerve stimulation to aid identification of the nerve. Infusions will typically be run at between 3 and 6 ml h^{-1} with either bupivacaine or ropivacaine, possibly with the addition of fentanyl 1–2 $\mu g\ ml^{-1}$. Clonidine has also been used as an adjuvant.

It may be technically very difficult to perform a peripheral nerve block in a patient suffering from advanced malignant disease. The presence of brawny oedema, the absence of peripheral pulses, or both may make identification of landmarks difficult or impossible. Scarring and contractures and tumour invasion or compression may distort the neuroanatomy. Performing a single-shot peripheral nerve block can be challenging and the insertion of a catheter invariably adds to the technical difficulty. An additional feature in these patients is that they may find positioning or simply lying still for any length of time very difficult.

Virtually any peripheral nerve or plexus block can be considered. In addition to reports of peripheral nerve blocks for cancer pain, there are also published reports of peripheral nerve block infusions for surgery, postoperative pain, chronic pain syndromes, and to facilitate other treatments such as physiotherapy. The information in the latter may be useful if it is proposed to attempt a peripheral nerve block for cancer pain where no publication on this specific situation is available. The peripheral nerve blocks which have been reported include femoral nerve block,[26 37] sciatic nerve block,[39] paravertebral,[15] brachial plexus block,[33 44] suprascapular,[31] psoas compartment,[8] distal lumbar plexus,[23] and intrapleural blocks.[32] However, clinical reports on the use of peripheral nerve blocks are quite limited. Most are single case reports or small case series consisting of a description of what has worked. Not surprisingly, there are few reports of something that has not worked and little or no comparative studies on which one could base any recommendations for practice.

Autonomic blocks

Coeliac plexus block

Coeliac plexus block inhibits the autonomic supply to the upper gastrointestinal tract and can provide good quality analgesia for patients suffering from pancreatic and other upper abdominal malignancies. Its use may be associated with an improved survival time.[12 16 21 24 30 42] A variety of approaches have been described and one of several radiological imaging techniques can be used. A neurolytic block is usually performed with alcohol and although it is possible to perform a diagnostic block with local anaesthetic before proceeding to neurolysis, the predictive value of this is not absolute.[47]

Other autonomic blocks

Stellate ganglion block can be used for pain in the head or arm which has an autonomic component. Single or repeated injections are performed as catheter techniques are difficult and neurolytic block carries significant risks in view of the anatomical relations of the ganglion. Lumbar sympathetic block can be carried out for ischaemic leg pain, pain mediated by the sympathetic nervous

system, and bilaterally for tenesmus.[13] Pain from pelvic structures may be helped by neurolytic block of the superior hypogastric plexus[14 36] or the ganglion of impar (ganglion of Walther).[35 46]

Other procedures

A variety of neurosurgical procedures are available for interventional therapy. Cordotomy is used for unilateral pain and although it is relatively uncommon for patients with advanced cancer to have pain confined to one side of the body, where this is the case it can be particularly effective. It has been used successfully for patients with mesothelioma.[22] The procedure can be carried out percutaneously under local anaesthesia with the aid of an image intensifier or at open operation.

Conclusions

In the small but significant group of patients in whom simpler measures fail to adequately control the pain of advanced cancer, there are a wide variety of interventional techniques available, one or more of which may be appropriate in an individual patient. It is vital that knowledge of these procedures and how they can be accessed is present in all specialist palliative care units so that appropriate care can be provided. Although the prognosis of these patients is often very limited, the benefit they can obtain from such procedures is extremely worthwhile. Almost 20 yr ago, one of the pioneers of pain management in the UK stated that 'Analgesic drugs are the first line of pain relief in cancer but they should not be the only treatment offered. If nerve blocks and other destructive procedures are to be used, they should be used early with conviction and persistence. They might not be being used because there are not enough doctors who can use them properly'.[29] Despite significant advances in training and education in pain management since then, and the likelihood that many more practitioners now have the necessary skills to perform these procedures, the statement bears repetition.

References

1 Ballantyne JC, Carwood CM. Comparative efficacy of epidural, subarachnoid, and intracerebroventricular opioids in patients with pain due to cancer. *Cochrane Database Syst Rev* 2005; **1**: CD005178

2 Ballantyne JC, Carr DB, Berkley CS. Comparative efficacy of epidural, subarachnoid and intracerebroventricular opioids in patients with pain due to cancer. *Reg Anesth* 1996; **21**: 542–56

3 Bennet G, Serafini M, Burchiel K, *et al*. Evidence based reviews of the literature on intrathecal delivery of pain medication. *J Pain Symptom Manage* 2000; **20**: S12–36

4 Bennet G, Burchiel K, Buchser E, *et al*. Clinical guidelines for intraspinal infusion: report of an expert panel. *J Pain Symptom Manage* 2000; **20**: S37–43

5 Bennet G, Deer T, Du Pen S, *et al*. Future directions in the management of pain by intraspinal drug delivery. *J Pain Symptom Manage* 2000; **20**: S44–50

6 Bristow A, Foster JM. Lumbar sympathectomy in the management of rectal tenesmoid pain. *Ann R Coll Surg Engl* 1988; **70**: 38–9

7 Buchheit T, Rauck R. Subarachnoid techniques for cancer pain therapy. *Curr Rev Pain* 1999; **3**: 198–205

8 Calava JM, Patt RB, Reddy S, Varma DG, Chiang J. Psoas sheath chemical neurolysis for management of intractable leg pain from metastatic liposarcoma. *Clin J Pain* 1996; **12**: 69–75

9 Cherney N, Portenoy RK. Cancer pain: principles of assessment and syndromes. In: Wall PD, Melzack R, eds. *Textbook of Pain*, 4th Edn. Edinburgh: Churchill Livingstone, 1017–64

10 Cleland CS, Gonin R, Hatfield AK, *et al*. Pain and its treatment in outpatients with metastatic cancer. *N Engl J Med* 1994; **330**: 592–6

11 Dahm P, Nitescu P, Aplegren L, *et al*. Efficacy and technical complications of long term continuous intraspinal infusions of opioid and/or bupivacaine in refractory non malignant pain. *Clin J Pain* 1009; **14**: 4–16

12 De Cicco M, Matovic M, Bortolussi R, *et al*. Celiac Plexus Block: injectate spread and pain relief in patients with regional anatomic distortion. *Anesthesiology* 2001; **94**: 561–5

13 de Leon-Casasola OA. Critical evaluation of chemical neurolysis of the sympathetic axis for cancer pain. *Cancer Control* 2000; **7**: 142–8

14 de Leon-Casasola OA, Kent E, Lema MJ. Neurolytic superior hypogastric plexus block for chronic pelvic pain associated with cancer. *Pain* 1993; **54**: 145–51

15 Eason MJ, Wyatt R. Paravertebral thoracic block—a reappraisal. *Anaesthesia* 1979; **34**: 638–42

16 Eisenberg E, Carr DB, Chalmers TC. Neurolytic celiac plexus block for treatment of cancer pain: a meta-analysis. *Anesth Analg* 1995; **80**: 290–5

17 Grond S, Zech D, Diefenbach C, *et al*. Assessment of cancer pain: a prospective evaluation of 2266 cancer patients referred to a pain service. *Pain* 1996; **64**: 107–14

18 Hildebrand KR, Elsberry DD, Anderson VC. Stability and compatibility of hydromorphone hydrochloride in an implantable infusion system. *J Pain Symptom Manage* 2001; **22**: 1042–7

19 Hildebrand KR, Elsberry DD, Deer TR. Stability compatibility and safety of intrathecal bupivacaine administered chronically via an implantable delivery system. *Clin J Pain* 2001; **17**: 239–44

20 Hildebrand KR, Elsberry DD, Hassenbusch SJ. Stability and compatibility of morphine–clonidine admixtures in an implantable infusion system. *J Pain Symptom Manage* 2003; **25**: 464–71

21 Ischia S, Ischia A, Polati E, *et al*. Three posterior percutaneous celiac block techniques. *Anesthesiology* 1992; **76**: 534–40

22 Jackson MB, Pounder D, Price C, Matthews AW, Neville E. Percutaneous cervical cordotomy for the control of pain in patients with pleural mesothelioma. *Thorax* 1999; **54**: 238–41

23 Kaki AM, Lewis GW. Inguinal paravascular (lumbar plexus) neurolytic block—description of a catheter technique: case report. *Reg Anesth Pain Med* 1998; **23**: 214–8

24 Kawamata M, Ishitani K, Ishikawa K, *et al*. A comparison between celiac plexus block and morphine treatment on quality of life in patients with pancreatic cancer. *Pain* 1996; **64**: 597–602

25 Kedlaya D, Reynolds L, Waldman S. Epidural and intrathecal analgesia for cancer pain. *Best Pract Res Clin Anaesthesiol* 2002; **16**: 651–5

26 Khor KE, Ditton JN. Femoral nerve blockade in the multidisciplinary management of intractable localized pain due to metastatic tumor: a case report. *J Pain Symptom Manage* 1996; **11**: 57–61
27 Lee MA, Leng ME, Tiernan EJ, Chambers WA. A simple method of using epidural analgesia in palliative medicine. *Palliat Med* 2001; **15**: 347–8
28 Linklater GT, Leng MEF, Tiernan EJJ, Lee MA, Chambers WA. Pain management services in palliative care: a national survey. *Palliat Med* 2002; **16**: 435–9
29 Lipton S. Pain relief in active patients with cancer: the early use of nerve blocks improves the quality of life. *Br Med J* 1989; **298**: 37–8
30 Mercadante S, Nicosia F. Celiac plexus block: a reappraisal. *Reg Anesth Pain Med* 1998; **23**: 37–48
31 Mercadante S, Sapio M, Vilari P. Suprascapular nerve block by catheter for breakthrough shoulder cancer pain. *Reg Anesth* 1995; **20**: 343–6
32 Myers DP, Lema MJ, de Leon Cassola OA, Bacon DR. Interpleural analgesia for the treatment of severe cancer pain in terminally ill patients. *J Pain Symptom Manage* 1993; **8**: 505–10
33 Neill RS. Ablation of the brachial plexus: control of intractable pain, due to a pathological fracture of the humerus. *Anaesthesia* 1979; **34**: 1024–7
34 Nitesca P, Applegren P, Applegren L, *et al*. Epidural versus intrathecal morphine bupivacaine: assessment of consecutive treatments in advanced cancer pain. *J Pain Symptom Manage* 1990; **3**: 18–26
35 Plancarte R, Amescua C, Patt RB. Presacral blockade of the ganglion of Walther. *Anesthesiology* 1990; **73**: A751
36 Plancarte R, de Leon-Casasola OA, El-Helaly M, *et al*. Neurolytic superior hypogastric plexus block for chronic pelvic pain associated with cancer. *Reg Anesth* 1977; **22**: 562–8
37 Rosenblatt RM. Continuous femoral anesthesia for lower extremity surgery. *Anesth Analg* 1980; **59**: 631–2
38 Samuelsson H, Malmberg F, Eriksson M, Hedner T. Outcomes of epidural morphine treatment in cancer pain: nine years of clinical experience. *J Pain Symptom Manage* 1995; **10**: 105–12
39 Smith BE, Fischer HB, Scott PV. Continuous sciatic nerve block. *Anaesthesia* 1984; **39**: 155–7
40 Smith TJ, Staats PS, Deer T, *et al*. Randomized clinical trial of an implantable drug delivery system compared with comprehensive medical management for refractory cancer pain: impact on pain, drug related toxicity and survival. *J Clin Oncol* 2002; **20**: 4040–9
41 Staats P. Neuraxial infusion for pain control. *Oncology* 1999; **13**: 58–62
42 Staats P, Hekmat H, Sauter P, *et al*. The effects of alcohol celiac plexus block, pain and mood on longevity in patients with unresectable pancreatic cancer. *Pain Med* 2001; **2**: 28–34
43 Twycross R. Cancer pain classification. *Acta Anaesthesiol Scand Suppl* 1997; **41**: 141–5
44 Vranken JH, Zuurmond WW, de Lange JJ. Continuous brachial plexus block as treatment for the Pancoast Syndrome. *Clin J Pain* 2000; **16**: 327–33
45 Wang JK, Nauss LE, Thomaas JE. Pain relief by intrathecally applied morphine in man. *Anesthesiology* 1979; **50**: 149
46 Wilsey C, Ashford NS, Dolin SJ. Presacral neurolytic blockade for relief of pain from pelvic cancer. *Palliat Med* 2002; **16**: 441–4
47 Yuen TS, Ng KF, Tsui SL. Neurolytic celiac plexus block for visceral abdominal malignancy: is prior diagnostic block warranted? *Anaesth Intensive Care* 2002; **30**: 442–8