Epidural analgesia after spinal surgery via intervertebral foramen

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Patients undergoing major spinal surgery may experience significant postoperative pain. Epidural analgesia has previously been shown to be safe and effective and may confer some advantages over opioid-based postoperative analgesia. We discuss the case of a 47-yr-old female patient undergoing the prolonged anterior component of a lower thoracic/upper lumbar spine correction involving the stripping of the diaphragm from the lower thoracic spine and retraction of the left lower lobe of the lung. Despite initially planning opioid-based postoperative analgesia, a joint anaesthetic and surgical decision was made to use epidural analgesia in an attempt to avoid potential postoperative respiratory complications. Because of the surgical anatomy of the correction, the catheter was inserted via the T11 intervertebral foramen. A bolus of bupivacaine 0.25% intraoperatively with a postoperative infusion of bupivacaine 0.167% with diamorphine 0.1 mg ml−1 provided excellent analgesia. The technique was associated with no postoperative complications.

Continuous epidural analgesia via catheters placed during surgery, under direct vision before wound closure, is a well-described technique after major spinal surgery. For posterior spinal correction, the catheter can be inserted directly through the ligamentum flavum by the surgeon. For anterior spinal surgery, the epidural catheter can be inserted percutaneously or under direct vision and tunnelled to the skin. However, the exact route into the epidural space has not been described in previous studies and reports. Once inserted, analgesia can be established with a bolus of local anaesthetic with or without additional opioid (fentanyl or diamorphine), which is given before the end of anaesthesia. An infusion of dilute local anaesthetic with or without opioid can be used to provide continuous analgesia for the initial postoperative period.

This approach has been shown to be safe and effective in elective procedures on adult, adolescent and paediatric patients,1–5 including spinal fixation for traumatic injury.6 Studies comparing the technique with patient-controlled opioid infusions have shown comparable analgesia7,8 and suggested some advantages, including absence of opioid-induced side-effects,5 less enteroparesis after posterior spinal surgery5,7,8 and low complication rates.9 Epidural analgesia for spinal surgery has not been used widely in the UK compared with the USA, where it has gained greater popularity.

We report the successful use of continuous epidural analgesia after anterior correction of a lumbar and lower thoracic kyphosis where the epidural catheter was inserted intraoperatively through the intervertebral foramen at T11.

Case report

A 47-yr-old female who had 3 yr previously undergone lumbar spine segmental decompressions was scheduled for the anterior component of a two-stage correction. Apart from chronic back pain related to her spinal deformity, previous gynaecological surgery and a spontaneous deep vein thrombosis, she was well. After temazepam 20 mg as a premedicant, anaesthesia was induced with propofol supplemented by fentanyl 100 μg, the patient was paralysed with atracurium, the trachea intubated and the lungs ventilated with a mix of oxygen, air and isoflurane. Invasive monitoring with arterial and internal jugular venous lines was established. A percutaneous epidural catheter was not inserted because the initial intention for postoperative analgesia
was to use a patient-controlled morphine infusion with regular oral or rectal paracetamol and a non-steroidal anti-inflammatory agent. In theatre, the patient was placed in the right lateral position and a remifentanil infusion (0.2–0.5 μg kg\(^{-1}\) min\(^{-1}\)) used intraoperatively, with morphine 10 mg administered i.v. 4 h into the case. Surgery required a large incision following the line of the twelfth rib around the loin to the anterior abdominal wall, with the thoracolumbar junction exposed by an extrapleural and retroperitoneal approach. Detaching the diaphragm from the chest wall and retracting the left lower lobe of the lung within the pleural sac completed the exposure. The extent of this dissection had not been anticipated before surgery. This raised concerns that postoperative analgesia would be important to help optimize her respiratory function. Surgical access to the posterior epidural space via the ligamentum flavum was not possible because of the anterior spinal approach, and the surgical team were technically unable to pass a catheter through the corpse. As the exposure was extrapleural, the pleura was stripped off the paravertebral space. This would have rendered a paravertebral catheter and infusion less effective. An intrapleural catheter was considered but rejected because of the potential for poorer analgesia and the risk of local anaesthetic toxicity when compared with an epidural infusion. The issue of consent was also discussed in theatre. The methods of analgesia after spinal surgery had been explained to the patient before surgery, including the use of epidural catheters, although the patient was expecting opioid-based analgesia. It was agreed jointly that in the circumstances the provision of epidural analgesia was acting in the patient’s best interests. The placement of the catheter surgically could be considered as part of the surgical procedure. Therefore, after 8 h of surgery an epidural catheter (Portex) was gently inserted via the left T11 nerve root foramen, providing easy access to the epidural space. Four centimetres of catheter was advanced into the space, with the remainder tunnelled through the muscle and skin. An initial injection of bupivacaine 0.5%, 3 ml was given. Subsequently, bupivacaine 0.25%, 15 ml, plus fentanyl 50 μg was given incrementally over the following 45 min. The patient was extubated in theatre after reversal of neuromuscular block and cessation of anaesthesia and transferred to the intensive care unit (ICU) for monitoring. Postoperative analgesia consisted of a continuous epidural infusion of bupivacaine 0.167% with diamorphine 0.1 mg ml\(^{-1}\) (a concentration of diamorphine used as standard at this centre unless contraindicated by patient comorbidity), at the rate of 3–9 ml h\(^{-1}\), 6-hourly rectal then oral paracetamol, but no non-steroidal anti-inflammatory drugs. Visual analogue pain scores (VAS) of zero were recorded overnight. The following morning a VAS of 3 out of 10 was quickly improved to zero with a bolus of 10 ml of infusion. The patient left the ICU the next day. The epidural infusion was continued on the ward until catheter removal, and over the next 48 h VAS pain scores remained between 0 and 3. The epidural catheter was removed on the fifth postoperative day before the posterior part of the surgical correction. Another anaesthetic team was involved in this procedure, after which patient-controlled morphine infusion was used. At outpatient follow-up, she was deemed to be making good progress orthopaedically with no symptoms or signs suggesting epidural catheter-related problems.

**Discussion**

The cuff of dura mater surrounding the spinal nerves as they pass through the intervertebral foramen is continuous with that surrounding the spinal cord. An epidural catheter pushed through the foramen will be guided by this dural cuff into the epidural space, provided it is advanced gently so as not to breach the dura and lie intrathecally. This case demonstrates the successful use of this technique to provide epidural analgesia after an anterior multilevel spinal correction, and provides an alternative approach to the epidural space with respect to the conventional surgical placement of epidural catheters.

Major spinal surgery may involve two body cavity procedures with the risk of significant postoperative pain and morbidity. These include respiratory complications (7%), and pulmonary embolism (0.8%), with much higher rates of venous thrombosis (15.5%) when no thromboprophylactic measures are used. Epidural infusions can provide excellent analgesia and have been demonstrated to produce a reduction in pulmonary morbidity after major abdominal and thoracic surgery, postoperative thromboembolic disease and paralytic ileus. They may be preferable to i.v. opioids in patients with serious respiratory and cardiovascular comorbidity. The placing of catheters surgically theoretically allows greater accuracy. Turner et al. checked the position of epidural catheters after surgical placement with the injection of radio-opaque dye and related this to the quality of analgesia. They suggest that the variable rates of failure of analgesia in previous studies are due to catheter misplacement or poor spread of the solution.

The risks associated with epidural catheters themselves must be considered. In addition to the possibility of superficial skin infection, epidural abscess and epidural haematoma, the technique reported carries the risk of dural puncture and intrathecal catheter placement. Epidural infusions may make the neurological assessment of patients after spinal surgery difficult, and in the present case there may be a theoretical risk of nerve root compression. The risk of dural puncture from the gentle advancement of the epidural catheter through the intervertebral foramen is unknown. At T11, catheter-related nerve root compression is unlikely to cause serious sequelae; however, theoretically, at the lumbar level it may produce sensory and motor symptoms in a lower limb. This was discussed during the procedure but in reality an epidural catheter is small and in the present case it passed easily through the intervertebral foramen next to the spinal nerve. One review of 4185 patients receiving epidural analgesia found 0.2% of patients to have postoperative radicular pain, and all of these patients were responsive
to withdrawal of the catheter with no permanent sequelae. With this in mind, the neurological sequela of epidural analgesia are rare and our patient developed none.

Confirming the correct position of the epidural catheter in the epidural space is difficult. Without the injection of radio-opaque dye and X-ray, placement under direct vision is the only way to confirm this intraoperatively. The fate of a conventionally placed epidural catheter inserted percutaneously can vary and may coil in the epidural space or exit via an intervertebral foramen with a spinal nerve. It may be argued that surgical placement under direct vision gives a better chance of correct positioning. We would use radio-opaque dye in future.

This technique provided excellent postoperative analgesia with no postoperative complications and may be useful in future when catheter access to the epidural space is difficult, either percutaneously or under direct vision.

References

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