What is the role of epidural analgesia in abdominal surgery?



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Key points

Epidural analgesia can provide excellent analgesia after abdominal surgery.

Epidural analgesia positively contributes to recovery by facilitating mobilization and recovery of gut function.

Epidural analgesia can reduce pulmonary, cardiovascular, thromboembolic, and gastrointestinal complications occurring after abdominal surgery.

NAP3 has provided us with a more accurate assessment of the risks of perioperative epidural analgesia.

Alternative local anaesthetic techniques may be beneficial as part of multimodal analgesia in patients for whom epidural analgesia is not considered appropriate or in whom epidural analgesia cannot be achieved.

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What is the role of epidural analgesia in abdominal surgery?

Many of the benefits of effective epidural analgesia for open abdominal surgery are soundly established. A well-managed epidural can provide excellent analgesia in the postoperative period allowing the patient to be pain free at rest and when mobilizing. In addition, epidural block will obtund the acute stress response to surgery. Consequently along with the analgesic benefits, patients are less likely to suffer cardiac, respiratory, or gastrointestinal side-effects. However, the increasing application of laparoscopic techniques for many major intra-abdominal procedures results in less pain and shorter recovery times than open surgery. We now have a clearer appreciation of the potential risks of epidural analgesia. A number of alternative local anaestheticbased analgesic techniques have been described. In the context of these advances, we discuss whether in fact in abdominal surgery, there is still a time and a place for the thoracic epidural?

Benefits of epidural analgesia¹

In the continued search for outcome benefits from the application of effective epidural analgesia, perhaps the most obvious but frequently overlooked benefit is analgesia (Fig. 1). Patients who have an effective epidural can experience excellent and often complete pain relief after operation while the epidural is running. Patients report reduced visual analogue pain scores at rest and on movement, this latter being beneficial for early mobilization of patients. The few studies seeking the patient's perspective on postoperative epidural analgesia show a high level of satisfaction and quality of recovery.²

The presence of an indwelling epidural catheter allows either a continuous infusion or bolus dosing, or most commonly, a combination of the two, allowing analgesia to be continued for several days as determined by patient requirement. A detailed discussion of the drugs and doses used for epidural analgesia is beyond the scope of this review.

After tissue injury such as surgery, our bodies respond through a complex neurohumoral response, the aim of which is survival from the acute injury and the repair of tissue damage (Fig. 2). However, in the perioperative patient, components of the stress response may be detrimental and contribute to postoperative complications. This will be more significant in patients who are elderly or who have major co-morbidities.

Surges of catecholamines result in increasing workload for the heart, and consequent increasing myocardial oxygen requirements. An oxygen supply-demand mismatch in patients with underlying coronary disease can lead to myocardial ischaemia or infarction, arrhythmias, and cardiac failure.

Postoperative patients are at high risk for development of thromboembolic disease. This is due to a combination of perioperative immobility, their surgical condition such as malignancy or inflammatory bowel disease, and the hypercoagulable state resulting from activation of the stress response.

The catabolic response leads to hyperglycaemia, postoperative negative nitrogen balance, and fatigue. Patients are also immunocompromised with a resultant increased risk of postoperative infection.

Block of afferent neural input from the site of surgery with epidural analgesia has a beneficial effect in reducing the neuro-hormonal aspect of the surgical stress response, with the potential for a reduction in respiratory, thromboembolic, and cardiovascular events after major surgery. The beneficial effects of effective epidural analgesia on respiratory function and complications after abdominal surgery are well established. The evidence for a reduction in thromboembolic complications comes mainly from the orthopaedic literature. Studies in abdominal surgery have shown only a non-significant trend towards reduction; however, active mobilization has not

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Fig | Benefits of effective epidural analgesia (level of evidence in support of these from a range of surgical specialities).



Fig 2 Components of the stress response to surgery.

been promoted in these. Similarly, studies assessing cardiovascular complications after abdominal surgery suggest an improvement in cardiovascular morbidity. A recently published retrospective subgroup analysis of patients with epidural analgesia included in the POISE study has actually suggested an increased cardiovascular complication rate in the thoracic epidural group. They also recorded significant hypotension in this group which may have been the mechanism for this. Since avoidance of hypotension should be a goal of management of patients with epidural analgesia and since specific details of the epidural block including extent of block and agents used have not been recorded, the importance of these results is uncertain. This paper does however raise important issues which mandate further study and ensures that risks and benefits of such analgesic techniques continue to be appropriately questioned. Reducing the neuro-hormonal input to the postoperative stress response with epidural analgesia can also improve nitrogen balance, fatigue, and postoperative mobility. The combination of normoglycaemia and avoidance of immunosupression contributes to a reduction in infectious complications.

Abdominal surgery with handling of the gut predisposes patients to developing the unpleasant and potentially life-threatening complication of paralytic ileus. Surgical handling, excessive i.v. fluids causing bowel oedema, increased sympathetic tone, and systemic opioids can all contribute to intestinal hypo-motility and ileus.

In open abdominal surgery, the use of a thoracic epidural has been shown to be an effective intervention in reducing the incidence and duration of postoperative ileus. This is due both to the sympathetic block produced by epidural local anaesthetic and by the avoidance of systemic opioids. Conversely, there are concerns that epidural hypotension and/or vasopressor use to combat this could compromise healing of the anastomosis after gastrointestinal resections. It is therefore reassuring that there is <u>no published evidence</u> for an association between epidural analgesia and anastomotic leak. Some studies have demonstrated a reduced rate of anastomotic break down after bowel resection in patients with a thoracic epidural.

The development of gut oedema may also be a factor in anastomotic breakdown and leak. It is therefore essential that individual units have a policy to effectively manage epidural-related hypotension, so that excessive i.v. fluids are not administered beyond that required for optimal intravascular filling.

Multimodal/enhanced recovery programmes

It is increasingly recognized that in recovery from major surgery, the trio of effective pain relief, early mobilization, and early recovery of gastrointestinal function is crucial. These components of recovery are inextricably linked and if we are to gain maximum benefit for our patients from effective analgesia, then these other factors must also be addressed and achieved. It will be apparent from this that while good analgesia will aid recovery, side-effects from analgesia have the potential to obstruct this process. This would include limiting mobility by having patients attached to pumps and monitors associated with the analgesic technique which is often a particular issue for patients receiving epidural analgesia. Increasing numbers of studies are confirming benefit from multimodal recovery programmes including the use of epidural analgesia for abdominal surgery and these are demonstrating improved quality of recovery, shorter length of hospital stay, and reduced perioperative complications.³

Chronic post-surgical pain

Chronic post-surgical pain (CPSP) is now recognized as a significant problem.⁴ Recent research indicates that acute postoperative pain and CPSP are not separate entities, but rather they are a continuum of the same phenomenon. Severe acute postoperative pain is a recognized risk factor for the development of CPSP in susceptible individuals. Repetitive nociceptive stimulation in the acute postoperative period leads to peripheral and central sensitization and in some patients, this appears to be maintained beyond the acute pain episode resulting in chronic pain. By blocking afferent nociceptive input, it is anticipated that pain and sensitization will be reduced leading to a reduction in the incidence and severity of CPSP. Similarly, it is recognized that up to 10% of patients will experience acute neuropathic pain after abdominal surgery. Failure to recognize and manage this may be a contributory factor for CPSP in susceptible individuals. Considerable research is being targeted at this important area both to assess which patients are at risk and whether pain management strategies can reduce the incidence.

The socio-economic burden of chronic pain is enormous, with patients experiencing a poor quality of life while suffering from a condition that is difficult to treat. Minimizing the risk factors for development of CPSP should be a clinical priority and considered when planning the approach to anaesthesia and analgesia. While many of the risk factors are unavoidable such as age, genetics, psychosocial circumstance, others such as type of surgery, anaesthetic, and perioperative analgesia are modifiable. To date, there is limited published evidence on the efficacy of good perioperative acute pain management in reducing CPSP. However, a <u>recently published casecontrolled series of more than 100 patients demonstrates a reduction in chronic postsurgical pain after abdominal surgery, in patients <u>managed with epidural analgesia.⁵</u> In the future, if patients at high risk of CPSP could be identified, they might benefit from the quality of analgesia achievable with effective epidural block.</u>

Postoperative cognitive dysfunction and delirium

With a growing elderly population presenting for major surgery, the risks for and avoidance of postoperative cognitive dysfunction (POCD) become increasingly important. POCD is associated with increased hospital length of stay, persistent cognitive defects, increasing physical dependence, and an increased rate of admission to nursing homes.

Comparisons of the impact of general anaesthesia and regional anaesthesia on the incidence of postoperative cognitive dysfunction suggest that patients undergoing general anaesthesia are more likely to suffer from POCD. Recent research in depth of anaesthesia monitoring has shown that the risk of POCD can be reduced by reduction in the exposure to general anaesthetic agents.⁶ Where general anaesthesia remains necessary, for example, in abdominal surgery, one of the benefits of epidural anaesthesia and analgesia used intraoperatively is that it reduces the depth of general anaesthesia required and a combined technique should therefore have a beneficial effect in reducing POCD and delirium.

Preventing cancer recurrence⁷

Both anaesthetic and analgesic agents are known to have immunomodulating effects. It is clearly important that in the context of increasing numbers of operations to treat cancer, the effect of this is investigated to facilitate the optimal choice of perioperative anaesthesia and analgesia. A number of retrospective studies have suggested an improvement in disease-free survival where regional anaesthesia and analgesia has been used. It is postulated that the reduced stress response occurring with a regional technique results in less postoperative immunocompromise with consequent reduced potential for the spread of micrometastases at the time of surgery. Alternatively, the benefit may be in avoiding systemic opioid therapy, since it is well established that morphine and other opioids inhibit the activity of natural killer cells and other cell-mediated immunity in vitro and could have a similar effect in vivo hence favouring spread of metastatic cells. Prospective trials are currently underway to determine whether the use of a regional anaesthetic technique does reduce the risk of cancer recurrence. The results of these studies could have significant implications for the choice of postoperative analgesia.

Role of epidural analgesia in abdominal surgery

Complications and disadvantages of epidural analgesia

Epidural analgesia is not free of risk however. In 2009, the Royal College of Anaesthetists published the results of their 3rd National Audit Project, recording and investigating major complications of central neuraxial block in the UK.⁸ It was the largest ever audit of its kind and allowed the risk of morbidity and mortality after neuraxial block to be more accurately stratified than previously, as an accurate denominator figure for the number of blocks undertaken in a year was achieved.

The total number of neuraxial blocks performed annually in the UK is \sim 707 000; of which, around 98 000 are epidural blocks placed for perioperative analgesia in adults (excluding obstetrics) and acute pain management for conditions such as rib fractures and acute pancreatitis. In this audit project, a total of 84 serious complications related to central neuraxial block were reviewed. Perioperative central neuraxial block, including epidurals, accounted for more than 80% of the total complications. Severe complications, that is permanent neurological deficit or death, could not always be directly attributed to the neuraxial technique and therefore results in the audit are reported as pessimistic, that is, assuming the block was always the cause and optimistic where unlikely cases were excluded. Severe complications included vertebral canal haematomas, spinal cord ischaemia, vertebral canal abscess, and other neurological injury. Interpreted pessimistically epidurals cause permanent injury or death in this group of patients in one in 5800 cases and optimistically one in 12 200 cases.

Avoidance of or reduction in the risk of complications must include careful patient selection for epidural analgesia with particular consideration of perioperative anticoagulation and risk of infection. Similarly, care must be taken in ensuring an effective aseptic technique for epidural insertion. Currently, chlorhexidine is considered the antiseptic of choice for skin preparation. The possibility of nerve injury secondary to introduction of chlorhexidine into the epidural space mandates extra care with its use, particularly ensuring that the epidural needle and catheter do not come into contact with chlorhexidine and that the skin is fully dry before commencing the procedure. Insertion technique must be fastidious in preventing complications. Multiple attempts should be avoided, particularly if the insertion is associated with pain or dysaesthesia. Finally, postoperative management of epidural analgesia must be adequate to both optimize the benefits of epidural analgesia and to identify any problems at an early enough stage for investigation and management to be undertaken in time to avoid permanent neurological injury. Best practice guidelines for management of epidural analgesia have been published and should be adhered to.⁹

Careful patient selection and meticulous care with epidural insertion and management should keep complications to the minimum. It should be borne in mind when deciding to use epidural analgesia for a patient that there are advantages as outlined and also risks, and that the alternative analgesic regimens available are not without their own complications. The benefit of NAP3 is that it allows us to make a more accurate risk assessment in considering epidural analgesia for any one individual patient, based on likely benefit *vs* risk.

A further disadvantage of epidural analgesia is failure to achieve an acceptable level of pain relief. It has been estimated that only around two-thirds of attempted epidural placements result in effective analgesia for the duration of time intended.¹⁰ The insertion of a thoracic epidural is a skilled procedure. Although at completion of training, all anaesthetists should be competent at inserting thoracic epidurals unless the procedure is repeated often, the skill may be lost. Patients may not be able to achieve the optimum position for insertion, or may have anatomy that makes insertion difficult or even impossible. The use of ultrasound may improve success rates of insertion, particularly in anatomically challenging patients, but is not yet in widespread use, and in itself requires a high level of training and skill.

Once successfully established, epidural analgesia requires constant attention from skilled nurses and anaesthetists often in an acute pain service to achieve and maintain optimal analgesia. Attention must also be directed to limiting or avoiding side-effects such as hypotension or motor block, which will reduce the benefits of the technique by preventing the patient from mobilizing effectively after operation.

On this background, there is a continuing search for new local anaesthetic-based techniques to provide equivalent analgesia, with a better safety profile and applicable to patients for whom an epidural is contraindicated.

In addition, surgical practice continues to evolve and many major surgical procedures including nephrectomy and colorectal resection can be achieved using minimally invasive laparoscopic techniques. Since the level and duration of pain and the stress response are all reduced, the benefit to risk balance for epidural analgesia becomes less favourable. Similarly, as demonstrated by some studies discussed below, it is often more complicated to mobilize patients attached to epidural pumps and associated drips and monitoring than it is to achieve this for patients without encumbrance so that epidural analgesia might actually slow recovery in these instances. As a result, epidural analgesia is probably not the analgesia of choice for most laparoscopic procedures.

Alternative local anaesthetic techniques for abdominal surgery

These include transversus abdominis plane (TAP) blocks, rectus sheath blocks, and wound infiltration. There is also increasing interest in the use of i.v. lidocaine infusions perioperatively.

Abdominal wall blocks are usually performed as a single-shot technique depositing local anaesthetic around the nerves supplying the anterior abdominal wall and parietal peritoneum. Thus, the skin and consequent site of operative incision can be effectively blocked by local anaesthetic. The increasing availability and use of ultrasound has allowed operators to perform this technique based on direct visualization, improving accuracy, compared with the previous landmark and 'pop' techniques. Alternatively, the block can be placed under direct vision by the surgeon. The use of TAP blocks in particular has been shown to provide effective analgesia at rest and on movement when used as part of a multi-modal strategy for surgery below the level of the umbilicus. Subcostal placement is also described and can provide analgesia for higher incisions. Patients benefit from reduced opioid consumption, reduced pain scores, and decreased duration of admission, compared with those not receiving a block. Using single-shot techniques, the duration of these effects is <u>limited to the first 8–24 h a</u>fter operation. While this may be adequate for laparoscopic procedures, it is unlikely to be so for open surgery. These blocks however can be prolonged by the placement of catheters allowing infusions or boluses of local anaesthetic to be administered for longer periods.

There is also increasing interest in the use of catheters placed directly in the surgical wound for administration of local anaesthetic after operation. It is likely that the placement of these catheters is important, with more effective analgesia achieved if the catheter is placed pre-peritoneally. The position of the catheter should be specified when discussing this technique. Again, some studies have shown wound catheters to be very effective in both improving quality of analgesia and opioid sparing as part of a multimodal analgesic package.

Alternatively, <u>lidocaine can be safely and effectively infused i.v.</u> to provide analgesia. Studies have shown that patients receiving i.v. lidocaine infusion can have improved pain scores at 24 h post-operation, shorter duration of hospital admission, and a significantly reduced incidence of postoperative bowel dysfunction. Although lidocaine is known to have analgesic, anti-inflammatory, and anti-hyperalgesic properties, the exact mechanism of its action in this situation is unknown. Lidocaine infusions are used as a part of multi-modal analgesia and patients may still require significant opioid.

To date, there are only a few small studies directly comparing epidural analgesia with alternative local anaesthetic techniques:

- A comparison of subcostal TAP blocks with epidural analgesia encouragingly showed similar pain scores in the two groups. However, the TAP group required more rescue analgesia. An analgesic block was not achieved in 30% of the TAP patients and it is confounding that both groups received epidural bupivacaine intraoperatively.¹¹
- In a study comparing epidural analgesia vs i.v. lidocaine infusion in patients undergoing open colonic resection post-operative pain, recovery of bowel function and duration of hospital stay were the same in both groups. However, all patients received PCA opioids for breakthrough pain raising concerns as to whether all of the patients receiving epidural analgesia had optimal management of this.¹²
- In a comparison of epidural analgesia with local anaesthetic via an intra-abdominal retropubic catheter, epidural analgesia provided superior pain relief after radical prostatectomy, but recovery and hospital discharge were the same in both groups.¹³

• In a study of patients undergoing liver resection comparing epidural analgesia with continuous local anaesthetic wound infiltration for postoperative analgesia, the epidural group had superior analgesia, but the wound catheter group fulfilled discharge criteria more quickly, and went home significantly earlier.¹⁴ These 'wound catheters' were placed by the surgeons after operation in the transversus plane and posterior rectus sheath.

What questions and issues do these studies raise?

Analgesia *per se* is not the only endpoint required for effective postoperative recovery and while good analgesia is extremely important both for recovery and for patient satisfaction, there is a balance to be achieved between this and other patient factors such as mobility and recovery of gut function.

• What is the optimal analgesia regimen, for an individual patient, to achieve an acceptable level of pain relief, while also optimizing recovery?

We must ensure that we do not embrace new analgesia techniques simply because they appear safer and easier than epidural analgesia. It is apparent from studies to date that there is some compromise in terms of quality of analgesia when applying these techniques.

• So, is it acceptable to compromise on analgesia in the interests of improved safety? Does this vary for different patient groups and surgical procedures?

Opioid analgesia can be very effective, but there are some patients who are poorly tolerant of opioids and cannot achieve a good balance of analgesia *vs* side-effects.

• How much opioid sparing is beneficial to patients? In a patient, who from previous experience is known to respond poorly to opioid analgesia, is it better to use a technique which avoids rather than reduces systemic opioid use?

We now have extensive detail on the risks and complications of epidural analgesia. This is not the case with alternative local anaesthetic techniques and while generally these would appear to be safer, they are not without the potential for problems.

• What are the risks and complications of these techniques?

Conclusions

- High-risk patients with significant cardiorespiratory comorbidity, or extreme age, particularly if they are undergoing open surgery undoubtedly benefit from the quality of analgesia provided by an effective epidural and are more likely to benefit from associated early mobilization and nutrition.
- Patients for whom severe acute pain is likely, or for whom opioids, non-steroidal anti-inflammatory drugs, or both are poorly tolerated gain huge benefits.

- Those patients who have a high risk of progression from acute to chronic pain may also benefit, although further investigation of the role of acute pain management and identification of these patients is needed here.
- Once the results of ongoing prospective studies are analysed, the use of regional techniques may need to be considered in the context of reduction of the risk of cancer recurrence.
- There will be a group of patients who of all the analgesic options available simply choose to have an epidural.

In conclusion, and to answer the question posed at the start of this article, yes, unequivocally there is still a place for epidural analgesia in patients having abdominal surgery.

In patients whose pain is managed with epidural analgesia, it is essential that the optimum benefit from the epidural is achieved while also minimizing risks from it. Current evidence suggests that optimal benefit will result if epidural analgesia is combined with active management of other aspects of recovery in a multimodal recovery programme and where possible, the epidural itself should not slow down rehabilitation.

Epidural analgesia should remain an integral part of our analgesic armamentarium for use in appropriately selected patients. The various other local analgesic techniques provide us with useful alternatives allowing individualized tailoring of analgesia to the patient and the surgical procedure both to provide good pain relief but also, importantly to facilitate recovery.

Declaration of interest

None declared.

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Please see multiple choice questions 21–24.