

Perioperative Analgesia for Patients Undergoing Open Liver Resection: Epidural or Paravertebral?

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Open liver resection is a painful surgery, and patients clearly benefit from regional anesthesia for pain management in the perioperative period. However, it is still unclear which regional block technique is superior in these patients.

Epidural Analgesia in Open Liver Resection

Although simple liver resection is increasingly done laparoscopically, patients with large liver masses or previous abdominal surgery often undergo an open liver resection. This requires a long right subcostal incision, the associated pain of which may carry significant morbidity in the post-operative period. The best-studied regional technique in abdominal as well as thoracic procedures is thoracic epidural block. Decreasing nociceptive input via epidural analgesia reduces activation of sympathetic outflow, thus reducing surgical stress, which negatively impacts many organ systems [1]. Epidural analgesia decreases pain-related tachycardia and hypertension, which could cause perioperative myocardial ischemia. Furthermore, thoracic and upper abdominal nociceptive input activates reflex inhibition of diaphragmatic excursion and increased expiratory intercostal and abdominal muscle tone, leading to increased atelectasis and risk of pneumonia. One study of 915 major abdominal surgical patients revealed that epidural analgesia both decreased pain scores in the first three postoperative days and decreased rates of respiratory failure [2]. Interestingly, a handful of studies have also documented a positive impact of epidural analgesia on the coagulation profile, which prevents post-operative thromboembolic complications [1]. Other benefits include a decrease in stress-induced gastrointestinal disruption and immunosuppression. Moreover, in patients undergoing open liver resection, epidural technique resulted not only in improved analgesia, but also in decreased postoperative morphine consumption [3], the latter of which is an additional benefit of epidural analgesia, given the potentially deleterious side effects associated with intravenous (IV) opioids (*i.e.*, respiratory depression, decreased gastrointestinal motility). Indeed, epidural analgesia was sufficient for 80% of patients undergoing open liver resection in another study, with only 20% of patients requiring additional analgesia with IV opioids [4].

Potential Risks and Side Effects of Epidural Analgesia in Open Liver Resection

One of the significant drawbacks of effective thoracic epidural analgesia is hypotension due to the inhibition of sympathetic outflow. In fact, epidural analgesia has been independently associated with increased risk of administration of larger amounts of colloid and crystalloid solutions, and transfusion of packed red blood cells after hepatectomy [4,5]. Other potential complications of epidural catheter placement are rare, including failure to produce anesthesia on the first attempt (4.1%), local bleeding or intravascular cannulation (0.67%) leading to local anesthetic toxicity (0.12%), unintentional dural puncture (0.61%), and paresthesia (0.16%) in a large university-based practice which routinely uses epidural anesthesia and analgesia [6]. These complication rates may be higher when trainee physicians

administer epidural anesthesia [7]. Epidural hematoma, a more serious complication which can result in paraplegia, is reported to occur in 0.03% [8] and is an important consideration in liver resection. A retrospective study in liver resection estimated the incidence of post-operative coagulopathy as high as 47% [9]. In these patients who develop post-operative coagulopathy, pain management with epidural analgesia can be complicated by a need to delay removal of the catheter until after coagulation normalizes, even requiring transfusion of fresh frozen plasma for catheter removal.

Paravertebral Nerve Block: A Potential Alternative?

With this heightened concern for epidural hematoma in the setting of the coagulopathy associated with liver resection, paravertebral nerve block (PVB) has been proposed as a promising alternative analgesic technique. The paravertebral space contains the intercostal nerves, posterior primary rami, and sympathetic nerves, thus making it an ideal location for blockade of nociceptive transmission [10]. The risk of hypotension after PVB is significantly less compared to epidural. The risks specific to PVB include pleural puncture (0.8%) with resultant pneumothorax (0.5%) and risk for local anesthetic toxicity due to the relatively higher total infusion rates required [11]. Previous anatomic studies suggest that the paravertebral spaces between vertebral levels on each side are contiguous, such that injected methylene blue or radio-opaque dye spreads to include an average of six levels of ipsilateral paravertebral spaces [11,12], allowing analgesic coverage beyond the level of catheter placement. Moreover, a large number of studies, particularly in thoracic surgery, have compared epidural analgesia and PVB either directly or indirectly. The overall conclusion is that PVB is roughly equivalent to thoracic epidural analgesia when similar concentrations of local anesthetic agents are used [13,14]. Importantly, the PVBs in the majority of these studies were placed by thoracic surgeons intraoperatively, so it is somewhat unclear whether this apparent analgesic equivalency can be extrapolated to the percutaneous placement of PVB by anesthesiologists. Although one small study in open liver resection patients reports decreased IV opioid consumption with PVB vs. no block [15], there have been no randomized, controlled studies directly comparing epidural vs PVB for analgesic efficacy and incidence of side effects. Furthermore, much of the literature suggesting

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the equivalency of these techniques derives from studies where PVB was placed by a surgeon intraoperatively, which is not feasible in open liver resection.

Conclusion

Patients undergoing open liver resection deserve the benefit of regional anesthesia, which clearly provides analgesia superior to IV opioids alone. It is clear from previous studies that thoracic epidural analgesia is effective in this regard, but routine use of this technique may carry a concern for epidural hematoma due to high rates of post-hepatectomy coagulopathy. An alternative approach using bilateral thoracic PVBs could potentially obviate this risk. However, only with well-designed, randomized and prospective studies will it be clear to what extent these two techniques provide equivalent analgesia.

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