Anaesthesia for Liver Resection Surgery

The Association of Anaesthetists Seminars
21 Portland Place, London
Thursday 15th December 2005

Role and safety of epidural analgesia

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TEA or not in this patient?
TEA - Key questions

# Does TEA change outcome?
  - and what about liver surgery?
# Is there a preemptive effect?
# Risks with thoracic epidurals?
# How important is coagulation?
# Can we predict liver failure?
# Catheter insertion after induction?
# Effects of TEA on perioperative course?
# Best level for congruent analgesia?
# What to give and how to administer?
Can we trust studies and meta-analyses?

Cochrane Database
or

ACP
American College of Physicians
INTERNAL MEDICINE | Doctors for Adults
ACP Catalog | Return to ACP Online

ACP Journal Club
Evidence-Based Medicine for Better Patient Care
Epidural or spinal anesthesia reduces postoperative mortality and morbidity

First: the results did not differ systematically among subgroups. Insufficient power or a true lack of treatment effect?

Second: of the included studies, 87 of 107 (81%) had <50 patients, which raises concerns about study quality.

Third: 51 of 107 studies (48%) were published before 1986, and 99 of 107 studies (93%) were published before 1991, when mortality was higher and thromboprophylaxis less frequently used.
Epidural anesthesia and analgesia did not reduce most comorbid outcomes in high-risk patients having major abdominal surgery

Rigg JR et al. for the MASTER Anaesthesia Trial Study Group.
Epidural anaesthesia and analgesia and outcome of major surgery: a randomised trial.
The results of the study by Riggs and colleagues are not all bad news!

Patients in the epidural group had a 7% absolute risk reduction for respiratory failure.

The epidural group also had less pain, an important goal in itself.....

The study was unblinded.....

The study may have been underpowered.......

In the study by Riggs overall mortality was high.
Patient controlled intravenous opioid analgesia versus continuous epidural analgesia for pain after intra-abdominal surgery (Review)

Werawatganon T, Charuhtumanun S

THE COCHRANE COLLABORATION®

Authors' conclusions
CEA is superior to opioid PCA in relieving postoperative pain for up to 72 hours in patients undergoing intra-abdominal surgery, but it is associated with a higher incidence of pruritus. There is insufficient evidence to draw comparisons about the other advantages and disadvantages of these two methods of pain relief.
Authors’ conclusions
Administration of epidural local anaesthetics to patients undergoing laparotomy reduce gastrointestinal paralysis compared with systemic or epidural opioids, with comparable postoperative pain relief. Addition of opioid to epidural local anaesthetic may provide superior postoperative analgesia compared with epidural local anaesthetics alone. The effect of additional epidural opioid on gastrointestinal function is so far unsettled. Randomized, controlled trials comparing the effect of combinations of epidural local anaesthetic and opioid with epidural local anaesthetic alone on postoperative gastrointestinal function and pain are warranted.
More preemptive effect of epidural analgesia in surgery where innervation is segmental than in procedures with visceroperitoneal nociception

Aida S. Anesth Analg 1999;89:711-6
Preemptive analgesia

# Preemptive effect shown in thoracic and upper abdominal surgery

# The combination of morphine and bupivacaine was superior to epidural morphine alone

Subramaniam B. Anaesth Intensive Care 2000;28:392-398
Preemptive analgesia

No difference pre- vs post-incisional

# Paracetamol, NSAID, NMDA-antagonists
# Epidural
  ▶ single dose or continuous
  ▶ opioid, local anaesthetic or combination
# Intrathecal
# Caudal

Insufficient data for

# Wound infiltration
# Peripheral blocks
# Intraperitoneal local anaesthetic

Moiniche S: Review in Anesthesiology 2002;96:725-41 (Ref 14)
Several multi-modal interventions were compared:

Epidural analgesia scored equal to local wound infiltration and NSAID administration on analgesic consumption and time to rescue request but postoperative pain less intense.
Effect studied of epidural morphine with or without ketamine in 104 cirrhotic patients (Child A) undergoing hepatic surgery.

Quality and duration of analgesia was significantly better in the group that received both epidural ketamine and morphine.

Unfortunately intravenous ketamine was given at induction and the epidural drugs were administered postoperatively.
Risks of neuraxial blockade

Persistent neurological complication

0.005 - 0.08 %

(Coagulopathy and technical difficulties)

Epidural abscess

0.004 - 0.05 %

(Catheterisation time, anticoagulant therapy, immunocompromise)
Risk and coagulation

ASRA
Consensus Conference Statement
Regional Anesthesia and Pain Medicine
2003;28:172-97
What is common practice?

To accept an increase in PT (INR ≤ 1.5) and APT of up to 50% above normal and a platelet count in the region of > 80,000 (> 50,000 - 100,000).

To use a neuraxial technique 4 hours after heparin or 12 hours after LMWH thromboprophylaxis.

Not to give heparin until 1 hour or LMWH until 2 hours after placement or removal of an epidural catheter.

Not to combine with antiplatelet drugs.
Epidural Catheter and Increased Prothrombin Time After Right Lobe Hepatectomy for Living Donor Transplantation

**Figure 1.** Postoperative prolongation of the prothrombin time (PT) in five patients after donor right lobectomy. Values at time zero were the first measurements taken in the postanesthesia care unit. All patients had normal PT values preoperatively.
Altered Hematologic Profiles Following Donor Right Hepatectomy and Implications for Perioperative Analgesic Management

Roman Schumann,1 Luis Zabala,1 Michael Angelis,2 Iwona Bonney,1 Hocine Tighiouart,3 and Daniel B. Carr1

Figure 1. Perioperative values for the international normalized ratio (INR) in 8 patients. Values in means ± standard deviation (SD). INR reference range: 0.9–1.1. Baseline = preoperatively, 0 = day of operation.

Figure 2. Perioperative platelet counts in 8 patients. Values in means ± standard deviation (SD). Platelet reference range: 150–400 K/μL. Baseline = preoperatively, 0 = day of operation.
Study of 413 patients including 53 thoracotomies and 142 upper abdominal operations. Patients undergoing partial hepatectomy were at an increased risk over other patients for delayed epidural catheter removal. The reasons were either persistent pain or transient coagulopathy.

The mean epidural duration was 6.2 days (range 5-9) for the patients with delayed catheter removal. No neurological complications were recorded, but the authors recommended that one should continue frequent neurological assessments in most if not all patients for 24 hours following epidural catheter removal.
Coagulation - Point of care testing

- CoaguChek Plus™
- Hemochron 801™
- HemoSTATUS II™
- PFA 100™
- Thrombelastography
- Sonoclot™

PT (INR), APTT
PT (INR), APTT, HNTT (Heparin)
Platelet function
Platelet function
Global coagulation
Global coagulation
Monitoring of coagulation

Thrombelastography
Thrombelastography
Monitoring of coagulation
Monitoring of coagulation

Sonoclot™
Hepatic failure and coagulopathy

Incidence 5-10%
(depending on co-morbidity, diabetes significant risk factor)

Quality of residual liver tissue (cirrhosis?)

Quantity of liver parenchyma (critical size?)

Use of vascular clamping (ischemia duration?)
Preoperative evaluation

- Assessment of co-morbidity
- Estimation of remnant liver size (CT)
- Liver function testing (ICG-Clearance)
Predictors of postoperative liver failure and coagulopathy

Critical functional remnant liver volume
250 ml/m² or 25 %

(> 40 % in presence of preoperative liver dysfunction)

Critical liver function
ICG<sub>(15 min) retention</sub> 15 %

(cut-off point for when extended resection is safe)
Liver function diagnostics

ICG-Clearance
<table>
<thead>
<tr>
<th>Condition</th>
<th>No. Patients</th>
<th>% Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate pain control possible with oral analgesics</td>
<td>3080</td>
<td>71.7</td>
</tr>
<tr>
<td>Technical problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dislodgement</td>
<td>126</td>
<td>2.9</td>
</tr>
<tr>
<td>Occlusion</td>
<td>111</td>
<td>2.6</td>
</tr>
<tr>
<td>Disconnect</td>
<td>97</td>
<td>2.3</td>
</tr>
<tr>
<td>Leakage</td>
<td>79</td>
<td>1.8</td>
</tr>
<tr>
<td>Catheter migration</td>
<td>104</td>
<td>2.4</td>
</tr>
<tr>
<td>Patient/primary service request</td>
<td>155</td>
<td>3.6</td>
</tr>
<tr>
<td>Inadequate analgesia</td>
<td>117</td>
<td>2.7</td>
</tr>
<tr>
<td>Fever</td>
<td>90</td>
<td>2.1</td>
</tr>
<tr>
<td>Side effect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedation</td>
<td>26</td>
<td>0.60</td>
</tr>
<tr>
<td>Pruritus</td>
<td>7</td>
<td>0.16</td>
</tr>
<tr>
<td>Respiratory depression</td>
<td>6</td>
<td>0.14</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td>Anticoagulation</td>
<td>11</td>
<td>0.25</td>
</tr>
<tr>
<td>Other</td>
<td>178</td>
<td>4.1</td>
</tr>
<tr>
<td>Not recorded</td>
<td>109</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td>4298</td>
<td>100</td>
</tr>
</tbody>
</table>
Technical aspects

- Congruent analgesia
  - Epidural catheter T 6-9, midline approach

- Choice of anaesthetic drugs and dosing

- Method of administration
  - Intermittent
  - Continuous
  - Patient controlled
# Epidural opioids

Thoracic epidural analgesia regimens / opioid use – Compiled data

<table>
<thead>
<tr>
<th>Drug</th>
<th>Lipid Solubility</th>
<th>Mid-Thoracic Bolus</th>
<th>Onset (min)</th>
<th>Duration (hr)</th>
<th>Continuous Infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td>~1</td>
<td>1-5 mg</td>
<td>40-60</td>
<td>12-24</td>
<td>0.1-1 mg/hr</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>~800</td>
<td>50-100 µg</td>
<td>10</td>
<td>2-4</td>
<td>4-50 µg/hr</td>
</tr>
<tr>
<td>Sufentanil</td>
<td>~1800</td>
<td>10-30 µg</td>
<td>5</td>
<td>1-3</td>
<td>1-10 µg/hr</td>
</tr>
</tbody>
</table>
## Epidural LA / opioid combinations

**continuous infusion and boluses**

Thoracic epidural analgesia regimens / LA + opioid combination – Compiled data

<table>
<thead>
<tr>
<th>Analgesic Solution</th>
<th>Continuous rate (mL/hr)</th>
<th>Demand dose (mL)</th>
<th>Lockout interval (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0625-0.15 % bupivacaine + 2-5 µg/mL fentanyl</td>
<td>4-6</td>
<td>2-4</td>
<td>10-15</td>
</tr>
<tr>
<td>0.0625-0.15 % bupivacaine + 0.5-1 µg/mL sufentanil</td>
<td>3-5</td>
<td>2-3</td>
<td>10-15</td>
</tr>
<tr>
<td>0.1-0.2% ropivacaine + 2-5 µg/mL fentanyl</td>
<td>3-6</td>
<td>2-5</td>
<td>10-20</td>
</tr>
</tbody>
</table>
Personal views on thoracic epidurals in liver surgery

# Activate the epidural intraoperatively and preferably prior to incision, regardless if you believe in a pre-emptive effect or not.

# Insert the catheter at an appropriate level (T6-T9) to achieve congruent analgesia.

# Use the epidural as long as needed, which normally is 3-5 days.

# Minimise haemodynamic consequences – avoid large doses of concentrated local anaesthetics. Use test dose and bolus opioid followed by a continuous infusion of the post-op mixture.
Personal views on thoracic epidurals in liver surgery

# Don’t let the use of epidural anaesthesia lead to excessive fluid loading – judicious use of low CVP and vasopressors intraoperatively is probably best.

# Practice fast track extubation – an option more likely to be successful with a well working thoracic epidural.

# Expect postoperative problems with coagulation when calculated residual liver mass (i.e. functioning parenchyma) is less than 250 mL/m² (25 %) or ICG$_{(15 \text{ min})}$ retention > 15 %.

# Use function testing (Thrombelastography) for decision making when coagulation is borderline.