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[Intervention review]

**Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery**

Henrik Jørgensen¹, Jørn W etterslev², Steen Møiniche³, Jørgen B Dahl⁴

¹Department of Anaesthesiology and Intensive Care, Herlev University Hospital, Copenhagen, Herlev, Denmark. ²Copenhagen Trial Unit, Centre for Clinical Intervention Research, Copenhagen, Denmark. ³Department of Surgery and Anaesthesiology, Y, Amtssygehuset i Glostrup, Glostrup, Denmark. ⁴Department of Anaesthesia and Intensive Care, Glostrup University Hospital, Glostrup, Denmark

Contact address: Henrik Jørgensen, Department of Anaesthesiology and Intensive Care, Herlev University Hospital, Copenhagen, Herlev Ringvej, Herlev, Copenhagen County, 2730, Denmark. hjorgensen@dadlnet.dk. (Editorial group: Cochrane Colorectal Cancer Group.)

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**ABSTRACT**

**Background**

Gastrointestinal paralysis, nausea and vomiting, and pain, are major clinical problems following abdominal surgery. Anaesthetic and analgesic techniques that reduce pain and postoperative nausea and vomiting (PONV), and prevent or reduce postoperative ileus, may reduce postoperative morbidity, duration of hospitalisation and hospital costs.

**Objectives**

To compare effects of postoperative epidural local anaesthetic with regimens based on systemic or epidural opioids, on postoperative gastrointestinal function, postoperative pain, PONV and surgical/anaesthetic complications.

**Search strategy**

Trials were identified by computerised searches of the Cochrane Controlled Trials Register, MEDLINE, EMBASE and by checking the reference lists of trials and review articles.

**Selection criteria**

Randomised controlled trials comparing the effects of postoperative epidural local anaesthetic with systemic or epidural opioids.

**Data collection and analysis**

Collected data included treatment in active (local anaesthetic) and control (opioid based) groups, time to first postoperative stool, time to first postoperative flatus, gastric emptying measured by the paracetamol absorption test, duration of the passage of barium sulphate, pain assessments, use of supplementary analgesics, nausea, vomiting and surgical/anaesthetic complications.
Main results

Most studies in this review involved a small number of patients. Furthermore half of the studies indicated a poor level of methodology in particular regarding blinding and report of withdrawals. Heterogeneity of included studies was substantial.

Results consistently showed reduced time to return of gastrointestinal function in the epidural local anaesthetic group compared with groups receiving systemic or epidural opioid (37 hours and 24 hours, respectively). Postoperative pain was comparable.

Two studies compared the effect of epidural local anaesthetic with a combination of epidural local anaesthetic and opioid on gastrointestinal function. One study favoured epidural local anaesthetic and one study was indifferent.

A meta analysis of five of eight studies comparing the effect of epidural local anaesthetic with a combination of epidural local anaesthetic and opioid on postoperative pain, yielded a reduction in VAS pain scores (0-100 mm) on the first postoperative day of 15 mm, in favour of the combination.

No significant differences in PONV were observed between epidural local anaesthetic and opioid based regimens.

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.
Epidural local anaesthetics versus opioid-based regimens used for reduction of postoperative pain on nausea and vomiting (PONV) and gastrointestinal paralysis after abdominal surgery

Following abdominal surgery, pain, gastrointestinal paralysis and nausea and vomiting can cause major problems. Anaesthetic and analgesic techniques that reduce the pain, nausea and vomiting and lack of gastrointestinal function (ileus) may reduce further postoperative complications and the length of hospital stay. Opioids themselves can cause nausea and vomiting so that using opioid-sparing anaesthetic and pain-relieving (analgesic) techniques may reduce PONV and improve bowel movement (motility).

Administration of epidural local anaesthetics to patients after undergoing abdominal surgery involving a laparotomy reduced gastrointestinal paralysis compared with using systemic or epidural opioids. Pain relief was comparable. These conclusions are based on 22 randomised controlled trials involving a total of 1023 patients undergoing abdominal surgery. Publication dates were from 1984 to 2000. Results consistently showed a reduction in time to return of gastrointestinal function in patients receiving epidural local anaesthetic compared with opioids delivered systemically (by 19 to 56 hours, mean 37 hours) or epidurally (by 10 to 39 hours, mean 24 hours). No clear differences in PONV were apparent. The epidural local anaesthetic used was bupivacaine (0.1 to 0.5%), continuous or with intermittent injections, in all trials but one where ropivacaine was used. Addition of opioid to epidural local anaesthetic may provide better postoperative pain relief compared with epidural local anaesthetics alone. Only two studies compared epidural local anaesthetic with a combination of epidural local anaesthetic and opioid on gastrointestinal function, with no clear findings. Most studies involved a small number of patients and some studies appeared to have poor methodology. The surgical procedures included colon or rectal surgery, hysterectomy, caesarean section, removal of the gall bladder (cholecystectomy), abdominal aortic surgery and major abdominal gynaecological surgery.

BACKGROUND

Gastrointestinal paralysis, nausea and vomiting, and pain, are major clinical problems following abdominal surgery (Livingston 1990, Schwieger 1989), and may result in increased postoperative morbidity and prolonged hospital stay (Kehlet 1998). Consequently, anaesthetic and analgesic techniques that reduce pain and postoperative nausea and vomiting (PONV), and prevent or reduce postoperative ileus, may reduce postoperative morbidity, duration of hospitalisation and hospital costs (Kehlet 1999).

The pathophysiology of postoperative ileus is complex, but activation of nociceptive afferent and sympathetic efferent nerves are believed to play a central role (Liu 1995a). Thus, blockade of these pathways may abolish inhibition of gastrointestinal motility induced by abdominal surgery (Kehlet 1987).

Factors affecting postoperative nausea and vomiting include the anaesthetic - and postoperative analgesic techniques. PONV are common side-effects of opioids (Watcha 1992), and therefore opioid-sparing anaesthetic/analgesic techniques may reduce PONV.

Administration of intra- and postoperative epidural local anaesthetics with blockade of both nociceptive afferent and sympathetic efferent nerves may reduce pain and perioperative opioid requirements, which may lead to reduced PONV, and improved bowel motility through blockade of the spinal reflex arc (Watwil 1989, Asantila 1991).

The aim of this systematic review of RCT’s was to compare the effects of postoperative epidural local anaesthetics (treatment group) with regimens based on systemic or epidural opioids (control groups), on postoperative gastrointestinal function, postoperative pain, PONV and surgical/anaesthetic complications.

OBJECTIVES

To compare the effect of postoperative epidural local anaesthetic alone with postoperative systemic or epidural opioids on gastrointestinal function, PONV and pain after abdominal surgery. Postoperative period is until gastrointestinal function is restored

Hypothesis(es):

1) Postoperative epidural local anaesthetic reduce the duration of postoperative paralytic ileus compared with opioid based analgesic regimens.

2) Postoperative pain relief (assessed on a visual analogue scale (VAS), verbal rating scale, time to first request of analgesics, supplementary analgesics etc.) with epidural local anaesthetics is comparable to pain relief with opioid based analgesic regimens.

3) The incidence of PONV is reduced with the administration of postoperative epidural local anaesthetics compared with opioid based regimens.

METHODS

Criteria for considering studies for this review
### Types of studies
Randomized trials in which postoperative analgesia by epidural local anaesthetic alone was compared with postoperative opioid based regimens. Blinding is not a criterion for studies to be included because the placement of an epidural catheter that is not used for pain management is unethical.

### Types of participants
Patients undergoing abdominal laparotomy

### Types of interventions
Treatments groups received postoperatively administered epidural local anaesthetic without opioid. The control groups received opioid-based analgesia either as systemic opioid, epidural opioid or the combination of epidural local anaesthetic and opioid. Patients or groups of patients that received intraoperatively epidural opioid and postoperatively epidural local anaesthetic alone was not included in the treatment group.

### Types of outcome measures
1. Time (hours) from end of operation to first passage of stool.
2. Time (hours) from end of operation to first passage of flatus.
3. Paracetamol absorption test as a measure of gastric emptying.
4. Passage of barium sulphate through the large intestine.
5. Pain assessment (VAS scale, first request for supplementary analgesics, use of supplementary analgesics, verbal rating scale)
6. Nausea
7. Vomiting
8. Surgical or anaesthetic complications

### Search methods for identification of studies
Relevant randomized trials was identified from the following sources:
- Searching the Cochrane Library
- The National Library of Medicine’s MEDLINE database (Silver Platter 3.11) was systematically searched from 1966 to March 1999 using the following strategy:
  1. explode “DIGESTIVE-SYSTEM-SURGICAL-PROCEDURES”/ all subheadings
  2. LAPAROTOMY
  3. explode “DIGESTIVE-SYSTEM”/ surgery
  4. explode “ABDOMEN”/ surgery
  5. explode “PAIN,-POSTOPERATIVE”/ all subheadings
  6. INTRAABDOMINAL near SURGERY
  7. ABDOMINAL near SURGERY
  8. ABDOMINAL near OPERATION
  9. INTRAABDOMINAL near OPERATION
  10. #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9
  11. #10
  12. “ANALGESIA,-EPIDURAL”/ all subheadings
  13. explode “ANAESTHESIA,-EPIDURAL”/ all subheadings
  14. EPIDURAL near ANALGE
  15. EPIDURAL near ANAST
  16. EPIDURAL near PAIN
  17. EPIDURAL near BLOCK
  18. CAUDAL near BLOCK
  19. CAUDAL near ANALGE
  20. CAUDAL near ANEST
  21. EPIDURAL near ANAEST
  22. CAUDAL near ANAEST
  23. #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22
  24. #11 and #23
  25. #24 and (RANDOMIZED-CONTROLLED-TRIAL in PT)
  26. #24 and (CONTROLLED-CLINICAL TRIAL in PT)
  27. #25 or #26

- Bibliographic Databases including EMBASE were searched.
- Reference lists of identified trials were reviewed to find additional references.
- Articles for all languages were considered for inclusion.

### Data collection and analysis
One reviewer (HJØ) scanned the titles and abstracts of reports identified by electronic searching to produce a list of possibly relevant reports. This list was studied by two reviewers (HJØ, JW) to determine which reports to retrieve in full text. All four reviewers (HJØ, JW, STM, JBD) independently assessed the included reports to confirm eligibility and methodological quality. The reason for excluding a retrieved study is stated.

Quality of included studies was assessed by quality of concealment of allocation which was scored either A, B, C or D (adequate, unclear, inadequate or not used) according to the criteria in the Cochrane Handbook, and according to details on randomization method, allocation concealment, withdrawal problems and ability to perform an intention-to-treat analysis (Jadad 1996):

- Where randomization was performed one point was given, and one further point if method of randomization was described and appropriate, but one point was deducted if randomization was inappropriate (0-2 points).
- When blinded, one point was given, and one further point was given if blinding was described and appropriate, but one point was deducted if blinding was inappropriate (0-2 points).
- If the number and reasons for possible withdrawals was described one point was given (0-1 point).

Thus, reports included had a maximum score of 5 and a minimum of 1 point.

Once articles were chosen on the basis of the inclusion criterions, they were reviewed and summary information extracted. Baseline data collected from each report included surgical procedure; type...
of local anaesthetic including dosage and concentration; type and dosage of opioids; time to first postoperative flatus and/or stool; postoperative gastric emptying and passage time for barium sulphate; pain assessments (and use of supplementary analgesics); nausea and vomiting; surgical/anaesthetic complications.

One reviewer (HJO) entered the data into Review Manager while another (JW) checked against this data extraction. A draft manuscript was performed by one reviewer (HJO) and revised by all four reviewers.

Periodically performed searches (every third months) will be conducted by the Danish Library of Science and Medicine and ourselves using the search string developed in this protocol to update eligible pool of studies to be included in the review. Where heterogeneity in methodology, dosage of used drugs and type of surgery, across the reviewed studies prohibited a quantitative review, we restricted to perform a qualitative review.

**RESULTS**

**Description of studies**

See: Characteristics of included studies; Characteristics of excluded studies.

See: Table of included studies and Table of excluded studies

Types of studies

Details of the studies are to be found in the included trials table. However, a broad summary follows.

Types of participants

The 22 studies included in this review consisted of a total of 1023 patients; 378 in the treatment groups, 645 in the control groups. All patients have had an intra abdominal operation, the surgical procedure included: “colonic or rectal surgery”, hysterectomy, cesarean section, “major abdominal surgery”, cholecystectomy, abdominal surgery, abdominal aortic surgery and “major abdominal gynaecological surgery”.

Types of interventions


Types of outcome measures

- Eight studies reported time (hours) from the end of operation to first passage of stool.
- Seven studies reported time (hours) from the end of operation to first passage of flatus.
- Three studies reported gastric emptying assessed by paracetamol absorption test.
- Three studies reported passage of barium sulphate or radiopaque through the intestine.
- Of the nine studies that assessed gastrointestinal function, eight reported on postoperative pain. In addition, eleven other studies, not reporting on gastrointestinal function, reported on postoperative pain. Pain was assessed by VAS, time to first request of analgesia, supplementary analgesia, volume of epidural infusion, pain relief scale, number of patients without need for additional analgesia, estimated mean of total pain scores, number of pain free patients and VAS pain reduction.
- The incidence of nausea was reported by ten studies. Data were analysed dichotomous: nausea / no nausea.
- The incidence of vomiting was reported by four studies. Data were analysed dichotomous: vomiting / no vomiting.
- Surgical or anaesthetic complications reported, are listed in Table of included studies.

**Risk of bias in included studies**

see Table of included studies

The quality of the 22 included studies was variable. In four studies the method of randomization was stated and adequate (sealed envelopes, blinded medicine from hospital pharmacy, etc.). In 17 studies the method of randomization was unclear. Allocation was not concealed in one study [Bredtmann 1990] which allocated treatment by date of operation.

Ten studies were blinded and 12 were not.

Withdrawals were reported in seven studies and not in 15.

The methodology scores using the scoring system described earlier were:

- Cochrane (A, B, C, D); and randomization (0-2), blinding (0-2), withdrawals (0-1) : totals (maximum 5)

<table>
<thead>
<tr>
<th>Study</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahn 1988</td>
<td>B 1 0 0 0 0 : 1</td>
</tr>
<tr>
<td>Asantila 1991</td>
<td>B 1 0 0 0 0 : 1</td>
</tr>
<tr>
<td>Beeby 1984</td>
<td>A 1 1 1 1 1 : 5</td>
</tr>
<tr>
<td>Bredtmann 1990</td>
<td>C 0 0 0 0 1 : 1</td>
</tr>
<tr>
<td>Brodner 2000</td>
<td>B 1 0 1 1 1 : 4</td>
</tr>
</tbody>
</table>

Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)

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The epidural local anaesthesia group was treatment group, the assessments can be seen in detail. Furthermore, in ADDITIONAL TABLES pain outcome measures analysed in this review are listed. Furthermore, in ADDITIONAL TABLES pain assessments can be seen in detail. The epidural local anaesthesia group was treatment group, the opioid based groups were control groups. Gastrointestinal function Nine of the included studies, with 23 study arms, reported on time to first passage of stool and/or flatus [Ahn 1988, Asantila 1991, Bredtmann 1990, Liu 1995, Riwar 1992, Scheinin 1987, Thörn 1989, Wallin 1986, Wattwil 1989]. The treatment groups in these studies all received postoperative epidural bupivacaine 0.25% except in the study by Liu, where patients received bupivacaine 0.15%. The absolute doses of bupivacaine administered were: Ahn 1988: 20–37.5 mg intermittent for 48 h, Asantila 1991: 10 mg/h for 24 h, Bredtmann 1990: (mean) 19.2-22.2 mg/h for 72 h, Liu 1995: 15 mg/h until bowel function, Riwar 1992: 15-30 mg/h for 48 h, Scheinin 1987: 10-15 mg/h for 48 h, Thörn 1989: 20 mg/h for 42 h, Wallin 1986: 25-35 mg intermittent for 24 h, Wattwil 1989: 20 mg/h for 26-30 h. The type, dose, mode of administration and duration of the analgesia in the opioid based control groups were very heterogeneous. In seven studies, including 7 control groups, the opioid was administered epidurally in combination with local anaesthetics: Ahn 1988: i.v. pentazocine 30-60 mg intermittent, Asantila 1991: continuous epidural morphine 0.2 mg/kg or bupivacaine 0.25%/morphine 0.2 mg/kg for 24 h, Bredtmann 1990: systemic piritramide 7.5-15 mg, tramadol 50-100 mg or a simple analgesic, on request, Liu 1995: i.v patient-controlled-analgesia (PCA) with morphine or continuous epidural morphine 0.5 mg/h or a continuous combination of bupivacaine 0.1%/morphine 0.03 mg/ml 10 ml/h all until bowel function, Riwar 1992: continuous i.v. infusion of pentazocine 10 mg/h for 48 h, Scheinin 1987: i.v. oxycodone 0.15 mg/kg on request or epidural morphine 2-6 mg once a day for three days or continuous epidural morphine 2-6 mg/ day for 48 h, Thörn 1989: epidural morphine 4 mg + 2 mg on request with a maximum of 12 mg per 24 h up to 42 h, Wallin 1986: i.m. pentazocine 30-60 mg on request, Wattwil 1989: systemic ketobemidone 5 mg on request Because of the heterogeneity of the control groups and the uncertainty how this would affect gastrointestinal outcomes, analysis were made in three ways:

- comparison with pooled control groups and differentiated outcome (passage of first postoperative stool or flatus)
- comparison with differentiated control groups (systemic opioid, epidurally opioid, combination of epidurally local anaesthetic/opioid) and pooled outcome (first gastrointestinal function)
- comparison with differentiated control groups and differentiated outcome

Effect on time to first passage of stool.

Epidural local anaesthetic (LA) versus one large pooled control group.

see Comparison 01, outcome 01

The meta analysis of this comparison included a total of 406 patients, 178 in the treatment group and 228 in the control group. The test for heterogeneity between studies was significant and therefore the random effect model was used. The analysis showed a significant reduction in time to first passage of stool in the treatment group of -44 [-72,-17] hours, compared to the control group. Only one of the eight studies did not find a difference between groups [Wallin 1986], whereas the remaining seven studies found a significant reduced time to first passage of stool in treatment groups. In the non-significant study, epidural local anaesthetic infusion was administered only for 24 hours postoperatively, while the epidural local anaesthetic infusion in the statistical significant studies was administered between 24 and 72 hours, mean 44 hours postoperatively.

Effect on time to first passage of flatus.

Epidural local anaesthetic versus one large pooled control group.

see Comparison 01, outcome 02

The meta analysis of this comparison included a total of 265 patients, 112 in the treatment group and 153 in the control group. The test for heterogeneity between studies was significant and therefore the random effect model was used. Six of the seven studies in this analysis favoured treatment and one was indifferent. The meta analysis showed a significant reduction in time to first passage of flatus in the treatment group of -36 [-56,-17] hours, compared to the control group. In the non-significant study, epidural local anaesthetic infusion was administered for only 24 hours postoperatively, while the epidural local anaesthetic infusion in the sta-
Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)

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Statistical significant studies was administered between 26 hours and until fulfillment of discharge criterions, mean 46 hours postoperatively.

Effect on time to return of gastrointestinal function (time to first passage of stool or flatus).

Epidural local anaesthetic versus systemic opioid, epidurally opioid and the combination of epidurally local anaesthetic/opioid analysed in subgroups.

The test for heterogeneity between studies was significant and therefore the random effect model was used.

Comparison 01, outcome 03
Subgroup 01
Epidural local anaesthetic versus systemic opioid
Seven studies that compared epidural local anaesthetic with systemic opioid, reported on gastrointestinal outcome. The comparison included a total of 319 patients, 159 in the treatment group and 160 in the control group. Six studies favoured treatment and one study was indifferent. The sub analysis yielded a reduction in time to return of overall gastrointestinal function of -37 [-56,-19] hours.

Subgroup 02
Epidural local anaesthetic versus epidural opioid.
Four studies that compared epidural local anaesthetic with epidural opioid, reported on gastrointestinal outcome. The comparison included a total of 135 patients, 60 in the treatment group and 75 in the control group. All four studies favoured treatment and the sub analysis yielded a reduction in time to return of gastrointestinal function of -24 [-39,-10] hours.

Subgroup 03
Epidural local anaesthetic versus epidural local anaesthetic/opioid.
Two studies that compared epidural local anaesthetic with a combination of epidural local anaesthetic and opioid, reported on gastrointestinal outcome. The comparison included a total of 66 patients, 34 in the treatment group and 32 in the control group. One study favoured treatment and one study was indifferent. The sub analysis did not significantly favour any of the groups.

Effect on time to first passage of stool - subgroups.

Epidural local anaesthetic versus systemic opioid.
Epidural local anaesthetic versus epidural local anaesthetic/opioid and the combination of epidural local anaesthetic/opioid analysed in subgroups.

The test for heterogeneity between studies was significant and therefore the random effect model was used.

Comparison 01, outcome 05
Subgroup 01
Epidural local anaesthetic versus systemic opioid.
Six studies that compared epidural local anaesthetic with systemic opioid, reported on time to first passage of stool. The comparison included a total of 261 patients, 129 in the treatment group and 100 in the control group. Five studies favoured treatment and one study was indifferent. The sub analysis yielded a reduction in time to first passage of stool of -16 [-26,-6] hours.

Effect on time to first passage of flatus - subgroups.

Epidural local anaesthetic versus systemic opioid.
Epidural local anaesthetic versus epidural opioid and the combination of epidural local anaesthetic/opioid analysed in subgroups.

The test for heterogeneity between studies was significant and therefore the random effect model was used.

Comparison 01, outcome 05
Subgroup 01
Epidural local anaesthetic versus systemic opioid.
Six studies that compared epidural local anaesthetic with systemic opioid, reported on time to first passage of flatus. The comparison included a total of 201 patients, 101 in the treatment group and 100 in the control group. Five studies favoured treatment and one study was indifferent. The sub analysis yielded a reduction in time to first passage of flatus of -39 [-60,-18] hours.

Subgroup 02
Epidural local anaesthetic versus epidural opioid.
Two studies that compared epidural local anaesthetic with epidural opioid, reported on time to first passage of flatus. The comparison included a total of 67 patients, 26 in the treatment group and 41 in the control group. Both studies favoured treatment and the sub analysis yielded a reduction in time first passage of flatus of -31 [-43,-19] hours.

Subgroup 03
Epidural local anaesthetic versus epidural local anaesthetic/opioid.
Only one study compared epidural local anaesthetic with a combination of epidural local anaesthetic and opioid, and reported on time to first passage of flatus. The comparison included 26 patients, 14 in the treatment group and 12 in the control group, and did not favour any of the groups.

Effect on gastric emptying assessed by paracetamol absorption test
Three studies reported on gastric emptying assessed by the paracetamol absorption test. In two studies the absorption tests were performed the day after cholecystectomy [Thörn 1992, Thörn 1996] and in one study [Geddes 1991] the absorption test was performed right after caesarean section. In the two studies by Thörn the treatment group received continuous epidural bupivacaine 0.25% 6-8
ml/h and the control group received epidural morphine 4 mg and 2 mg on request. The outcomes in the two studies were: maximum plasma paracetamol concentration (Cmax), time taken to reach maximum concentration (Tmax), areas under the serum concentration curve from 0 to 60 min (AUC60). In the study by Geddes the treatment group received an epidural bolus of bupivacaine 0.25% 8 ml and the control group received an epidural bolus of bupivacaine 0.25% 8 ml and fentanyl 100 mikrog. The outcomes in the latter study were: peak plasma paracetamol against time and area under the serum paracetamol concentration time curve from 0 - 45 min (AUC45) and 0 - 90 min (AUC90).

All three studies concluded that epidural opioid significantly delayed gastric emptying. Quantitatively analysis of the studies was not possible since the outcomes could not be compared.

Effect on passage of barium sulphate or radiopaque through the intestine

Three studies reported on motility of the intestine assessed by passage of barium sulphate or radiopaques [Ahn 1988, Wallin 1986, Wattwil 1989]. The barium or radiopaques were followed by serial radiographs. In the studies it was stated if the placements in the intestine, of barium sulphate or radiopaques, in the treatment or control groups differed from another. It was not possible to perform a quantitative analysis. Two studies [Ahn 1988, Wallin 1989] found significantly less transit time through the intestine in the epidural local anaesthetic group compared to the control group, and one study [Wallin 1986] did not find a difference.

Effect on postoperative pain

Nineteen of the included studies, with 53 different study arms, reported on postoperative pain.

Patients in the treatment groups received epidural bupivacaine in 18 studies; in eleven studies as a continuous infusion (4 - 25 mg/h), in five studies as intermittent injections (12.5 - 37.5 mg), in one study as patient-controlled epidural analgesia, and in one study as single bolus injection (50 mg). In one study patients received continuous epidural ropivacaine 2 mg/ml adjusted twice daily to the individual patients requirements (VAS < 40 mm).

The control groups (opioid based regimens) received a wide range of different treatments which made it impossible to pool data into one treatment group. Therefore comparisons were divided into the same subgroups as used in "gastrointestinal function":

- Epidural local anaesthetic versus systemic opioid
- Epidural local anaesthetic versus epidural opioid
- Epidural local anaesthetic versus epidural opioid

Within these subdivisions the treatment groups still showed wide heterogeneity concerning type and dose of opioid, mode of pain assessment, time of pain assessment and conditions of the pain assessment (rest, cough and mobilisation). Therefore under these premises we did not find it possible to perform quantitative analysis.

Below a description of the studies within the subdivision;

Epidural local anaesthetic versus systemic opioid. see Table 1

Eight studies, with 9 different control groups, that received systemic opioid, reported on pain- or pain relief- assessments. The control (systemic opioid) groups consisted of: i.v. or i.m. pentazocine 30 - 60 mg [Ahn 1988, Wallin 1986], “piriramide, tramadol or a simple analgesic” [Bredtmann 1990], intermittent or continuous systemic morphine [Cuschieri 1985], patient-controlled analgesia (PCA) i.v. morphine [Liu 1995], oxycodone 0.15 mg/kg [Scheinin 1987], i.v. morphine 2.5 mg as required [Rurberg 1984], i.m. ketobemidone 5 mg on request [Wattwil 1989].

Pain intensity and relief were assessed by visual analogue score, time to first request of analgesics, supplementary analgesics, estimated mean of total pain scores, number of patients without additional analgesics and a pain relief scale. The most frequent reported pain assessment was by the visual analogue scale, in six of the eight studies. In only one of the six studies it was reported whether pain scores was assessed under rest, cough or mobilisation. The pain assessment times (postoperative hours) ranged from every two hours to once a day.

In all studies epidural local anaesthetic was superior or as efficacious as systemic opioid. However, due to the different drugs, doses, administration and conditions under which pain is assessed, the overall interpretation regarding these regimens should be cautious.

Table 1. Pain - treatment group versus systemic opioid

<table>
<thead>
<tr>
<th>Study</th>
<th>N treat/contr</th>
<th>Surg procedure</th>
<th>Analgesic</th>
<th>Pain, specified?</th>
<th>VAS scores</th>
<th>First request</th>
<th>Suppl analgesic</th>
<th>Other pain outcome</th>
<th>Epi catheter level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahn 1988</td>
<td>16 / 14</td>
<td>Resection of left colon or rectum</td>
<td>Bupivacaine 0.25% intermitt 8-15 ml vs i.v. pen-</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Pain relief scale: NS</td>
<td>L2/3</td>
</tr>
</tbody>
</table>

Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)
Copyright © 2008 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
<table>
<thead>
<tr>
<th>Study</th>
<th>Patients</th>
<th>Procedure</th>
<th>Local Anesthetic</th>
<th>Dose / Mode</th>
<th>Compared To</th>
<th>Outcome</th>
<th>Additional Analgesics</th>
<th>Treatment Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bredtmann</td>
<td>57 / 59</td>
<td>Major abd. colonic resection and/or anastomosis</td>
<td>Bupivacaine 0.25% cont. for 72h vs &quot;systemic analgesics&quot; (pirtiramid, tramadol, or a simple analgesic)</td>
<td>No</td>
<td>LA superior to syst analg</td>
<td>Not reported</td>
<td>LA superior to syst analg</td>
<td>Not reported</td>
</tr>
<tr>
<td>Cuschieri</td>
<td>25 / 25 / 25</td>
<td>Cholecystectomy</td>
<td>Bupivacaine 0.5% cont. for 12h vs intermitt syst morphine and cont syst morphine</td>
<td>No</td>
<td>LA superior to intermitt morphine at 12h. NS at 24, 36, .....72</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Lower thoracic</td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14 / 12</td>
<td>Colon resection</td>
<td>Bupivacaine 0.15% 10 ml/h vs patient-controlled analgesia (i.v. morphine)</td>
<td>Activity pain</td>
<td>LA superior to syst morphine at day 1 &amp; 2</td>
<td>Not reported</td>
<td>Unclear</td>
<td>Not reported</td>
</tr>
<tr>
<td>Rutberg 1984</td>
<td>8 / 8</td>
<td>Cholecystectomy</td>
<td>Bupivacaine 0.25-0.375% intermitt. 5-8 ml vs i.v. morphine 2.5 mg as required</td>
<td>No</td>
<td>LA superior to syst opioid at 2,4,6,12 h. NS at 24 h.</td>
<td>Not reported</td>
<td>Not reported</td>
<td>T9/10, T10/11</td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>20 / 20</td>
<td>Hemicolecotomy or anterior resection</td>
<td>Bupivacaine 0.25% 4-6 ml/h vs systemic oxycodone</td>
<td>No</td>
<td>LA superior to syst opioid at 3 h. NS at 24 h.</td>
<td>Not reported</td>
<td>LAi superior to syst opioid</td>
<td>Number of patients without additional analgesics:</td>
</tr>
<tr>
<td>Study</td>
<td>N</td>
<td>Procedure</td>
<td>Local Anaesthetic</td>
<td>Dose</td>
<td>Route</td>
<td>Systemic Anaesthetic</td>
<td>Comparator</td>
<td>Pain Scores</td>
</tr>
<tr>
<td>---------------</td>
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<td>---------------</td>
<td>-------</td>
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<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Wallin 1986</td>
<td>12 / 15</td>
<td>Cholecystectomy</td>
<td>Bupivacaine 0.25% 10-14 ml/3h vs i.m. pentazocine</td>
<td>0.15 mg/kg</td>
<td>NS</td>
<td>Estimated mean of total pain scores: LA superior to syst opioid</td>
<td>T12/L1</td>
<td></td>
</tr>
<tr>
<td>Wallwil 1989</td>
<td>20 / 20</td>
<td>Hysterectomy</td>
<td>Bupivacaine 0.25% 8 ml/h vs i.v. ketobemidone 5 mg</td>
<td>No</td>
<td>Not reported</td>
<td>LA superior to syst opioid at 26-30 h.</td>
<td>Not reported</td>
<td>T12/L1</td>
</tr>
</tbody>
</table>

Table 1. Pain - treatment group versus systemic opioid

(Continued)
Epidural local anaesthetic versus epidural opioid. see Table 2

Twelve studies, with 15 different control groups, that received epidural opioid, reported on pain- or pain relief- assessments. In eight of the twelve studies the control (epidural opioid) groups received epidural morphine either as continuous infusion [Asantila 1991, Cullen 1985, Liu 1995, Scheinin 1987] or as intermittent bolus injections [Beeby 1984, Rutberg 1984, Scheinin 1987, Thorén 1989, Thörn 1996] ranging from 2 - 12 mg per day. In two studies epidural fentanyl was administered either as patient-controlled epidural analgesia [Cooper 1996] or as continuous infusion [George 1992]. Patients received epidural methadone in one study [Beeby 1984], epidural tramadol in one study [Delilkan 1993] and epidural diamorphine in one study [Lee 1988]. In the study by Beeby two groups of patients received two different epidural opioids, while in the study by Scheinin one group received continuous morphine and another group received bolus injections of morphine.

Pain intensity and - relief was assessed by visual analogue score, time to first request of analgesics, supplementary analgesics, reduction in pain scores after “top ups”, number of pain free patients, distribution of pain scores in groups, number of patients without additional analgesics. The most frequent reported pain assessment was by the visual analogue scale in eleven of the twelve studies, but in only two studies it is stated whether the assessment is under rest, coughing or mobilisation. Also the assessment times are very heterogeneous: “before and after top ups”, at certain postoperative hours and once a day.

Concerning pain relief, 4 authors concluded that epidural opioid was superior to epidural local anaesthetic, 3 authors concluded that epidural local anaesthetic was superior to epidural opioid and 4 authors concluded that pain relief was similar with the two regimens. One author did not conclude whether one of the regimens was superior.

However, no overall interpretation can be made, due to different drugs, doses, times of administration and conditions under which pain was assessed. Instead results are documented in the “Additional tables”.

<table>
<thead>
<tr>
<th>Study</th>
<th>N treat/contr</th>
<th>Surg procedure</th>
<th>Analgesic Pain, specified?</th>
<th>VAS pain First request</th>
<th>Suppl analgesic</th>
<th>Other pain outcome</th>
<th>Epi catheter level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asantila 1991</td>
<td>20 / 20</td>
<td>Hysterec-tomy</td>
<td>Bupi-vacaine 0.25% 4 ml/h vs epi morphine</td>
<td>No</td>
<td>Not reported</td>
<td>Not reported</td>
<td>LA inferior to epi morphine</td>
</tr>
</tbody>
</table>
Table 2. Pain - treatment group versus epidural opioid

(Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Intervention</th>
<th>VAS pain reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beeby 1984</td>
<td>10 / 12 / 11</td>
<td>Caesarean section</td>
<td>LA inferior to epi morphine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bupivacaine 0.5%, 10 ml</td>
<td>NS at 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>single dose vs epi morphine 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>mg, in 10 ml single dose</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>VAS pain reduction:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LA superior to epi morphine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>and epi methadone, before and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>after top up</td>
<td></td>
</tr>
<tr>
<td>Cooper 1996</td>
<td>20 / 20</td>
<td>Caesarean section</td>
<td>LA inferior to epi fentanyl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bupivacaine 0.1% patient-</td>
<td>NS at 12. NS at 0.5, 4, 8,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>controlled epidural analgesia</td>
<td>24. NS at 0.5, 4, 8, 24.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(PCEA) 5ml/10 min vs epi</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>fentanyl at 8-12, 12-24 h. NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>at the intervals 0-4, 4-8 h.</td>
<td></td>
</tr>
<tr>
<td>Cullen 1985</td>
<td>15 / 18</td>
<td>Major abdominal surgery</td>
<td>LA inferior to epi tramadol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bupivacaine 0.1% 3-4 ml/h vs</td>
<td>duration of escape doses:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>epi morphine 0.3-0.4 mg/h</td>
<td>LA</td>
</tr>
<tr>
<td>Delilkan 1993</td>
<td>20 / 18</td>
<td>Abdominal surgery</td>
<td>LA inferior to epi tramadol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bupivacaine 0.25% 10</td>
<td>Duration of escape doses: LA</td>
</tr>
</tbody>
</table>

Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)
Copyright © 2008 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
<table>
<thead>
<tr>
<th>Study</th>
<th>N / N</th>
<th>Procedure</th>
<th>Local Anesthetic Dose</th>
<th>Opioid Dose</th>
<th>Doses Interval</th>
<th>Comparison</th>
<th>Distribution</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>George 1992</td>
<td>10 / 10</td>
<td>Abdominal aortic surgery</td>
<td>Bupivacaine 0.2% 5 ml/h vs epi fentanyl 50 or 100 mg</td>
<td>Tramadol 100 mg at 3, 12, 24 h. NS at 1, 6 h.</td>
<td>1-2 doses with at least 15 min interval</td>
<td>Inferior to epi tramadol 100 mg</td>
<td>T7/8, T8/9</td>
<td></td>
</tr>
<tr>
<td>Lee 1988</td>
<td>20 / 20</td>
<td>Major gynaecological surgery</td>
<td>Bupivacaine 0.125% 15 ml/h vs epi diamorphine 0.5 mg in 15 ml/h</td>
<td>No</td>
<td>NS</td>
<td>Not reported</td>
<td>Dist. of pain scores: NS</td>
<td>T10/11, T11/12</td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14 / 12</td>
<td>Colonic surgery</td>
<td>Bupivacaine 0.15% 10 ml/h vs epi morphine 0.5 mg/ml 10 ml/h</td>
<td>Cough LA superior to epi morphine, day 1 &amp; 2. NS day 3</td>
<td>Not reported</td>
<td>Unclear</td>
<td>Not reported</td>
<td>T8-10</td>
</tr>
<tr>
<td>Rutberg 1984</td>
<td>8 / 8</td>
<td>Cholecystectomy</td>
<td>Bupivacaine 0.25-0.375% 5-8 ml/h vs epi morphine 4 ml/4h</td>
<td>No</td>
<td>NS</td>
<td>Not reported</td>
<td>Not reported</td>
<td>T9/10, T10/11</td>
</tr>
</tbody>
</table>

Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)

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Table 2. Pain - treatment group versus epidural opioid

(Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients</th>
<th>Intervention</th>
<th>Baseline</th>
<th>Additional Analgesics</th>
<th>Comparison</th>
<th>Patient Failure</th>
<th>Middle of Incision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheinin 1987</td>
<td>15 / 30 Hemi-colectomy or anterior resection</td>
<td>Bupivacaine 0.25% 4-6 ml/h vs epi morphine 2-6 mg once a day vs epi morphine 2-6 mg/day</td>
<td>No</td>
<td>NS</td>
<td>Not reported</td>
<td>NS</td>
<td>Number of patients without additional analgesics: NS</td>
</tr>
<tr>
<td>Thorén 1989</td>
<td>11 / 11 Hysterectomy</td>
<td>Bupivacaine 0.25% 8 ml/h vs epi morphine 2-12 mg/24h on request</td>
<td>No</td>
<td>LA superior to epi morphine at afternoon, morning and afternoon after surgery</td>
<td>Not reported</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Thörm 1996</td>
<td>7 / 7 Cholecystectomy</td>
<td>Bupivacaine 0.25% 8 ml/h vs epi morphine 4 mg + 2 mg on request</td>
<td>No</td>
<td>NS</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
</tr>
</tbody>
</table>
Epidural local anaesthetic versus epidural local anaesthetic/opioid.  
see Table 3  
Eight studies, with 10 different control groups, that received epidural combination of local anaesthetic and opioid, reported on pain- or pain relief-assessments. In three of the eight studies continuous epidural bupivacaine (4 - 25 mg/h) was compared to the same dose of bupivacaine plus morphine 0.2 - 0.5 mg/h [Asantila 1991, Cullen 1985, Scott 1989]. One study compared continuous epidural bupivacaine 6-10 mg/h with the combination of bupivacaine 6-10 mg/h plus fentanyl 30-50 mikrog/h [George 1992]. One study compared continuous epidural infusion of bupivacaine 18.75 mg/h with bupivacaine 18.75 mg/h plus diamorphine 0.5 mg/h [Lee 1988]. In one study continuous epidural bupivacaine 15 mg/h was compared to the combination of bupivacaine 10 mg/h plus morphine 0.3 mg/h [Liu 1995]. One study compared epidural bupivacaine 1 mg/ml with the combination of bupivacaine 0.5 mg/ml plus fentanyl 2 mikrog/ml via patient-controlled epidural analgesia [Cooper 1996]. Finally one study compared continuous epidural ropivacaine 2 mg/ml with the combination of ropivacaine 2 mg/ml plus sufentanil 0.5, 0.75 or 1.0 mikrog/ml, adjusted to the individual patients requirements [Brodner 2000]. Pain intensity and - relief was assessed by visual analogue score, time to first request of analgesics, supplementary analgesics, amount of epidural drug, number of pain free patients at certain times. The most frequent reported pain assessment was by the visual analogue scale, in six of the eight studies. In only three studies it was stated whether the assessment was made under rest, coughing or mobilisation. Pain assessments were made certain postoperative hours and once a day. In the study by Liu the dose of bupivacaine was not the same in the two groups as this was a study on "balanced analgesia". In the study by Lee patients were withdrawn at first request. In the study by Scott, patients with visual analogue pain scores > 20 mm were withdrawn. In the study by Brodner, patients with visual analogue pain scores > 40 mm were withdrawn.

Table 3. Pain - treatment group versus epidural local anaesthetic and opioid

<table>
<thead>
<tr>
<th>Study</th>
<th>N treat/contr</th>
<th>Surg procedure</th>
<th>Analgesic Pain, specified?</th>
<th>VAS pain First request</th>
<th>Suppl analgesic</th>
<th>Other pain outcome</th>
<th>Epid catheter level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asantila 1991</td>
<td>20 / 20</td>
<td>Hysterec-tomy</td>
<td>Bupivacaine 0.25%</td>
<td>No</td>
<td>Not reported</td>
<td>LA inferior to epi comb</td>
<td>T11/12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 ml/h vs bupivacaine 0.25% + morphine</td>
<td>Not reported</td>
<td>LA inferior to epi comb</td>
<td>Number of pain free patients: LA inferior to epi comb on postop</td>
<td></td>
</tr>
</tbody>
</table>
Table 3. Pain - treatment group versus epidural local anaesthetic and opioid

(Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>Surgery</th>
<th>Local anaesthetic</th>
<th>Nociceptive stimulation</th>
<th>Pain at rest and cough</th>
<th>Analgesic regimen</th>
<th>Side effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper 1996</td>
<td>20 / 20</td>
<td>Caesarean section</td>
<td>Bupivacaine 0.1%</td>
<td>No</td>
<td>Not reported</td>
<td>LA inferior to epi comb at intervals 4-8, 8-12 h. NS at 0-4 h.</td>
<td>L2/3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>vs bupivacaine 0.1% + fentanyl 10 microg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 ml/10 min</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cullen 1985</td>
<td>15 / 15</td>
<td>Major abdominal surgery</td>
<td>Bupivacaine 0.1%</td>
<td>No</td>
<td>NS day 0, 1, 2, 3</td>
<td>NS</td>
<td>Not reported</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>vs bupivacaine 0.1% + morphine 0.1 mg/ml</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>3-4 ml/h</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>george 1992</td>
<td>10 / 10</td>
<td>Abdominal aortic surgery</td>
<td>Bupivacaine 0.2%</td>
<td>No</td>
<td>Not reported</td>
<td>LA inferior to epi comb at 6, 12, 18, 24 h.</td>
<td>T7/8, T8/9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>vs bupivacaine 0.2% + fentanyl 10 mg/ml</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>5 ml/h</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee 1988</td>
<td>20 / 20</td>
<td>Major gynaecological surgery</td>
<td>Bupivacaine 0.125%</td>
<td>No</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Number of patients withdrawn at first request for analgesics: LA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>vs bupivacaine 0.125%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15 ml/h</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Table 3. Pain - treatment group versus epidural local anaesthetic and opioid

(Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Size</th>
<th>Procedure</th>
<th>Anaesthetic Regimen</th>
<th>Analgesia</th>
<th>Outcome Measures</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liu 1995 14 / 14 Colonic surgery</td>
<td>Bupivacaine 0.15% 10 ml/h vs bupivacaine 0.1% + morphine 0.03 mg/ml 10 mg/ml</td>
<td>Cough</td>
<td>NS at day 1, 2, 3</td>
<td>Not reported</td>
<td>Unclear</td>
<td>Number of pain free patients at rest: LA inferior to epi comb with sufentanil 0.75+1.0</td>
</tr>
<tr>
<td>Scott 1989 10 / 10 Upper abdominal surgery</td>
<td>Bupivacaine 0.5% 5 ml/h vs bupivacaine 0.5% + morphine 0.1 mg/ml 5 ml/h</td>
<td>At rest</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Number of pain free patients at rest: LA inferior to epi comb with sufentanil 0.75+1.0</td>
</tr>
<tr>
<td>Brodner 2000 22/25/30/26 Major abdominal gastrointestinal surgery</td>
<td>Ropivacaine 0.2% adjusted to VAS &lt; 40 + PCEA 2 ml max /20 min vs ropivacaine 0.2% + sufentanil 0.5, 0.75 or 1.0 microg/ml adjusted to VAS &lt; 40 + PCEA 2 ml max</td>
<td>Coughing or deep breath</td>
<td>LA inferior to epi comb with sufentanil 0.75+1.0</td>
<td>Not reported</td>
<td>NS</td>
<td>Cumulative volumes of epidural doses: NS</td>
</tr>
</tbody>
</table>
Postoperative pain (VAS score).
Epidural local anaesthetic versus epidural local anaesthetic/opioid.
Comparison 01, outcome 08
Despite the listed heterogeneity between studies in this subgroup, a meta analysis on VAS pain on the first postoperative day was made. Data could be extracted from five of the eight studies. The test for heterogeneity was significant and therefore the random effect model was used. The comparison includes a total of 163 patients, 79 in the epidural local anaesthetic group and 84 in the combined epidural local anaesthetic/opioid group. Three studies was in favour of the combination of epidural local anaesthetic and opioid and two studies was indifferent. The analysis yielded a reduction in VAS pain score on the first postoperative day of 20 [8,32] mm, in favour of the combination of epidural local anaesthetic and opioid.
Effect on the incidence of postoperative nausea
Comparison 01, outcome 07
The incidence and not the severity of postoperative nausea was analysed. If reported, the incidence of nausea on day 1 was used. A total of 514 patients, 165 in the treatment group and 349 in the control group, was included in the analysis. Of the ten studies included, two were in favour of treatment [Thorén 1989, Watwil 1989], seven were indifferent [Asantila 1991, Beeby 1984, Delilkan 1993, George 1992, Lee 1988, Liu 1995,] and one was in favour of control [Cooper 1996]. The overall analysis showed no significant difference between treatments, yielding a Peto OR of 0.76 [0.47,1.23].
Effect on the incidence of postoperative vomiting
Comparison 01, outcome 08
The incidence and not the severity of vomiting was analysed. If reported, the incidence of vomiting on day 1 was used. Three studies with a total of 259 patients, 80 in the treatment group and 179 in the control group, were included in the analysis. The four studies included showed no difference between treatment or control, nor did the overall analysis.
Effect on surgical or anaesthetic complications
An attempt was made to summarize the reported surgical or anaesthetic complications from the included studies. Because of inconsistency of reporting complications, duration of the studies, which complications were reported and because of the small number of patients in the studies, it was not possible to make a meaningful summation. In Table of included studies all reported outcomes are listed.

DISCUSSION
Postoperative gastrointestinal paralysis is a major clinical problem after abdominal surgical procedures as it may result in increased morbidity and prolonged rehabilitation. Therefore procedures or treatments that reduce time to return of gastrointestinal function are warranted. In this review results consistently showed reduced time to return of gastrointestinal function in the epidural local anaesthetic group compared with systemic or epidural administered opioid. Only one study did not find a difference [Wallin 1986], in this study patients in the epidural local anaesthetic group received treatment for 24 hours, while treatment in the other studies ranged from 24 to 72 hours. A time factor may play a role.
Most studies in this review involved a small number of patients. Furthermore half of the studies indicated a poor level of methodological rigour (Cochrane B and 1-2 points on the quality score) in particular regarding blinding and report of withdrawals.
All treatment groups except one in this review received postoperative epidural bupivacaine either continuously or intermittent while treatment in the opioid based groups was much more various. Our initial strategy was to pool all opioid based regimens into one large control group, but realising the heterogeneity of the included studies this was not sensible. In the analysis of gastrointestinal function we therefore analysed in three different ways, to demonstrate that the results did not change radically. Compared to both systemic opioid or epidural opioid alone, postoperative epidural local anaesthetic resulted in faster return of gastrointestinal function (stool and/or flatus). Only in the comparison of epidural local anaesthetic and epidural local anaesthetic/opioid there was no difference, but this comparison included only two studies. In the study by Liu et al there was no difference between epidural local anaesthetic and the combination of epidural local anaesthetic and opioid, but both groups showed faster return of gastrointestinal function than in the groups of systemic or epidural opioid. Data on gastrointestinal function after laparotomy comparing epidural local anaesthetic and the combination of epidural local anaesthetic and opioid are too sparse to make a conclusion.
The studies included in this review were based on different types of abdominal surgery. The consequences of this heterogeneity is unclear. The nine studies that reported on return of gastrointestinal function were based on colonic / rectal surgery (5 studies), hysterectomy (3 studies) and cholecystectomy (1 study). Time to return of gastrointestinal function (flatus / stool) in the epidural...
local anaesthetic groups of these studies ranged from 18 h (Riwar) to 71 h (Bredtmann). Patients in the studies by Riwar and Bredtmann both had colonic/rectal surgery, so the relative big differences are likely to be due to differences in study design rather than the surgical procedure.

It was not possible to perform analysis of gastric emptying and passage of barium sulphate and radiopaques, since outcome measures could not be directly compared. All three studies assessing gastric emptying, and two of the studies assessing transit time through the intestine, favours epidural local anaesthetic. Though, gastric emptying in itself does not provide any information about postoperative patient rehabilitation, nor does transit time through the intestine. First passage of flatus and stool may be a more valid parameter of gastrointestinal function, although this may be disputed.

Combining the analysis of gastrointestinal function with the analysis of postoperative pain it becomes clear that compared to systemic opioid, epidural local anaesthetic both produce faster return of gastrointestinal function and superior or as efficacious pain treatment. The comparison between epidural local anaesthetic and epidural opioid show faster return of gastrointestinal function in the local anaesthetic group while there is no trend towards a better pain relief regimen. Unfortunately only few studies compare epidural local anaesthetic and epidural local anaesthetic/opioid. Only two and eight studies report return of gastrointestinal function and pain assessment, respectively. The analysis of the gastrointestinal function does not yield any difference while it is indicated that epidural local anaesthetic/opioid provide the most superior pain treatment. More studies assessing both postoperative pain and gastrointestinal function, comparing postoperative epidural local anaesthetic alone and epidural combinations of local anaesthetic and opioid is absolutely warranted, since reporting only one of the outcomes could be reporting half of the truth.

The review of studies reporting pain assessments revealed a broad variation among studies in drugs, doses, administration form, outcome measures, assessment times, rest- or activity pain assessment etc, and it was not possible to perform either a quantitative or a qualitative analysis. Consequently, although there was no trend towards postoperative epidural local anaesthetic being inferior compared to systemic or epidural opioid, this part of the review should be interpreted with great care and the issue need further clarification.

Pooled results of the incidence of postoperative nausea or vomiting did not show a statistically significant difference between groups. It should be recognized, though, that our analysis was based on a conversion to dichotomous data. Consequently differences in severity of nausea and vomiting may have been overlooked.

Surgical and anaesthetic complications was inconsistently reported, and no conclusions can be made from this review.

AUTHORS’ CONCLUSIONS
Implications for practice
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 epidural 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.

Implications for research
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.

ACKNOWLEDGEMENTS
Janet Wale from CCNet-Contact for the synopsis
Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)

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References to studies included in this review

Ahn 1988 (published data only)

Asantila 1991 (published data only)

Bebee 1984 (published data only)

Bredtmann 1990 (published data only)

Broder 2000 (published data only)

Cooper 1996 (published data only)
Cooper DW, Ryall DM, McHardy FE, Lindsay SL, Eldabe SS. Patient-controlled extradural analgesia with bupivacaine, fentanyl, or a mixture of both, after caesarean section. Br J Anaesth 1996;76:611–5.

Cullen 1985 (published data only)

Cuscheri 1985 (published data only)

Delilkan 1993 (published data only)

Geddes 1991 (published data only)

George 1992 (published data only)

Lee 1988 (published data only)

Liu 1995 (published data only)

Riwar 1992 (published data only)

Rutberg 1984 (published data only)

Scheinin 1987 (published data only)

Scott 1989 (published data only)

Thorén 1989 (published data only)

Thörn 1992 (published data only)

Thörn 1996 (published data only)

Wallin 1986 (published data only)

Wallwil 1989 (published data only)

References to studies excluded from this review

Bigler 1989 (published data only)
Bigler D, Dirkes W, Hansen R, Rosenberg J, Kehlet H. Effects of thoracic paravertebral block with bupivacaine versus combined thoracic epidural block with bupivacaine and morphine on pain and...
Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)
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Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)

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Additional references

Jadad 1996

Kehlet 1987

Kehlet 1998

Kehlet 1999

Liu 1995a

Livingston 1990

Schwieger 1989

Watcha 1992

* Indicates the major publication for the study
**CHARACTERISTICS OF STUDIES**

**Characteristics of included studies [ordered by study ID]**

---

**Ahn 1988**

**Methods**
- Not blinded.
- All patients followed until all outcomes have occurred.
- No drop-outs reported.

**Participants**
- 30 patients undergoing colonic or rectal surgery.

**Interventions**
- Treatment group: postoperative epidural bupivacaine 2.5 mg/ml intermittent 8-15 ml for 48 h, n=16.
- Control group: postoperative intermittent IV injections of pentazocine 30-60 mg, n=14.

**Outcomes**
- Time of first flatus.
- Time of first stool.
- Pain relief.
- Transit time of barium from duodenum to colostomy or rectum.
- No anastomotic leakage.

**Notes**
- Epidural catheter at L2-3 level.

**Risk of bias**

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Asantila 1991

Nausea and vomiting
The dura mater was accidentally punctured in one patient

Notes
Epidural catheter at T11-12 level

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Beeby 1984

Methods
Double-blinded
Excluded patients reported

Participants
33 women undergoing cesarean section

Interventions
Treatment group:
postoperative bupivacaine 0.5% 10 ml+top ups, n = 10
Control group:
intermittent epidural morphine 4 mg, n = 12
and
intermittent epidural methadone 4 mg, n = 11

Outcomes
VAS pain scores
Nausea
Itching

Notes
Pain assessments when top ups were needed, not at certain times postoperatively.
Level of inserted epidural catheter not reported

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Bredtmann 1990

Methods
Not blinded
Excluded patients reported

Participants
116 patients undergoing various colonic surgery

Interventions
Treatment group:
postoperative epidural bupivacaine 2.5 mg/ml, dose adjusted to keep dermatomes T5-L2 blocked, for 72
Bredtmann 1990

h, n=57
Control group:
postoperative systemic piritramid 7.5-15 mg or tramadol 50-100 mg or a simple analgesic, if requested, n=59

Outcomes

- Time of first stool
- Pain relief
- Life threatening surgical complications
- Life threatening general complications
- Blood transfusion and colloids
- Positive bacteriological cultures
- Elevated temperatures
- Postoperative mechanical ventilation and critical care therapy

Notes

- Quasirandomisation by odd and even days
- Number of patients in active group decrease from 55 to 34 on day 3, not stated why.
- Unclear number of included patients in the two groups
- Level of inserted epidural catheter not reported.

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Brodner 2000

Methods

- Double-blinded
- Excluded patients reported

Participants

- 103 patients undergoing major abdominal gastrointestinal surgery

Interventions

- Treatment group:
  postoperative epidural ropivacaine 2.0 mg/ml, dose adjusted to individual patient requirement (VAS < 40 mm) + PCEA 2 ml maximum every 20 minutes, n = 22
- Control group:
  postoperative epidural ropivacaine 2.0 mg/ml plus sufentanil 0.5 microg/ml, dose adjusted to individual patient requirement (VAS < 40 mm) + PCEA 2 ml maximum every 20 minutes, n = 25
  and
  postoperative epidural ropivacaine 2.0 mg/ml plus sufentanil 0.75 microg/ml, dose adjusted to individual patient requirement (VAS < 40 mm) + PCEA 2 ml maximum every 20 minutes, n = 30
  and
  postoperative epidural ropivacaine 2.0 mg/ml plus sufentanil 0.5 microg/ml, dose adjusted to individual patient requirement (VAS < 40 mm) + PCEA 2 ml maximum every 20 minutes, n = 26

Outcomes

- VAS pain scores
- Cumulative epidural drug dose
- Supplementary analgesics
- Nausea and vomiting

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**Brodner 2000**

*Continued*

- Sedation
- Pruritus
- Motor block
- Plasma concentrations of sufentanil, ropivacaine and alpha1-acid glycoprotein

**Notes**

Epidural catheter inserted at T9-11.
If adequate analgesic effect (VAS < 40) could not be achieved, patient was excluded

**Risk of bias**

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**Cooper 1996**

**Methods**

- Double-blinded
- Drop-outs reported

**Participants**

- 56 women undergoing cesarean section

**Interventions**

- Treatment group: epidural bupivacaine 0.1%, PECA maximum 5 ml/10 min for 24 h n = 18
- Control group:
  - epidural fentanyl 4 mikrog/ml, PECA maximum 5 ml/10 min for 24 h, n = 19
  - and
  - epidural bupivacaine 0.05%/fentanyl 2 mikrog/ml, PECA maximum 5 ml/10 min for 24 h, n = 19

**Outcomes**

- VAS pain
- PONV
- Sedation
- Pruritus
- Motor block
- Inability to walk
- Hypotension

**Notes**

All groups received PCEA 5 ml bolus with a 10 min. lockout period for 24 h postoperatively.
Epidural catheter inserted at level L2-3 "or an adjacent space"

**Risk of bias**

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</table>
### Cullen 1985

**Methods**  
Double-blinded  
Drop-outs not reported

**Participants**  
48 women undergoing major abdominal surgery

**Interventions**  
**Treatment group:**  
edidural bupivacaine 0.1%, 3-4 ml/h, for 72 h, n = 15  
**Control group:**  
edidural morphine 0.1 mg/ml, 3-4 ml/h, for 72 h, n = 18  
and  
edidural bupivacaine 0.1%/morphine 0.1 mg/ml, 3-4 ml/h for 72 h, n = 15

**Outcomes**  
VAS pain  
All various complications and side effects

**Notes**  
Epidural catheter placed at the middle dermatome crossed by the surgical incision. Epidural infusion started at 4 ml/h, increments of 1 ml/h.  
Two groups (epidural saline n = 15 and noncatherized controls n = 18) of patients not included in this analysis.

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### Cuschieri 1985

**Methods**  
Not blinded  
Drop-outs not reported

**Participants**  
75 patients undergoing cholecystectomy

**Interventions**  
**Treatment group:**  
edidural bupivacaine 0.5%, intermittent bolus ml?, for 12 h, n = 25  
**Control group:**  
intermittent systemic morphine 10 mg, n = 25  
and  
continuous systemic morphine for 60 h, n = 25

**Outcomes**  
VAS pain  
Pulmonary complications  
Urinary retention  
Arterial oxygen tension  
Arterial hypotension

**Notes**  
Postoperative epidural analgesia for 12 h by intermittent injections.  
Epidural catheter “was placed in the lower thoracic region”.

### Risk of bias

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Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)  
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Delikan 1993

Methods
- Double-blinded
- Drop-outs reported

Participants
- 57 patients undergoing abdominal surgery

Interventions
- **Treatment group:** intermittent epidural bupivacaine 0.25%, 10 ml 1-2 doses with at least 15 min interval, n = 20
- **Control group:** intermittent epidural tramadol 50 mg, 1-2 doses with at least 15 min interval, n = 19
  and intermittent epidural tramadol 100 mg, 1-2 doses with at least 15 min interval, n = 18

Outcomes
- VAS pain
- PONV
- Hypotension
- Numbness
- Shivering
- Double vision
- Respiration frequency

Notes
- Postoperative epidural analgesia maintained by a maximum of 4 doses of a 10 ml study solution.
- Epidural catheter inserted at the L1-2 level.

Risk of bias

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Geddes 1991

Methods
- Unclear if blinded
- Drop-outs not reported

Participants
- 30 women undergoing elective Caesarean section under epidural anaesthesia

Interventions
- **Treatment group:** postoperative epidural bolus of bupivacaine 0.25 %, 8 ml and 2 ml saline, single dose, n=15
- **Control group:** postoperative epidural bolus of combination of bupivacaine 0.25 %, 8 ml and 2 ml fentanyl (100 mikg), single dose, n=15

Outcomes
- Gastric emptying by paracetamol absorption test
- Hypotension

Notes
- Level of inserted epidural catheter not stated.

Risk of bias

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Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)
George 1992

Methods
- Double-blinded
- Drop-outs not reported

Participants
- 30 patients undergoing abdominal aorta surgery

Interventions
- Treatment group: epidural bupivacaine 0.2%, 5 ml/h, for 24 h, n = 10
- Control group: epidural fentanyl 10 mikrog/ml, 5 ml/h, for 24 h, n = 10
- Epidural bupivacaine 0.2% /fentanyl 10 mikrog/ml, 5 ml/h, for 24 h, n = 10

Outcomes
- VAS pain
- (PONV)
- Itching
- Numbness
- Limp weakness
- Sedation

Notes
- Epidural test solution 5 ml bolus and 5 ml/h for 24 h.
- Epidural catheter inserted at level T7-8 or T8-9.

Risk of bias

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Lee 1988

Methods
- Double blinded
- Drop-outs reported

Participants
- 60 patients undergoing major abdominal gynaecological surgery

Interventions
- Treatment group: epidural bupivacaine 0.125%, 15 ml/h, for 21 h, n = 20
- Control group: epidural diamorphine 0.5 mg/h, for 21 h, n = 20
- Epidural bupivacaine 0.125%, 15 ml/t +diamorphine 0.5 mg/h, for 21 h, n = 20

Outcomes
- Supplementary analgesics
- PONV

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Lee 1988

(Continued)

- Itching
- Motor block
- Hypotension
- Sedation
- Respiration depression

Notes
- Patients were excluded when further analgesics was needed.
- Epidural catheter inserted at T10-11 or T11-12 level.

Risk of bias

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Liu 1995

Methods
- All epidural groups blinded
- Two center study
- Drop-outs reported
- Randomisation stratified by left versus right colonic anastomosis

Participants
- 25 females and 27 males undergoing colonic surgery
- ASA category I, II or III
- No history of chronic pain or drug/alcohol dependence
- Not planned total colectomy or colostomy
- No severe hepatic, renal or cardiovascular diseases

Interventions
- Treatment group:
  - Postoperative epidural bupivacaine 0.15%, 10 ml/h for various time, n=14
- Control group:
  - Postoperative combination of epidural morphine 0.03 mg/ml+bupivacaine 0.1%, 10 ml/h for various time, n=14
  - and
  - Postoperative epidural morphine 0.05 mg/ml 10 ml/h for various time, n=12
  - and
  - Postoperative iv PCA morphine 1 mg, lockout 10 min, n=12

Outcomes
- Time of first flatus
- Pain relief
- Nausea
- Pruritus
- Sedation
- Daily oral intake
- Orthostatic hypotension
- Anastomotic leakage
- Heart failure

Notes
- All patients received im ketorolac 60 mg at end of operation, thereafter im ketorolac 30 mg every 6 h for
Liu 1995

(Continued)

72 h.
Epidural catheter inserted at T8-9 or T9-10 level.

Risk of bias

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Riwar 1992

Methods

Not blinded
Drop-outs not reported

Participants

25 females and 23 males undergoing colonic surgery

Interventions

Treatment group:
postoperative bupivacaine 0.25%, 6-12 ml/h, for 48 h, n=24
Control group:
postoperative continuous iv pentazocine, 10 mg/h, for 48 h, n=24

Outcomes

Time to first flatus
Time to first stool
Anastomotic leakage
Pulmonary complications
Mortality

Notes

Epidural catheter inserted at L2-3 level

Risk of bias

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Rutberg 1984

Methods

Not blinded. Drop-outs not reported

Participants

24 women undergoing cholecystectomy

Interventions

Treatment group:
segmental level maintained throughout the study by repeating bupivacaine 0.25-0.375%, 5-8 ml, n=8
Control group:
epidural morphine 4 mg in 7 ml of saline, repeated every 10 h, n=8
and
Rutberg 1984

(Continued)

postoperative IV morphine 2.5 mg as required, n=8

Outcomes

VAS pain
Plasma adrenaline, noradrenaline and cortisol

Notes

Epidural catheter inserted at T9-10 or T10-11

Risk of bias

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Scheinin 1987

Methods

Not blinded.
Drop-outs not reported

Participants

Sixty patients undergoing colonic surgery (right or left hemicolectomy or anterior resection)
21 males, 39 females

Interventions

Treatment group:
epidural bupivacaine 0.25%, 4-6 ml/h, for 48 h, n=15
Control group:
postoperative epidural bolus morphine 2-6 mg/24 h, n=15
and
postoperative epidural morphine continuously 2-6 mg/24 h for 48 h, n=15
and
parenteral oxycodone 0.15 mg/kg on request, n=15

Outcomes

Time to first flatus or stool
Pain relief
Blood-gas analyses
Peak expiratory flow
Spirometry
Anastomotic leakage
Hypotension
Pulmonary function

Notes

Epidural catheter inserted "with its tip at a level responding to the middle of the planned incision".

Risk of bias

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### Scott 1989

**Methods**
Double-blinded. Drop-outs not reported.

**Participants**
20 patients undergoing upper abdominal surgery

**Interventions**
- **Treatment group:** epidural bupivacaine 0.5%, 5 ml/h, for 16 h, n=10
- **Control group:** epidural bupivacaine 0.5% + morphine 0.1 mg/ml, 5 ml/h, for 16 h, n=10

**Outcomes**
- Pain scores
- Serum glucose and cortisol
- Peak expiratory flow
- Forced vital capacity
- Forced expiratory flow rate in the first 1 s
- Hypotension
- Motor block

**Notes**
Epidural catheter inserted at T7-8 level

**Risk of bias**

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### Thorén 1989

**Methods**
Not blinded
Drop-out not reported
Parallel groups

**Participants**
22 females undergoing hysterectomy

**Interventions**
- **Treatment group:** postoperative epidural bupivacaine 0.25%, 8 ml/h, for 42 h, n=11
- **Control group:** postoperative epidural morphine 4 mg bolus, 2 mg on request, n = 11

**Outcomes**
- Time to first flatus and/or stool
- Pain relief
- Nausea
- Blood glucose concentrations
- Postoperative intake of fluid and food without nausea
- Postoperative mobilisation
- Length of hospital stay

**Notes**
Epidural catheter inserted at T12-L1 level

**Risk of bias**
### Thörn 1992

**Methods**
- Not blinded
- Drop-outs?
- Parallel groups
- Patients served as own control 4-5 weeks postoperatively

**Participants**
- 18 patients undergoing elective cholecystectomy

**Interventions**
- Treatment group: postoperative epidural bupivacaine 0.25%, 8 ml/h, n = 9
- Control group: postoperative epidural morphine 4 mg bolus, 2 mg on request, n = 9

**Outcomes**
- Gastric emptying by paracetamol absorption test
  - “Anaesthesia and operation were uneventful in all patients”

**Notes**
- Epidural catheter inserted at T6-7 level

### Thörn 1996

**Methods**
- Not blinded
- Drop-outs not reported

**Participants**
- 14 patients undergoing cholecystectomy

**Interventions**
- Treatment group: epidural bupivacaine 0.25% 8 ml/h, n = 7
- Control group: epidural morphine 4 mg bolus, 2 mg on request, n = 7

**Outcomes**
- Electromyography and manometry of the ventricle
- Gastric emptying by paracetamol absorption test

**Notes**
- Epidural catheter inserted at T5-6 level
Thörn 1996

(Continued)

**Risk of bias**

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<th>Description</th>
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<tbody>
<tr>
<td>Allocation concealment?</td>
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<td>B - Unclear</td>
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Wallin 1986

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<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
<td>Methods</td>
<td>Not blinded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drop-out reported</td>
<td></td>
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<tr>
<td>Participants</td>
<td>17 females and 10 males undergoing cholecystectomy</td>
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<tr>
<td>Interventions</td>
<td>Treatment group:</td>
<td>postoperative epidural bupivacaine 0.25%, intermittent injection of 10 - 14 ml every 3 h for 24 h, n=12</td>
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<tr>
<td></td>
<td>Control group:</td>
<td>postoperative parenteral pentazocine 30 - 60 mg on request, n=15</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Time of first flatus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time of first defaecation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gastrointestinal radiopaque</td>
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<tr>
<td></td>
<td>Pain relief</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blood glucose concentration</td>
<td></td>
</tr>
<tr>
<td>Notes</td>
<td>Time of first flatus and defaecation are not stated in text but only shown unprecisely on figure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Epidural catheter inserted at T12-L1 level</td>
<td></td>
</tr>
<tr>
<td>Risk of bias</td>
<td>Item</td>
<td>Authors' judgement</td>
</tr>
<tr>
<td>Allocation concealment?</td>
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Wattwil 1989

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors' judgement</th>
<th>Description</th>
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<tr>
<td>Methods</td>
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</tr>
<tr>
<td></td>
<td>Parallel groups</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No drop-outs reported</td>
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<tr>
<td>Participants</td>
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<tr>
<td>Interventions</td>
<td>Treatment group:</td>
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<tr>
<td></td>
<td>Control group:</td>
<td>postoperative intermittent im injections of ketobemidone 5 mg, n=20</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Time to first flatus</td>
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</tbody>
</table>
Wattwil 1989

(Continued)

<table>
<thead>
<tr>
<th>Time to first defaecation</th>
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<tr>
<td>Radiopaque markers movement</td>
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<tr>
<td>Nausea and vomiting</td>
</tr>
<tr>
<td>Pain relief</td>
</tr>
<tr>
<td>Blood glucose concentrations</td>
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</tbody>
</table>

Notes: Epidural catheter inserted at T12-L1 level.

Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
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</tbody>
</table>

*im*= intramuscular  
*iv*= intravenous  
*PCA*= patient controlled analgesia  
*PECA*= patient-controlled extradural analgesia

Characteristics of excluded studies  [ordered by study ID]  

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bigler 1989</td>
<td>Study on effects of paravertebral block versus epidural block after cholecystectomy. Excluded as no group of patients received postoperative epidural local anaesthetic.</td>
</tr>
<tr>
<td>Bridenbaugh 1976</td>
<td>Study on bupivacaine and etidocaine for epidural anaesthesia for abdominal pelvic surgery. Excluded as epidural local anaesthetic was not compared with an opioid-based regimen.</td>
</tr>
<tr>
<td>Brownridge 1985</td>
<td>Study comparing efficacy of systemic pethidin, epidural pethidin and epidural bupivacaine after caesarean section or lower abdominal surgery. Excluded as all patients received pethidin in the first 24 hours after surgery and prior to the beginning of the trial.</td>
</tr>
<tr>
<td>Buckley 1978</td>
<td>Study of different solutions of epidural etidocaine to patients undergoing gynaecological surgery. Excluded as epidural local anaesthetic was not compared with an opioid-based regimen.</td>
</tr>
<tr>
<td>Carli 1992</td>
<td>Study on the effect of perioperative epidural local anaesthetic on whole body protein turnover and urinary excretion of urea nitrogen, adrenaline noradrenaline and cortisol. Excluded as it was not relevant to this review.</td>
</tr>
<tr>
<td>Chestnut 1986</td>
<td>Study on epidural hydromorphone for postcesarean analgesia. Excluded as only one epidural bolus injection was administered at the end of surgery.</td>
</tr>
<tr>
<td>Davies 1993</td>
<td>Study on morbidity after abdominal aortic surgery. Focuses on intra- and post-operative complications. Excluded as it was not relevant to this review.</td>
</tr>
<tr>
<td>Dupont 1987</td>
<td>Study on the effect of caudal anaesthesia on catecholamine in children. Excluded as there was other surgical procedures than laparotomy.</td>
</tr>
<tr>
<td>Dyer 1992</td>
<td>Intraoperative epidural local anaesthetic and postoperative epidural opioid with or without ephedrine. Excluded</td>
</tr>
<tr>
<td>Study</td>
<td>Reason for exclusion</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Frings 1982</td>
<td>Study on epidural opioid vs systemic opioid after various surgery. Excluded as the opioid-based regimens were not compared with epidural local anaesthetic and the types of surgery included other than laparotomy.</td>
</tr>
<tr>
<td>Gelman 1977</td>
<td>Study of electroenterography after cholecystectomy. Electroenterography is a surrogate parameter of stomach and intestinal motility. Excluded as the study was not randomized.</td>
</tr>
<tr>
<td>Grass 1993</td>
<td>Patients receive epidural fentanyl with or without ketorolac. Excluded as no group of patients received epidural local anaesthetic.</td>
</tr>
<tr>
<td>Harukuni 1995</td>
<td>Patients receive epidural opioid or systemic opioid. Excluded as no group of patients received epidural local anaesthetic.</td>
</tr>
<tr>
<td>Hendolin(1) 1987</td>
<td>Study on the effect of thoracic epidural analgesia on postoperative stress and morbidity. Excluded as no outcome measurements relevant to this review was reported.</td>
</tr>
<tr>
<td>Hendolin(2) 1987</td>
<td>Study on the effect of thoracic epidural analgesia on respiratory after cholecystectomy. Excluded as no outcome measurements relevant to this review was reported.</td>
</tr>
<tr>
<td>Hjortsø 1985</td>
<td>Both study groups receive epidural opioids as standard postoperative medication. Excluded as no group of patients received epidural local anaesthetic.</td>
</tr>
<tr>
<td>Hjortsø 1985a</td>
<td>Study on the effects of epidural local anaesthetic and opioid on postoperative excretion of cortisol, catecholamines and nitrogen. Excluded as no group of patients received epidural local anaesthetic alone.</td>
</tr>
<tr>
<td>Hjortsø 1986</td>
<td>Study on postoperative epidural bupivacaine with or without morphine. Excluded as it is not a randomized trial.</td>
</tr>
<tr>
<td>Houwelling 1992</td>
<td>Study comparing peroperative hemodynamic changes of epidural bupivacaine with epidural sufentanil. Excluded as no postoperative outcomes was presented.</td>
</tr>
<tr>
<td>Hull 1991</td>
<td>Study on non-closure of the visceral and parietal peritoneum during cesarean section. Excluded as it was not relevant to this review.</td>
</tr>
<tr>
<td>Håkonson 1985</td>
<td>Study on the effects of epidural bupivacaine or epidural morphine on the metabolic response after upper abdominal surgery.</td>
</tr>
<tr>
<td>Jorgensen 1978</td>
<td>Study on anaesthesia with epidural bupivacaine 0.75% vs epidural bupivacain 0.5% or mepivacaine 1.5%. Excluded as epidural local anaesthetic was not compared to an opioid-based regimen and not all patients had a laparotomy.</td>
</tr>
<tr>
<td>Kapral 1996</td>
<td>The study compares intraoperative gastric intramucosal CO2 as a measure of the visceral perfusion to get an indirect measure of surgical stress response. Excluded as it was not relevant to this review.</td>
</tr>
<tr>
<td>Kausalya 1994</td>
<td>Excluded as patients were undergoing anal surgery, not laparotomy.</td>
</tr>
<tr>
<td>Kentner 1996</td>
<td>Study on postoperative effects of patient-controlled-analgesia (PCA) vs PCA+epidural bupivacaine after urologic surgery. Excluded as all patients received an opioid-based analgesia.</td>
</tr>
<tr>
<td>Kilbride 1992</td>
<td>All three groups received opioids as standard postoperative medication; intramuscular morphine, patient controlled morphine or epidural morphine. Excluded as no group had epidural local anaesthetic.</td>
</tr>
<tr>
<td>Korinek 1985</td>
<td>Study on the effect of epidural morphine on antidiuretic hormone secretion after surgery. Excluded as patients were undergoing knee ligamentoplasty and not laparotomy.</td>
</tr>
<tr>
<td>Krane 1987</td>
<td>A comparison of caudal morphine, caudal bupivacaine and intravenous morphine for postoperative analgesia in abdominal surgery. The study compared outcomes in patients receiving different analgesic regimens.</td>
</tr>
<tr>
<td>Study</td>
<td>Reason for exclusion</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Krane 1989</td>
<td>A dose response study of caudal morphine in children. Excluded as no group had epidural local anaesthetic.</td>
</tr>
<tr>
<td>Kumar 1993</td>
<td>Children undergoing various surgery below segmental level of T-10. Excluded as there was other surgical procedures than laparotomy.</td>
</tr>
<tr>
<td>Lee 1991</td>
<td>Study on the influence on the route of administration of diamorphine as a supplement to epidural bupivacaaine. Excluded as no group only received epidural local anaesthesia.</td>
</tr>
<tr>
<td>Mann 2000</td>
<td>Study comparing intavenous or epidural patient-controlled analgesia in the elderly after major abdominal surgery. Excluded as no group had epidural local anaesthetic alone.</td>
</tr>
<tr>
<td>Marco Valls 1989</td>
<td>Study on postoperative pain treatment of children undergoing various surgical procedures. Excluded as there was other surgical procedures than laparotomy.</td>
</tr>
<tr>
<td>Miller 1976</td>
<td>Study on effects of systemic meperidine and epidural lidocaine on respiratory function after cholecystectomy. Excluded as only respiratory parameters was reported.</td>
</tr>
<tr>
<td>Modig 1981</td>
<td>Study comparing postoperative pain relief with epidural morphine and epidural bupivacaaine after total hip replacement. Excluded as the surgical procedure was not laparotomy.</td>
</tr>
<tr>
<td>Moine 1992</td>
<td>Children undergoing genito-urinary operations. Excluded as there was other surgical procedures than laparotomy.</td>
</tr>
<tr>
<td>Moskovitz 1986</td>
<td>Study on effects of epidural morphine/bupivacaaine vs spinal or general anaesthesia to urologic surgery. Excluded as there was no randomisation of patients.</td>
</tr>
<tr>
<td>Muneyuki 1967</td>
<td>Study comparing postoperative pain relief by epidural mepivacaaine and intravenous meperidine after upper abdominal surgery. Excluded as the study was not randomized.</td>
</tr>
<tr>
<td>Murrat 1988</td>
<td>Study on cortisol response after abdominal or peripheral surgery in children. Excluded as there was other surgical procedures than laparotomy and it was not relevant to this review.</td>
</tr>
<tr>
<td>Mushambi 1992</td>
<td>Study on gastric emptying (paracetamol absorption test) after general anaesthesia for minor gynaecological surgery. Excluded as no patients had epidural local anaesthetic.</td>
</tr>
<tr>
<td>Neudecker 1999</td>
<td>The study evaluate if perioperative epidural analgesia had any effect on duration of postoperative ileus after laparoscopic sigmoid resection. Excluded as the type of operation was not laparotomy.</td>
</tr>
<tr>
<td>Nimmo 1978</td>
<td>Study on gastric emptying (paracetamol absorption) following hysterectomy with general/epidural or general anaesthesia. Excluded as there was no randomisation of patients.</td>
</tr>
<tr>
<td>Olofsson 1997</td>
<td>Study on the anaesthetic quality during cesarean section following subarachnoid or epidural administration of bupivacaaine with or without fentanyl. Excluded as patients only had intraoperative epidural bolus injections, not postoperative.</td>
</tr>
<tr>
<td>Petring 1984</td>
<td>Study on gastric emptying (paracetamol absorption test) after epidural anaesthesia. Excluded as patients underwent surgery on the extremities not laparotomy.</td>
</tr>
<tr>
<td>Porter 1997</td>
<td>Study on gastric emptying (by paracetamol absorption) after epidural bupivacaaine alone or in combination with fentanyl in women in labour. Excluded as patients were not undergoing laparotomy.</td>
</tr>
<tr>
<td>Randalls 1991</td>
<td>Comparison of four subarachoid solutions for cesarean section. Excluded as no group received epidural local anaesthesia.</td>
</tr>
<tr>
<td>Study</td>
<td>Reason for exclusion</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Renck 1975</td>
<td>Study of epidural bupivacaine and etodocaine to patients undergoing upper abdominal surgery. Excluded as epidural local anaesthetic was not compared with an opioid-based regimen.</td>
</tr>
<tr>
<td>Rucci 1985</td>
<td>Study on single dose epidural bupivacaine with or without fentanyl on time to regression of analgesic blockade. Excluded as not all patients had a laparotomy.</td>
</tr>
<tr>
<td>Saito 1993</td>
<td>Study on the effects of epidural anaesthesia on ventilatory response to hypoxia. Excluded as no postoperative outcome measure relevant to this review is reported.</td>
</tr>
<tr>
<td>Schurizek 1982</td>
<td>Study on epidural morphine vs systemic morphine after upper abdominal surgery. Excluded as no group only received epidural local anaesthetic.</td>
</tr>
<tr>
<td>Seeling 1984</td>
<td>Study on respiratory function with epidural analgesia or systemic opioid after upper abdominal surgery. Excluded as it was not relevant to this review.</td>
</tr>
<tr>
<td>Seeling 1985</td>
<td>Study on the cardiovascular effects of two anaesthetic regimens. Excluded as there is no postoperative assessments.</td>
</tr>
<tr>
<td>Seow 1976</td>
<td>Study compairing epidural etidocaine with epidural lidocaine after pelvic floor repair. Excluded as it was not abdominal surgery and epidural local anaesthetic was not compared with an opioid-based regimen.</td>
</tr>
<tr>
<td>Seow 1982</td>
<td>Study compairing epidural lidocaine and bupivacaine after lower abdominal surgery. Excluded as epidural anaesthetic was not compaired with an opioid-based regimen.</td>
</tr>
<tr>
<td>Sinclair 1984</td>
<td>Study compairing efficacy of epidural bupivacaine and epidural etidocaine in patients undergoing major gynaecological surgery. Excluded as the local anaesthetic was not compared with an opioid-based regimen.</td>
</tr>
<tr>
<td>Torda 1995</td>
<td>All patients receive both epidural local anaesthetic and opioid, since it is a cross-over study. Excluded as no group only received epidural local anaesthesia.</td>
</tr>
<tr>
<td>Tsuji 1983</td>
<td>Study on the influence of splanchnic or epidural blockade on endocrine-metabolic responses to upper abdominal surgery. Excluded as it was not relevant to this study.</td>
</tr>
<tr>
<td>Welch 1998</td>
<td>Study on postoperative effects of epidural morphine/bupivacaine and systemic opioid. Excluded as no group of patients had epidural local anaesthetic alone.</td>
</tr>
<tr>
<td>White 1979</td>
<td>Study compairing intravenous fentanyl with epidural bupivacaine after peripheral vascular surgery. Excluded as the surgical procedures were others than laparotomy.</td>
</tr>
<tr>
<td>Wiebalck 1997</td>
<td>Patients undergoing thoracal or abdominal surgery. Excluded as there was other surgical procedures than laparotomy.</td>
</tr>
<tr>
<td>Wolf 1993</td>
<td>Study on pain relief in infant undergoing abdominal surgery. Excluded as this review does not include studies on infants.</td>
</tr>
<tr>
<td>Wright 1992</td>
<td>Study on gastric emptying (by paracetamol absorption) and duration of analgesia after epidural bupivacaine alone or in combination with fentanyl in women in labour. Excluded as patients were not undergoing laparotomy.</td>
</tr>
<tr>
<td>Yeager 1987</td>
<td>Study comparing postoperative morbidity after epidural anaesthesia and analgesia with general anaesthesia. Excluded as no group only received epidural local anaesthesia.</td>
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</table>
## Comparison 1. Epidural local anaesthetic (LA) vs opioid based regimens

<table>
<thead>
<tr>
<th>Outcome or subgroup title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Effect on time (h) to first passage of stool</td>
<td>8</td>
<td>406</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-44.64 [-72.43, -16.85]</td>
</tr>
<tr>
<td>2 Effect on time (h) to first passage of flatus</td>
<td>7</td>
<td>265</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-36.11 [-55.76, -16.47]</td>
</tr>
<tr>
<td>3 Effect on time (h) to return of gastrointestinal function (flatus or stool) - subgroups</td>
<td></td>
<td></td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>Subtotals only</td>
</tr>
<tr>
<td>3.1 Epi LA vs systemic opioid</td>
<td>7</td>
<td>319</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-37.24 [-55.67, -18.82]</td>
</tr>
<tr>
<td>3.2 Epi LA vs epi opioid</td>
<td>4</td>
<td>135</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-24.42 [-38.81, -10.03]</td>
</tr>
<tr>
<td>3.3 Epi LA vs epi LA/opioid</td>
<td>2</td>
<td>66</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-9.31 [-22.05, 3.42]</td>
</tr>
<tr>
<td>4 Effect on time to first passage of stool - subgroups</td>
<td></td>
<td></td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>Subtotals only</td>
</tr>
<tr>
<td>4.1 Epi LA vs syst opioid</td>
<td>5</td>
<td>261</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-54.49 [-102.61, -6.38]</td>
</tr>
<tr>
<td>4.2 Epi LA vs epi opioid</td>
<td>3</td>
<td>107</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-20.75 [-30.17, -11.33]</td>
</tr>
<tr>
<td>4.3 Epi LA vs epi LA/opioid</td>
<td>1</td>
<td>40</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-16.01 [-25.85, -6.15]</td>
</tr>
<tr>
<td>5 Effect on time to first passage of flatus - subgroups</td>
<td></td>
<td></td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>Subtotals only</td>
</tr>
<tr>
<td>5.1 Epi LA vs syst opioid</td>
<td>6</td>
<td>201</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-39.26 [-60.04, -18.48]</td>
</tr>
<tr>
<td>5.2 Epi LA vs epi opioid</td>
<td>2</td>
<td>67</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-30.77 [-42.56, -18.97]</td>
</tr>
<tr>
<td>5.3 Epi LA vs Epi LA/opioid</td>
<td>1</td>
<td>26</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>-3.01 [-11.84, 5.84]</td>
</tr>
<tr>
<td>6 Postoperative pain (VAS score). Epidural local anaesthetic versus epidural local anaesthetic/opioid</td>
<td>4</td>
<td>135</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>19.93 [8.36, 31.50]</td>
</tr>
<tr>
<td>6.1 Epidural local anaesthetic vs epidural local anaesthetic/opioid</td>
<td>4</td>
<td>135</td>
<td>Mean Difference (IV, Random, 95% CI)</td>
<td>19.93 [8.36, 31.50]</td>
</tr>
<tr>
<td>7 Effect on the incidence of postoperative nausea</td>
<td>10</td>
<td>514</td>
<td>Peto Odds Ratio (Peto, Fixed, 95% CI)</td>
<td>0.76 [0.47, 1.23]</td>
</tr>
<tr>
<td>8 Effect on the incidence of postoperative vomiting</td>
<td>4</td>
<td>259</td>
<td>Peto Odds Ratio (Peto, Fixed, 95% CI)</td>
<td>0.43 [0.18, 1.03]</td>
</tr>
</tbody>
</table>
Analysis 1.1. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 1 Effect on time (h) to first passage of stool.

Review: Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery
Comparison: 1 Epidural local anaesthetic (LA) vs opioid based regimens
Outcome: 1 Effect on time (h) to first passage of stool

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wattwil 1989</td>
<td>20 70 (44)</td>
<td>20 103 (26)</td>
<td>-33.00 [-55.40, -10.60]</td>
<td>12.2 %</td>
<td>-33.00 [-55.40, -10.60]</td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15 66 (28)</td>
<td>45 92 (32)</td>
<td>-26.00 [-42.98, -9.02]</td>
<td>12.6 %</td>
<td>-26.00 [-42.98, -9.02]</td>
</tr>
<tr>
<td>Thorn 1989</td>
<td>11 57 (44)</td>
<td>11 92 (22)</td>
<td>-35.00 [-64.07, -5.93]</td>
<td>11.5 %</td>
<td>-35.00 [-64.07, -5.93]</td>
</tr>
<tr>
<td>Ahn 1988</td>
<td>16 57 (12)</td>
<td>14 192 (36)</td>
<td>-135.00 [-154.75, -115.25]</td>
<td>12.4 %</td>
<td>-135.00 [-154.75, -115.25]</td>
</tr>
<tr>
<td>Riwat 1992</td>
<td>24 21 (19)</td>
<td>24 110 (35)</td>
<td>-89.00 [-104.93, -73.07]</td>
<td>12.7 %</td>
<td>-89.00 [-104.93, -73.07]</td>
</tr>
<tr>
<td>Bredtmann 1990</td>
<td>57 71 (36)</td>
<td>59 96 (29)</td>
<td>-25.00 [-36.92, -13.08]</td>
<td>12.9 %</td>
<td>-25.00 [-36.92, -13.08]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>178</strong></td>
<td><strong>228</strong></td>
<td><strong>-44.64 [-72.43, -16.85]</strong></td>
<td><strong>100.0 %</strong></td>
<td><strong>-44.64 [-72.43, -16.85]</strong></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 1521.37; Chi² = 192.41, df = 7 (P<0.00001); I² = 96%
Test for overall effect: Z = 3.15 (P = 0.0016)
### Analysis 1.2. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 2 Effect on time (h) to first passage of flatus.

#### Review:
Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery

#### Comparison:
1 Epidural local anaesthetic (LA) vs opioid based regimens

#### Outcome:
2 Effect on time (h) to first passage of flatus

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahn 1988</td>
<td>16</td>
<td>48 (10)</td>
<td>14</td>
<td>14.4 %</td>
<td>-80.00 [ -92.04, -67.96 ]</td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14</td>
<td>40 (7.5)</td>
<td>24</td>
<td>14.9 %</td>
<td>-25.00 [ -31.52, -18.48 ]</td>
</tr>
<tr>
<td>Riwar 1992</td>
<td>24</td>
<td>18 (12)</td>
<td>24</td>
<td>14.8 %</td>
<td>-63.00 [ -71.65, -54.35 ]</td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15</td>
<td>66 (28)</td>
<td>45</td>
<td>13.6 %</td>
<td>-26.00 [ -42.98, -9.02 ]</td>
</tr>
<tr>
<td>Thorn 1989</td>
<td>11</td>
<td>22 (16)</td>
<td>11</td>
<td>13.8 %</td>
<td>-34.00 [ -50.08, -17.92 ]</td>
</tr>
<tr>
<td>Wallin 1986</td>
<td>12</td>
<td>43 (20)</td>
<td>15</td>
<td>14.0 %</td>
<td>4.00 [ -10.53, 18.53 ]</td>
</tr>
<tr>
<td>Wattwil 1989</td>
<td>20</td>
<td>31 (22)</td>
<td>20</td>
<td>14.5 %</td>
<td>-27.00 [ -38.43, -15.57 ]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>112</strong></td>
<td><strong>153</strong></td>
<td><strong>100.0 %</strong></td>
<td><strong>-36.11 [ -55.76, -16.47 ]</strong></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 661.34; Chi² = 131.86, df = 6 (P<0.00001); I² =95%

Test for overall effect: Z = 3.60 (P = 0.00032)
### Analysis 1.3. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 3 Effect on time (h) to return of gastrointestinal function (flatus or stool) - subgroups.

Review: Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery

Comparison: 1 Epidural local anaesthetic (LA) vs opioid based regimens

Outcome: 3 Effect on time (h) to return of gastrointestinal function (flatus or stool) - subgroups

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N Mean(SD)</td>
<td>N Mean(SD)</td>
<td>IV ,Random,95% CI</td>
<td>IV ,Random,95% CI</td>
<td></td>
</tr>
<tr>
<td><strong>1 Epi LA vs systemic opioid</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ahn 1988</td>
<td>16 48 (10)</td>
<td>14 128 (21)</td>
<td>14.5 % -80.00 [ -92.04, -67.96 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bredtmann 1990</td>
<td>57 71 (36)</td>
<td>59 96 (29)</td>
<td>14.5 % -25.00 [ -36.92, -13.08 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14 40 (7.5)</td>
<td>12 81 (10)</td>
<td>15.1 % -41.00 [ -48.52, -33.48 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piwar 1992</td>
<td>25 18 (12)</td>
<td>25 81 (18)</td>
<td>14.9 % -63.00 [ -71.48, -54.52 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15 66 (28)</td>
<td>15 91 (35)</td>
<td>12.5 % -25.00 [ -34.53, -6.47 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wallin 1986</td>
<td>12 43 (20)</td>
<td>15 39 (18)</td>
<td>14.1 % 4.00 [ -10.53, 18.53 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wattwil 1989</td>
<td>20 31 (22)</td>
<td>20 58 (14)</td>
<td>14.5 % -27.00 [ -38.43, -15.57 ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Subtotal (95% CI)** 159 160 100.0 % -37.24 [ -55.67, -18.82 ]

Heterogeneity: Tau² = 573.76; Chi² = 116.86, df = 6 (P<0.0001); I² =95%

Test for overall effect: Z = 3.96 (P = 0.000074)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N Mean(SD)</td>
<td>N Mean(SD)</td>
<td>IV ,Random,95% CI</td>
<td>IV ,Random,95% CI</td>
<td></td>
</tr>
<tr>
<td><strong>2 Epi LA vs epi opioid</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asantila 1991</td>
<td>20 46 (12)</td>
<td>20 55 (7)</td>
<td>29.1 % -9.00 [ -15.09, -2.91 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14 40 (7.5)</td>
<td>14 71 (15)</td>
<td>27.5 % -31.00 [ -39.78, -22.22 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15 66 (28)</td>
<td>30 93 (28)</td>
<td>21.2 % -27.00 [ -44.35, -9.65 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thorn 1989</td>
<td>11 22 (16)</td>
<td>11 56 (22)</td>
<td>22.2 % -34.00 [ -50.08, -17.92 ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Subtotal (95% CI)** 60 75 100.0 % -24.42 [ -38.81, -10.03 ]

Heterogeneity: Tau² = 175.83; Chi² = 21.62, df = 3 (P = 0.00008); I² =86%

Test for overall effect: Z = 3.33 (P = 0.000088)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N Mean(SD)</td>
<td>N Mean(SD)</td>
<td>IV ,Random,95% CI</td>
<td>IV ,Random,95% CI</td>
<td></td>
</tr>
<tr>
<td><strong>3 Epi LA vs epi LA/opioid</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asantila 1991</td>
<td>20 46 (12)</td>
<td>20 62 (19)</td>
<td>48.6 % -16.00 [ -25.85, -6.15 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14 40 (7.5)</td>
<td>12 43 (14)</td>
<td>51.4 % -3.00 [-11.84, 5.84 ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Subtotal (95% CI)** 34 32 100.0 % -9.31 [ -22.05, 3.42 ]

Heterogeneity: Tau² = 61.70; Chi² = 3.71, df = 1 (P = 0.05); I² =73%

Test for overall effect: Z = 1.43 (P = 0.15)
Comparison: 1 Epidural local anaesthetic (LA) vs opioid based regimens

Outcome: 3 Effect on time (h) to return of gastrointestinal function (flatus or stool) - subgroups

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Epi LA vs systemic opioid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ahn 1988</td>
<td>16 48 (10)</td>
<td>14 128 (21)</td>
<td>-80.00 [ -92.04, -67.96 ]</td>
<td></td>
</tr>
<tr>
<td>Bredtmann 1990</td>
<td>57 71 (36)</td>
<td>59 96 (29)</td>
<td>-25.00 [ -36.92, -13.08 ]</td>
<td></td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14 40 (7.5)</td>
<td>12 81 (10)</td>
<td>-41.00 [ -47.89, -34.11 ]</td>
<td></td>
</tr>
<tr>
<td>Riwar 1992</td>
<td>25 18 (12)</td>
<td>25 81 (18)</td>
<td>-63.00 [ -71.48, -54.52 ]</td>
<td></td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15 66 (28)</td>
<td>15 91 (35)</td>
<td>-25.00 [ -47.68, -2.32 ]</td>
<td></td>
</tr>
<tr>
<td>Wallin 1986</td>
<td>12 43 (20)</td>
<td>15 39 (18)</td>
<td>4.00 [-10.53, 18.53]</td>
<td></td>
</tr>
<tr>
<td>Wattwil 1989</td>
<td>20 31 (22)</td>
<td>20 58 (14)</td>
<td>-27.00 [ -38.43, -15.57 ]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>159 160</td>
<td>-37.24 [ -55.67, -18.82 ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: $\tau^2 = 573.76; \chi^2 = 116.86, df = 6 (P<0.00001); I^2 = 95\%$
Test for overall effect: $Z = 3.96 (P = 0.000074)$

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Epi LA vs epi opioid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asantila 1991</td>
<td>20 46 (12)</td>
<td>20 55 (7)</td>
<td>-9.00 [-15.09, -2.91 ]</td>
<td></td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14 40 (7.5)</td>
<td>14 71 (15)</td>
<td>-31.00 [-39.78, -22.22 ]</td>
<td></td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15 66 (28)</td>
<td>30 93 (28)</td>
<td>-27.00 [-44.35, -9.65 ]</td>
<td></td>
</tr>
<tr>
<td>Thom 1989</td>
<td>11 22 (16)</td>
<td>11 56 (22)</td>
<td>-34.00 [-50.08, -17.92 ]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>60 75</td>
<td>-24.42 [-38.81, -10.03 ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: $\tau^2 = 175.83; \chi^2 = 21.62, df = 3 (P = 0.00008); I^2 = 86\%$
Test for overall effect: $Z = 3.33 (P = 0.000088)$
Comparison 1. Epidural local anaesthetic (LA) vs opioid based regimens

Outcome 4 Effect on time to first passage of stool - subgroups

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N Mean(SD)</td>
<td>N Mean(SD)</td>
<td>IV,Random,95% CI</td>
<td>IV,Random,95% CI</td>
<td></td>
</tr>
<tr>
<td>1 Epi LA vs syst opioid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ahn 1988</td>
<td>16 57 (12)</td>
<td>14 192 (36)</td>
<td>-135.00 [-154.75, -115.25]</td>
<td>19.8 %</td>
<td>-135.00 [-154.75, -115.25]</td>
</tr>
<tr>
<td>Bredtmann 1990</td>
<td>57 71 (36)</td>
<td>59 96 (29)</td>
<td>-25.00 [-36.92, -13.08]</td>
<td>20.2 %</td>
<td>-25.00 [-36.92, -13.08]</td>
</tr>
<tr>
<td>Riwar 1992</td>
<td>24 21 (19)</td>
<td>24 110 (35)</td>
<td>-89.00 [-104.93, -73.07 ]</td>
<td>20.0 %</td>
<td>-89.00 [-104.93, -73.07]</td>
</tr>
<tr>
<td>Wallin 1986</td>
<td>12 82 (16)</td>
<td>15 74 (11)</td>
<td>8.00 [-2.63, 18.63]</td>
<td>20.3 %</td>
<td>8.00 [-2.63, 18.63]</td>
</tr>
<tr>
<td>Wattwil 1989</td>
<td>20 70 (44)</td>
<td>20 103 (26)</td>
<td>-33.00 [-55.40, -10.60 ]</td>
<td>19.6 %</td>
<td>-33.00 [-55.40, -10.60]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>129</td>
<td>132</td>
<td>100.0 % -54.49 [-102.61, -6.38 ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Heterogeneity: Tau^2 = 2940.86; Chi^2 = 208.17, df = 4 (P<0.0001); I^2 =98%

Test for overall effect: Z = 2.22 (P = 0.026)

Analysis 1.4. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 4 Effect on time to first passage of stool - subgroups.

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Review: Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery

Comparison: 1 Epidural local anaesthetic (LA) vs opioid based regimens

Outcome: 4 Effect on time to first passage of stool - subgroups

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N Mean(SD)</td>
<td>N Mean(SD)</td>
<td>IV,Random,95% CI</td>
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<td>IV,Random,95% CI</td>
</tr>
<tr>
<td>1 Epi LA vs syst opioid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ahn 1988</td>
<td>16 57 (12)</td>
<td>14 192 (36)</td>
<td>-135.00 [-154.75, -115.25]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bredtman 1990</td>
<td>57 71 (36)</td>
<td>59 96 (29)</td>
<td>-25.00 [-36.92, -13.08]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riwai 1992</td>
<td>24 21 (19)</td>
<td>24 110 (35)</td>
<td>-89.00 [-104.93, -73.07]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wallin 1986</td>
<td>12 82 (16)</td>
<td>15 74 (11)</td>
<td>8.00 [-2.63, 18.63]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wattwil 1989</td>
<td>20 70 (44)</td>
<td>20 103 (26)</td>
<td>-33.00 [-55.40, -10.60]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td>129 132</td>
<td>16.49 [-102.61, -6.38]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 2940.86; Chi² = 208.17; df = 4 (P<0.0001); I² = 98%
Test for overall effect: Z = 2.22 (P = 0.026)
**Comparison:** Epidural local anaesthetic (LA) vs opioid based regimens

**Outcome:** Effect on time to first passage of stool - subgroups

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>2 Epi LA vs epi opioid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asantila 1991</td>
<td>20</td>
<td>46 (12)</td>
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<td>62 (19)</td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15</td>
<td>66 (28)</td>
<td>30</td>
<td>93 (28)</td>
</tr>
<tr>
<td>Thorn 1989</td>
<td>11</td>
<td>57 (44)</td>
<td>11</td>
<td>92 (22)</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>46</strong></td>
<td><strong>61</strong></td>
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</tr>
</tbody>
</table>

Heterogeneity: Tau² = 10.77; Chi² = 2.28, df = 2 (P = 0.32); I² = 12%

Test for overall effect: Z = 4.32 (P = 0.000016)

---

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>3 Epi LA vs epi LA/opioid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asantila 1991</td>
<td>20</td>
<td>46 (12)</td>
<td>20</td>
<td>62 (19)</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>20</strong></td>
<td><strong>20</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: not applicable

Test for overall effect: Z = 3.18 (P = 0.0015)
### Analysis 1.5. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 5 Effect on time to first passage of flatus - subgroups.

**Review:** Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery

**Comparison:** 1 Epidural local anaesthetic (LA) vs opioid based regimens

**Outcome:** 5 Effect on time to first passage of flatus - subgroups

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
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<tbody>
<tr>
<td>Ahn 1988</td>
<td>16 48 (10)</td>
<td>14 128 (21)</td>
<td>-80.00</td>
<td>-92.04</td>
<td>-67.96</td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14 40 (7.5)</td>
<td>12 81 (10)</td>
<td>17.6%</td>
<td>-41.00</td>
<td>-34.11</td>
</tr>
<tr>
<td>Riwar 1992</td>
<td>24 18 (12)</td>
<td>24 81 (18)</td>
<td>17.4%</td>
<td>-63.00</td>
<td>-54.35</td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15 66 (28)</td>
<td>15 91 (35)</td>
<td>14.8%</td>
<td>-25.00</td>
<td>-16.88</td>
</tr>
<tr>
<td>Wallin 1986</td>
<td>12 43 (20)</td>
<td>15 39 (18)</td>
<td>16.5%</td>
<td>4.00</td>
<td>-10.53</td>
</tr>
<tr>
<td>Wattwil 1989</td>
<td>20 31 (22)</td>
<td>20 58 (14)</td>
<td>17.0%</td>
<td>-27.00</td>
<td>-15.57</td>
</tr>
</tbody>
</table>

Subtotal (95% CI) 101 100 100.0% -39.26 [-60.04, -18.48]

Heterogeneity: $\tau^2 = 628.08; \chi^2 = 106.58, df = 5 (P<0.00001); I^2 =95$

Test for overall effect: $Z = 3.70 \ (P = 0.00021)$

2 Epi LA vs epi opioid

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheinin 1987</td>
<td>15 66 (28)</td>
<td>30 93 (28)</td>
<td>46.2%</td>
<td>-27.00</td>
<td>-15.65</td>
</tr>
<tr>
<td>Thorn 1989</td>
<td>11 22 (16)</td>
<td>11 56 (22)</td>
<td>53.8%</td>
<td>-34.00</td>
<td>-17.92</td>
</tr>
</tbody>
</table>

Subtotal (95% CI) 26 41 100.0% -30.77 [-42.56, -18.97]

Heterogeneity: $\tau^2 = 0.0; \chi^2 = 0.34, df = 1 (P = 0.56); I^2 =0.0$

Test for overall effect: $Z = 5.11 \ (P < 0.00001)$

3 Epi LA vs Epi LA/opioid

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liu 1995</td>
<td>14 40 (7.5)</td>
<td>12 43 (14)</td>
<td>100.0%</td>
<td>-3.00</td>
<td>-11.84</td>
</tr>
</tbody>
</table>

Subtotal (95% CI) 14 12 100.0% -3.00 [-11.84, 5.84]

Heterogeneity: not applicable

Test for overall effect: $Z = 0.67 \ (P = 0.51)$

---

Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery (Review)

Copyright © 2008 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
## Review: Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery

### Comparison: 1 Epidural local anaesthetic (LA) vs opioid based regimens

### Outcome: 5 Effect on time to first passage of flatus - subgroups

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>1 Epi LA vs syst opioid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ahn 1988</td>
<td>16</td>
<td>48 (10)</td>
<td>14</td>
<td>128 (21)</td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14</td>
<td>40 (7.5)</td>
<td>12</td>
<td>81 (10)</td>
</tr>
<tr>
<td>Riwar 1992</td>
<td>24</td>
<td>18 (12)</td>
<td>24</td>
<td>81 (18)</td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15</td>
<td>66 (28)</td>
<td>15</td>
<td>91 (35)</td>
</tr>
<tr>
<td>Wallin 1986</td>
<td>12</td>
<td>43 (20)</td>
<td>15</td>
<td>39 (18)</td>
</tr>
<tr>
<td>Wattwil 1989</td>
<td>20</td>
<td>31 (22)</td>
<td>20</td>
<td>58 (14)</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>101</strong></td>
<td><strong>100</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: $\tau^2 = 628.08; \ Chi^2 = 106.58, df = 5 (P<0.00001); I^2 = 95\%$

Test for overall effect: $Z = 3.70 (P = 0.00021)$

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>2 Epi LA vs epi opioid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheinin 1987</td>
<td>15</td>
<td>66 (28)</td>
<td>30</td>
<td>93 (28)</td>
</tr>
<tr>
<td>Thom 1989</td>
<td>11</td>
<td>22 (16)</td>
<td>11</td>
<td>56 (22)</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>26</strong></td>
<td><strong>41</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: $\tau^2 = 0.0; \ Chi^2 = 0.34, df = 1 (P = 0.56); I^2 = 0.0\%$

Test for overall effect: $Z = 5.11 (P < 0.00001)$
Analysis 1.6. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 6 Postoperative pain (VAS score). Epidural local anaesthetic versus epidural local anaesthetic/opioid.

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA</th>
<th>Opioid based analg</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidural LA vs Epidural LA/opioid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liu 1995</td>
<td>14</td>
<td>40 (7.5)</td>
<td>12</td>
<td>43 (14)</td>
<td>-3.00 [ -11.84, 5.84 ]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>14</td>
<td>12</td>
<td></td>
<td></td>
<td>-3.00 [ -11.84, 5.84 ]</td>
</tr>
</tbody>
</table>

Heterogeneity: not applicable
Test for overall effect: Z = 0.67 (P = 0.51)
### Study or subgroup | Epidural LA | Epidural LA/opioid | Mean Difference | Mean Difference
---|---|---|---|---
Brodner 2000 | 22 42 (20) | 26 30 (18) | - | 12.00 [ 1.15, 22.85 ]
Cooper 1996 | 18 33 (18) | 19 9 (8) | - | 24.00 [ 14.94, 33.06 ]
Cullen 1985 | 15 29 (20) | 15 22 (19) | - | 7.00 [ -6.96, 20.96 ]
George 1992 | 10 33 (11) | 10 0 (3) | - | 33.00 [ 25.93, 40.07 ]

#### Analysis 1.7. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 7 Effect on the incidence of postoperative nausea.

### Study or subgroup | Epidural LA | Opioid based analg | Peto Odds Ratio | Weight | Peto Odds Ratio
---|---|---|---|---|---
Asantila 1991 | 5/20 | 8/40 | 13.5 % | 13.5 % | 1.34 [ 0.37, 4.86 ]
Beeby 1984 | 0/10 | 2/23 | 2.4 % | 2.4 % | 0.23 [ 0.01, 4.87 ]
Brodner 2000 | 5/22 | 13/81 | 14.8 % | 14.8 % | 1.58 [ 0.46, 5.44 ]
Cooper 1996 | 2/18 | 0/38 | 2.5 % | 2.5 % | 23.78 [ 1.19, 475.13 ]
Delikan 1993 | 3/20 | 14/38 | 16.2 % | 16.2 % | 0.35 [ 0.11, 1.15 ]
George 1992 | 3/10 | 7/20 | 9.0 % | 9.0 % | 0.80 [ 0.17, 3.92 ]
Lee 1988 | 12/20 | 19/40 | 19.9 % | 19.9 % | 1.64 [ 0.56, 4.75 ]
Liu 1995 | 2/14 | 6/38 | 8.0 % | 8.0 % | 0.89 [ 0.17, 4.80 ]
Thorn 1989 | 0/11 | 5/11 | 5.9 % | 5.9 % | 0.08 [ 0.01, 0.59 ]
Wattwil 1989 | 0/20 | 6/20 | 7.7 % | 7.7 % | 0.10 [ 0.02, 0.56 ]
Total (95% CI) | 165 | 349 | 100.0 % | 0.76 [ 0.47, 1.23 ]

Total events: 32 (Epidural LA), 80 (Opioid based analg)
Heterogeneity: Chi² = 21.61, df = 9 (P = 0.01); I² = 58%
Test for overall effect: Z = 1.12 (P = 0.26)
Analysis 1.8. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 8 Effect on the incidence of postoperative vomiting.

Review: Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery

Comparison: 1 Epidural local anaesthetic (LA) vs opioid based regimens

Outcome: 8 Effect on the incidence of postoperative vomiting

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Epidural LA n/N</th>
<th>Opioid based analg n/N</th>
<th>Peto Odds Ratio Peto,Fixed,95% CI</th>
<th>Weight</th>
<th>Peto Odds Ratio Peto,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asantila 1991</td>
<td>3/20</td>
<td>14/40</td>
<td>55.8 % 0.38 [ 0.12, 1.24 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brodner 2000</td>
<td>1/22</td>
<td>7/81</td>
<td>25.4 % 0.57 [ 0.10, 3.27 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooper 1996</td>
<td>1/18</td>
<td>0/38</td>
<td>4.4 % 22.45 [ 0.34, 1491.91 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wattwil 1989</td>
<td>0/20</td>
<td>3/20</td>
<td>14.4 % 0.12 [ 0.01, 1.24 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>80</strong></td>
<td><strong>179</strong></td>
<td><strong>100.0 % 0.43 [ 0.18, 1.03 ]</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 5 (Epidural LA), 24 (Opioid based analg)
Heterogeneity: Chi² = 4.69, df = 3 (P = 0.20); I² =36%
Test for overall effect: Z = 1.89 (P = 0.059)

WHAT’S NEW

Last assessed as up-to-date: 31 August 2000

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 July 2008</td>
<td>Amended</td>
<td>Converted to new review format.</td>
</tr>
</tbody>
</table>
HISTORY

Protocol first published: Issue 1, 2000
Review first published: Issue 4, 2000

Date | Event | Description
--- | --- | ---
1 September 2000 | New citation required and conclusions have changed | Substantive amendment

CONTRIBUTIONS OF AUTHORS

None mentioned

DECLARATIONS OF INTEREST

None known

INDEX TERMS

Medical Subject Headings (MeSH)

Abdomen [*surgery]; *Analgesics, Opioid; *Anesthesia, Epidural; *Anesthetics, Local; Gastrointestinal Diseases [drug therapy; etiology]; Pain, Postoperative [drug therapy]; Postoperative Complications [*drug therapy]; Postoperative Nausea and Vomiting [drug therapy]

MeSH check words

Humans