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

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[Intervention review]

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

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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.

PLAIN LANGUAGE SUMMARY

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 (Wattwil 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

Treatment 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 intra operatively 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 LAPAROTOM*
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 identified 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 (HJØ) entered the data into Review Manager while another (JW) checked against this data extraction. A draft manuscript was performed by one reviewer (HJØ) 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

Patients in the treatment groups received epidural bupivacaine in doses ranging from 0.1% - 0.5% or epidural ropivacaine 0.2%. Continuous postoperative epidural infusion of bupivacaine were used in 13 studies [Asantila 1991, Bredtmann 1990, Cullen 1985, George 1992, Lee 1988, Liu 1995, Riwar 1992, Scheinin 1987, Scott 1989, Thorén 1989, Thörn 1992, Thörn 1996 and Wattwil 1989], while postoperative intermittent epidural injections were used in eight studies [Ahn 1988, Beeby 1984, Cooper 1996, Cuschieri 1985, Delilkan 1993, Geddes 1991, Rutberg 1984 and Wallin 1986]. Continuous postoperative epidural infusion of ropivacaine was administered in one study [Brodner 2000]. Patients in the control groups received an opioid based postoperative analgesia either systemic [Ahn 1988, Bredtmann 1990, Cuschieri 1985, Liu 1995, Riwar 1992, Scheinin 1987, Wallin 1986 and Wattwil 1989], epidural [Asantila 1991 , Beeby 1984 , Chestnut 1986 , Cooper 1996 , Cullen 1985 , Delilkan 1993 , George 1992 , Lee 1988 , Liu 1995 , Rutberg 1984 , Scheinin 1987 , Thorén 1989 , Thörn 1992, Thörn 1996], epidural in combination with bupivacaine [Asantila 1991 , Cooper 1996 , Cullen 1985 , Geddes 1991 , Liu 1995 and Scott 1989] or epidural in combination with ropivacaine [Brodner 2000]. Some studies included more than one opioid based study arm.

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)

Ahn 1988 B 1 0 0 0 0 : 1

Asantila 1991 B 1 0 0 0 0 : 1

Beeby 1984 A 1 1 1 1 1 : 5

Bredtmann 1990 C 0 0 0 0 1 : 1

Brodner 2000 B 1 0 1 1 1 : 4

Cooper 1996 A 1 1 1 1 1 : 5
Cullen 1985 B 1 0 1 1 0 : 3
Cuschieri 1985 B 1 0 0 0 1 : 2
Delilkan 1993 B 1 0 1 1 1 : 4
Geddes 1991 B 1 0 1 0 0 : 2
George 1992 A 1 1 1 1 1 : 5
Lee 1988 B 1 0 1 1 1 : 4
Liu 1995 B 1 0 1 0 1 : 3
Riwar 1992 A 1 1 0 0 0 : 2
Rutberg 1984 B 1 0 0 0 0 : 1
Scheinin 1987 B 1 0 0 0 0 : 1
Scott 1989 B 1 0 1 1 0 : 3
Thorén 1989 B 1 0 0 0 0 : 1
Thörn 1992 B 1 0 0 0 0 : 1
Thörn 1996 B 1 0 0 0 0 : 1
Wallin 1986 B 1 0 0 0 1 : 2
Wattwil 1989 1989 B 1 0 0 0 0 : 1

Effects of interventions

All outcome measures in the included studies were extracted and can be seen in detail in TABLE OF INCLUDED STUDIES. In TABLE OF COMPARISONS outcome measures analysed in this review are listed . Futhermore, 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 , Thorén 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, Thorén 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 systemic, in four studies, including 5 control groups, the opioid was administered epidurally and in 2 studies, including 2 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 piritramid 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, Thorén 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 for only 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-

tistical 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 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 04

Subgroup 01

Epidural local anaesthetic versus systemic opioid.

Five 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 132 in the control group. Four studies favoured treatment and one study was indifferent. The sub analysis yielded a reduction in time to first passage of stool of -54 [-102,-6] hours.

Subgroup 02

Epidural local anaesthetic versus epidural opioid.

Three studies that compared epidural local anaesthetic with epidural opioid, reported on time to first passage of stool. The comparison included a total of 107 patients, 46 in the treatment group and 61 in the control group. All three studies favoured treatment and the sub analysis yielded a reduction in time to first passage of stool of -21 [-30,-11] 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 stool. The comparison included 40 patients, 20 in the treatment group and 20 in the control group, and favoured treatment with 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 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 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 time 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, Wattwil 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 local anaesthetic/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], "piritramide, 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 [Rutberg 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 painrelief 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

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

Bredt-mann 1990	57 / 59	Major abd. : colonic resection and/or anastomo-sis	Bupi-vacaine 0.25% cont. for 72h vs "systemic analgesics" (pir-itramid, tramadol, or a simple analgesic)	No	LA superior to syst analg	Not reported	LA superior to syst analg	Not reported	T8/9, T9/10
Cuschieri 1985	25 / 25 / 25	Cholecys-tectomy	Bupi-vacaine 0.5% cont. for 12h vs intermitt syst morphine and cont syst morphine	No	LA superior to intermitt morphine at 12h. NS at 24, 36, ...,72	NS	Not reported	Not reported	Lower thoracic
Liu 1995	14 / 12	Colon resection	Bupi-vacaine 0.15% 10 ml/h vs patient-controlled analgesia (i.v. morphine)	Activity pain	LA superior to syst morphine at day 1 & 2	Not reported	Unclear	Not reported	T8/9
Rutberg 1984	8 / 8	Cholecy-tectomy	Bupi-vacaine 0.25-0.375% intermitt. 5-8 ml vs i.v. morphine 2.5 mg as required	No	LA superior to syst opioid at 2,4,6,12 h. NS at 24 h.	Not reported-	Not reported-	Not reported	T9/10, T10/11
Scheinin 1987	20 / 20	Hemi-colectomy or anterior resection	Bupi-vacaine 0.25% 4-6 ml/h vs systemic oxycodone	No	LA supirior to syst opioid at 3 h. NS at 24 h.	Not reported	LAi superior to syst opioid	Number of patients without additional analgesics:	Middle of planned incision

Table 1. Pain - treatment group versus systemic opioid

(*Continued*)

			0.15 mg/kg					NS	
Wallin 1986	12 / 15	Cholecystectomy	Bupivacaine 0.25% 10-14 ml/3h vs i.m. pentazocine	No	Not reported	Not reported	LA superior to syst opioid	Estimated mean of total pain scores: LA superior to syst opioid	T12/L1
Wattwil 1989	20 / 20	Hysterectomy	Bupivacaine 0.25% 8 ml/h vs i.v. ketobemidone 5 mg	No	LA superior to syst opioid at 26-30 h.	Not reported	LA superior to syst opioid	Not reported	T12/L1

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 2. Pain - treatment group versus epidural opioid

Study	N treat/contr	Surg procedure	Analgesic	Pain, specified?	VAS pain	First request	Suppl analgesic	Other pain outcome	Epi catheter level
Asantila 1991	20 / 20	Hysterectomy	Bupivacaine 0.25% 4 ml/h vs epi morphine	No	Not reported	Not reported	LA inferior to epi morphine	Number of pain free patients at evening of surgery:	T11/12

Table 2. Pain - treatment group versus epidural opioid

(*Continued*)

			0.2 mg/h					LA inferior to epi morphine. NS at day 1	
Beeby 1984	10 / 12 / 11	Caesarean section	Bupivacaine 0.5%, 10 ml single dose vs epi morphine 4 mg, in 10 ml single dose vs epi methadone 4 mg, in 10 ml single dose	No	Not reported	Not reported	Not reported	VAS pain reduction: LA superior to epi morphine and epi methadone, before and after top up	Not reported
Cooper 1996	20 / 20	Caesarean section	Bupivacaine 0.1% patient-controlled epidural analgesia (PCEA) 5ml/10 min vs epi fentanyl PCEA 20 microg/10 min	Rest and cough	At rest: LA inferior to epi fentanyl at 12 h. NS at 0.5, 4, 8, 24 h. At cough: NS at 0.5, 4, 8, 24.	Not reported	LA inferior to epi fentanyl at the intervals 8-12, 12-24 h. NS at the intervals 0-4, 4-8 h.	Not reported	L2/3
Cullen 1985	15 / 18	Major abdominal surgery	Bupivacaine 0.1% 3-4 ml/h vs epi morphine 0.3-0.4 mg/h	No	NS at days 0, 1, 2, 3.	Not reported	NS	Not reported	Middle of planned incision
Delilkan 1993	20 / 18	Abdominal surgery	Bupivacaine 0.25% 10	No	LA inferior to epi	Not reported	LA inferior epi tramadol	Duration of escape doses: LA	L1/2

Table 2. Pain - treatment group versus epidural opioid

(*Continued*)

			ml 1-2 doses with at least 15 min interval vs epi tramadol 50 or 100 mg 1-2 doses with at least 15 min interval		tramadol 100 mg at 3, 12, 24 h. NS at 1, 6 h.		100 mg	inferior to epi tramadol 100 mg	
George 1992	10 / 10	Abdominal aortic surgery	Bupivacaine 0.2% 5 ml/h vs epi fentanyl 50 microg in 10 ml /h	No	NS	Not reported	Not reported	Distribution of pain scores: NS	T7/8, T8/9
Lee 1988	20 / 20	Major gynaecological surgery	Bupivacaine 0.125% 15 ml/h vs epi diamorphine 0.5 mg in 15 ml/h	No	NS	NS	Not reported	Not reported	T10/11, T11/12
Liu 1995	14 / 12	Colonic surgery	Bupivacaine 0.15% 10 ml/h vs epi morphine 0.5 mg/ml 10 ml/h	Cough	LA superior to epi morphine, day 1 & 2. NS day 3	Not reported	Unclear	Not reported	T8-10
Rutberg 1984	8 / 8	Cholecystectomy	Bupivacaine 0.25-0.375% 5-8 ml/h vs epi morphine 4 m l/4h	No	NS	Not reported	Not reported	Not reported	T9/10, T10/11

Table 2. Pain - treatment group versus epidural opioid

(*Continued*)

Scheinin 1987	15 / 30	Hemi-colectomy or anterior resection	Bupi-vacaine 0.25% 4-6 ml/h vs epi morphine 2-6 mg once a day vs epi morphine 2-6 mg/day	No	NS	Not reported	NS	Number of patients without additional analgesics: NS	Middle of planned incision
Thorén 1989	11 / 11	Hysterec-tomy	Bupi-vacaine 0.25% 8 ml/h vs epi morphine 2-12 mg/24h on request	No	LA superior to epi morphine at afternoon, morning and afternoon after surgery	Not reported	NS	NS	T12/L1
Thörn 1996	7 / 7	Cholecys-tectomy	Bupi-vacaine 0.25% 8 ml/h vs epi morphine 4 mg + 2 mg on request	No	NS	Not reported	Not reported	Not reported	T6/7

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

Study	N treat/contr	Surg procedure	Analgesic	Pain, specified?	VAS pain	First request	Suppl analgesic	Other pain outcome	Epi catheter level
Asantila 1991	20 / 20	Hysterectomy	Bupivacaine 0.25% 4 ml/h vs bupivacaine 0.25% + morphine	No	Not reported	Not reported	LA inferior to epi comb	Number of pain free patients: LA inferior to epi comb on postop	T11/12

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

(*Continued*)

			0.05 mg/ml 4 ml/h					evening. NS day 1	
Cooper 1996	20 / 20	Caesarean section	Bupivacaine 0.1 % patient-controlled epidural analgesia (PCEA) 5 ml/10 min vs bupivacaine 0.1% + fentanyl 10 microg 5 ml/10 min	At rest and cough	Rest: LA inferior to epi comb at 12 h. NS at 4, 8 h. Cough: NS	Not reported	LA inferior to epi comb at intervals 4-8, 8-12 and 8-12 h. NS at 0-4 h.	Not reported	L2/3
Cullen 1985	15 / 15	Major abdominal surgery	Bupivacaine 0.1% 3-4 ml/h vs bupivacaine 0.1% + morphine 0.1 mg/ml 3-4 ml/h	No	NS day 0, 1, 2, 3	Not reported	NS	Not reported	L2/3
George 1992	10 / 10	Abdominal aortic surgery	Bupivacaine 0.2% 5 ml/h vs bupivacaine 0.2% + fentanyl 10 mg/ml 5ml/h	No	LA inferior to epi comb at 6, 12, 18, 24 h.	Not reported	LA inferior to epi comb	Not reported	T7/8, T8/9
Lee 1988	20 / 20	Major gynaecological surgery	Bupivacaine 0.125% 15 ml/h vs bupivacaine 0.125% +	No	LA inferior to epi comb at 2, 4, 6, 12, 21 h.	Not reported	Not reported	Number of patients withdrawn at first request for analgesics: LA	T10/11, T11/12

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

(*Continued*)

			diamorphine 0.5 mg/ml 15 ml/h					inferior to epi comb	
Liu 1995	14 / 14	Colonic surgery	Bupivacaine 0.15% 10 ml/h vs bupivacaine 0.1% + morphine 0.03 mg/ml 10 mg/ml	Cough	NS at day 1, 2, 3	Not reported	Unclear	Not reported	T8/9, T9/10
Scott 1989	10 / 10	Upper abdominal surgery	Bupivacaine 0.5% 5 ml/h vs bupivacaine 0.5% + morphine 0.1 mg/ml 5 ml/h	At rest	Not reported	Not reported	Not reported	Number of pain free patients at rest: LA inferior to epi comb number of pain free patients at rest	T7/8
Brodner 2000	22/25/30/26	Major abdominal gastrointestinal surgery	Ropivacaine 0.2% adjusted to VAS < 40 + PCEA 2 ml max /20 min vs ropivacaine 0.2% + sufetanil 0.5, 0.75 or 1.0 microg/ml adjusted to VAS < 40 + PCEA 2 ml max	Coughing or deep breath	LA inferior to epi comb with sufetanil 0.75+1.0	Not reported	NS	Cumulative volumes of epidural doses: NS	T9/10,T10/11

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

(*Continued*)

/20 min

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.
Six of the eight studies [Asantila 1991 , Brodner 2000 ,Cooper 1996, George 1992, Lee 1988, Scott 1989] concluded that the epidural combination of local anaesthetic and opioid was superior to local anaesthetic alone as a pain relief regimen.
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, Wattwil 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 incidense of postoperative vomiting
Comparison 01, outcome 08
The incidence and not the severity or the number 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 consequenses 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, althrough 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.

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* *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 untill all outcomes have occured 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 Transittime of barium from duodenum to colostomy or rectum No anastomotic leakage
Notes	Epidural catheter at L2-3 level

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Asantila 1991

Methods	Not blinded No drop-outs reported
Participants	60 females undergoing hysterectomy
Interventions	Treatment group: postoperative epidural bupivacaine 2.5 mg/ml 4 ml/h for 24 h, n=20 Control group: postoperative epidural morphine 2 mg followed by 0.2 mg/kg for 24 h, n=20 and postoperative epidural bupivacaine+morphine, given as a combination of the two dosages above for 24 h, n=20
Outcomes	Time of first defaecation Supplementary analgesics Pain relief

Asantila 1991

(*Continued*)	
	Nausea and vomitting The dura mater was accidentally punctured in one patient
Notes	Epidural catheter at T11-12 level

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

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

(*Continued*)	
	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.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

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

Brodner 2000

(*Continued*)

	Sedation Pruritus Motor block Plasma concentrations of sufentanil, ropivacaine and alfa1-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

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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 epiduralbupivacaine 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 periode for 24 h postoperatively. Epidural catheter inserted at level L2-3 "or an adjacent space"

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Cullen 1985

Methods	Double-blinded Drop-outs not reported
Participants	48 women undergoing major abdominal surgery
Interventions	Treatment group: epidural bupivacaine 0.1%, 3-4 ml/h, for 72 h, n = 15 Control group: epidural morphine 0.1 mg/ml, 3-4 ml/h, for 72 h, n = 18 and epidural 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.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Cuschieri 1985

Methods	Not blinded Drop-outs not reported
Participants	75 patients undergoing cholecystectomy
Interventions	Treatment group: Epidural 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

Item	Authors' judgement	Description

Allocation concealment?	Unclear	B - Unclear

Delilkan 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 frequence
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

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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

Item	Authors' judgement	Description

Allocation concealment?	Unclear	B - Unclear

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 and 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

Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

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 and epidural bupivacaine 0.125%, 15 ml/t +diamorphine 0.5 mg/h, for 21 h, n = 20
Outcomes	Supplementary analgesics PONV

Lee 1988

(*Continued*)

	Itching Motor block Hypotension Sedation Respiration depression
Notes	Patients were excluded when futher analgesics was needed. Epidural catheter inserted at T10-11 or T11-12 level.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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 Pruitus 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

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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 continous 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

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Rutberg 1984

Methods	Not blinded. Drop-outs not reported
Participants	24 women undergoing cholecystectomy
Interventions	Treatment group: segmental level maintained thoughout 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

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

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

Thorén 1989

(*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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: postoperativ 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 uneventfull in all patients"
Notes	Epidural katheter inserted at T6-7 level

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

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 absorbtion test
Notes	Epidural catheter inserted at T5-6 level

Thörn 1996

(*Continued*)

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Wallin 1986

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

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Wattwil 1989

Methods	Not blinded. Parallel groups No drop-outs reported
Participants	40 patients undergoing hysterectomi
Interventions	Treatment group: postoperative epidural bupivacaine 0.25%, 8 ml/h for 26-30 h, n=20 Control group: postoperative intermittent im injections of ketobemidone 5 mg, n=20
Outcomes	Time to first flatus

Wattwil 1989

(*Continued*)

	Time to first defaecation Radiopaque markers movement Nausea and vomitting Pain relief Blood glucose concentrations
Notes	Epidural catheter inserted at T12-L1 level.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

[a] im= intramuscular
iv= intravenous
PCA= patient controlled analgesia
PECA=patient-controlled extradural analgesia

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

Study	Reason for exclusion
Bigler 1989	Study on effects of paravertebral block versus epidural block after cholecystectomy. Excluded as no group of patients received postoperative epidural local anaesthetic.
Bridenbaugh 1976	Study on bupivacaine and etidocaine for epidural anaesthesia for abdominal pelvic surgery. Excluded as epidural local anaesthetic was not compaired with an opioid-based regimen.
Brownridge 1985	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.
Buckley 1978	Study of different solutions of epidural etidocaine to patients undergoing gynaecological surgery. Excluded as epidural local anaesthetic was not compaired with an opioid-based regimen.
Carli 1992	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.
Chestnut 1986	Study on epidural hydromorphone for postcesarean analgesia. Excluded as only one epidural bolus injection was administered at the end of surgery.
Davies 1993	Study on morbidity after abdominal aortic surgery. Focuses on intra- and post-operative complications. Excluded as it was not relevant to this review.
Dupont 1987	Study on the effect of caudal anaesthesia on catacholeamine in children. Excluded as there was other surgical procedures than laparotomy.
Dyer 1992	Intraoperative epidural local anaesthetic and postoperative epidural opioid with or without ephedrine. Excluded

(*Continued*)

Study	Reason for exclusion
	as no group of patients received postoperative epidural local anaesthetic.
Frings 1982	Study on epidural opioid vs systemic opioid after various surgery. Excluded as the opioid-based regimens were not compaired with epidural local anaesthetic and the types of surgery included other than laparotomy.
Gelman 1977	Study of electroenterography after cholecystectomy. Electroenterography is a surrogate parameter of stomac and intestinal motility. Excluded as the study was not randomized.
Grass 1993	Patients receive epidural fentanyl with or without ketorolac. Excluded as no group of patients received epidural local anaesthetic.
Harukuni 1995	Patients receive epidural opioid or systemic opioid. Excluded as no group of patients received epidural local anaesthetic.
Hendolin(1) 1987	Study on the effect of thoracic epidural analgesia on postoperative stress and morbidity. Excluded as no outcome measurements relevant to this review was reported.
Hendolin(2) 1987	Study on the effect of thoracic epidural analgesia on respiratory after cholecystectomy. Excluded as no outcome measurements relevant to this review was reported.
Hjortsø 1985	Both study groups receive epidural opioids as standard postoperative medication. Excluded as no group of patients received epidural local anaesthetic.
Hjortsø 1985a	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.
Hjortsø 1986	Study on postoperative epidural bupivacaine with or without morphine. Excluded as it is not a randomized trial.
Houwelling1992	Study compairing peroperative hemodynamic changes of epidural bupivacaine with epidural sufentanil. Excluded as no postoperative outcomes was presented.
Hull 1991	Study on non-closure of the visceral and parietal peritoneum during cesarean section. Excluded as it was not relevant to this review.
Håkonson 1985	Study on the effects of epidural bupivacaine or epidural morphine on the metabolic response after upper abdominal surgery.
Jorgensen 1978	Study on anaesthesia with epidural bupivacaine 0.75% vs epidural bupivacain 0.5% or mepivacaine 1.5%. Excluded as epidural local anaesthetic was not compaired to an opioid-based regimen and not all patients had a laparotomy.
Kapral 1996	The study compaires intraoperative gastric intramucosal CO2 as a measure of the visceral perfusion to get an indirect measure of surgical stress respons. Excluded as it was not relevant to this review.
Kausalya 1994	Excluded as patients were undergoing anal surgery, not laparotomy.
Kentner 1996	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.
Kilbride 1992	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.
Korinek 1985	Study on the effect of epidural morphine on antidiuretic hormone secretion after surgery. Excluded as patients were undergoing knee ligamentoplasty and not laparotomy.
Krane 1987	A comparison of caudal morphine, caudal bupivacaine and intravenous morphine for postoperative analgesia in

(*Continued*)

Study	Reason for exclusion
	children undergoing genitourinary or lower extremity surgery. Excluded as there was other surgical procedures than laparotomy.
Krane 1989	A dose response study of caudal morphine in children. Excluded as no group had epidural local anaesthetic.
Kumar 1993	Children undergoing various surgery below segmental level of T-10. Excluded as there was other surgical procedures than laparotomy.
Lee 1991	Study on the influence on the route of administration of diamorphine as a supplement to epidural bupivacaine. Excluded as no group only received epidural local anaesthesia.
Mann 2000	Study comparing intavenous or epidural patient-controlled analgesia in the elderly after major abdominal surgery. Excluded as no group had epidural local anaesthetic alone.
Marco Valls 1989	Study on postoperative paint treatment of children undergoing various surgical procedures. Excluded as there was other surgical procedures than laparotomy.
Miller 1976	Study on effects of systemic meperidine and epidural lidocaine on respiratory function after cholecystectomy. Excluded as only respiratory parameters was reported.
Modig 1981	Study comparing postoperative pain relief with epidural morphine and epidural bupivacaine efter total hip replacement. Excluded as the surgical procedure was not laparotomy.
Moine 1992	Children undergoing genito-urinary operations. Excluded as there was other surgical procedures than laparotomy.
Moskovitz 1986	Study on effects of epidural morphine/bupivacaine vs spinal or general anaesthesia to urologic surgery. Excluded as there was no randomisation of patients.
Muneyuki 1967	Study compairing postoperative pain relief by epidural mepivacaine and intravenous meperidine after upper abdominal surgery. Excluded as the study was not randomized.
Murrat 1988	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.
Mushambi 1992	Study on gastric emptying (paracetamol absorption test) after general anaesthesia for minor gynaecological surgery. Excluded as no patients had epidural local anaesthetic.
Neudecker 1999	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.
Nimmo 1978	Study on gastric emptying (paracetamol absorption) following hysterectomy with general/epidural or general anaesthesia. Excluded as there was no randomisation of patients.
Olofsson 1997	Study on the anaesthetic quality during cesarean section following subarachnoid or epidural administration of bupivacaine with or without fentanyl. Excluded as patients only had intraoperative epidural bolus injections, not postoperative.
Petring 1984	Study on gastric emptying (paracetamol absorption test) after epidural anaesthesia. Excluded as patients underwent surgery on the extremities not laparotomy.
Porter 1997	Study on gastric emptying (by paracetamol absorption) after epidural bupivacaine alone or in combination with fentanyl in women in labour. Excluded as patients were not undergoing laparotomy.
Randalls 1991	Comparison of four subarachoid solutions for ceasarean section. Excluded as no group received epidural local anaesthesia.

(*Continued*)

Study	Reason for exclusion
Renck 1975	Study of epidural bupivacaine and etodocaine to patients undergoing upper abdominal surgery. Excluded as epidural local anaesthetic was not compaired with an opioid-based regimen.
Rucci 1985	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.
Saito 1993	Study on the effects of epidural anaesthesia on ventilatory response to hypoxia. Excluded as no postoperative outcome measure relevant to this review is reported.
Schurizek 1982	Study on epidural morphine vs systemic morphine after upper abdominal surgery. Excluded as no group only received epidural local anaesthetic.
Seeling 1984	Study on respiratory function with epidural analgesia or systemic opioid after upper abdominal surgery. Excluded as it was not relevant to this review.
Seeling 1985	Study on the cardiovascular effects of two anaesthetic regimens. Excluded as there is no postoperative assessments.
Seow 1976	Study compairing epidural etidocaine with epidural lidocaine after pelvic floor repair. Excluded as it was not abdominal surgery and epidural local anaesthetic was not compaired with an opioid-based regimen.
Seow 1982	Study compairing epidural lidocaine and bupivacaine after lower abdominal surgery. Excluded as epidural anaesthetic was not compaired with an opioid-based regimen.
Sinclair 1984	Study compairing efficacy of epidural bupivacaine and epidural etidocaine in patients undergoing major gynaecological surgery. Excluded as the local anaesthetic was not compaired with an opioid-based regimen.
Torda 1995	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.
Tsuji 1983	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.
Welch 1998	Study on postoperative effects of epidural morphine/bupivacaine and systemic opioid. Excluded as no group of patients had epidural local anaesthetic alone.
White 1979	Study compairing intravenous fentanyl with epidural bupivacaine after peripheral vascular surgery. Excluded as the surgical procedures were others than laparotomy.
Wiebalck 1997	Patients undergoing thoracal or abdominal surgery. Excluded as there was other surgical procedures than laparotomy.
Wolf 1993	Study on pain relief in infant undergoing abdominal surgery. Excluded as this review does not include studies on infants.
Wright 1992	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.
Yeager 1987	Study comparing postoperative morbidity after epidural anaesthesia and analgesia with general anaesthesia. Excluded as no group only received epidural local anaesthesia.

DATA AND ANALYSES

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

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

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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Wattwil 1989	20	70 (44)	20	103 (26)		12.2 %	-33.00 [-55.40, -10.60]
Scheinin 1987	15	66 (28)	45	92 (32)		12.6 %	-26.00 [-42.98, -9.02]
Thorn 1989	11	57 (44)	11	92 (22)		11.5 %	-35.00 [-64.07, -5.93]
Wallin 1986	15	62 (18)	15	65 (27)		12.6 %	-3.00 [-19.42, 13.42]
Ahn 1988	16	57 (12)	14	192 (36)		12.4 %	-135.00 [-154.75, -115.25]
Riwar 1992	24	21 (19)	24	110 (35)		12.7 %	-89.00 [-104.93, -73.07]
Asantila 1991	20	46 (12)	40	59 (17)		13.1 %	-13.00 [-20.44, -5.56]
Bredtmann 1990	57	71 (36)	59	96 (29)		12.9 %	-25.00 [-36.92, -13.08]
Total (95% CI)	**178**		**228**			**100.0 %**	**-44.64 [-72.43, -16.85]**

Heterogeneity: Tau^2 = 1521.37; Chi^2 = 192.41, df = 7 (P<0.00001); I^2 =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

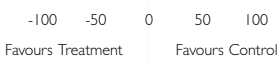
Comparison: 1 Epidural local anaesthetic (LA) vs opioid based regimens

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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Ahn 1988	16	48 (10)	14	128 (21)		14.4 %	-80.00 [-92.04, -67.96]
Liu 1995	14	40 (7.5)	24	65 (13)		14.9 %	-25.00 [-31.52, -18.48]
Riwar 1992	24	18 (12)	24	81 (18)		14.8 %	-63.00 [-71.65, -54.35]
Scheinin 1987	15	66 (28)	45	92 (32)		13.6 %	-26.00 [-42.98, -9.02]
Thorn 1989	11	22 (16)	11	56 (22)		13.8 %	-34.00 [-50.08, -17.92]
Wallin 1986	12	43 (20)	15	39 (18)		14.0 %	4.00 [-10.53, 18.53]
Wattwil 1989	20	31 (22)	20	58 (14)		14.5 %	-27.00 [-38.43, -15.57]
Total (95% CI)	**112**		**153**			**100.0 %**	**-36.11 [-55.76, -16.47]**

Heterogeneity: $Tau^2 = 661.34$; $Chi^2 = 131.86$, df = 6 ($P<0.00001$); $I^2 = 95\%$

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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
1 Epi LA vs systemic opioid							
Ahn 1988	16	48 (10)	14	128 (21)		14.5 %	-80.00 [-92.04, -67.96]
Bredtmann 1990	57	71 (36)	59	96 (29)		14.5 %	-25.00 [-36.92, -13.08]
Liu 1995	14	40 (7.5)	12	81 (10)		15.1 %	-41.00 [-47.89, -34.11]
Riwar 1992	25	18 (12)	25	81 (18)		14.9 %	-63.00 [-71.48, -54.52]
Scheinin 1987	15	66 (28)	15	91 (35)		12.5 %	-25.00 [-47.68, -2.32]
Wallin 1986	12	43 (20)	15	39 (18)		14.1 %	4.00 [-10.53, 18.53]
Wattwil 1989	20	31 (22)	20	58 (14)		14.5 %	-27.00 [-38.43, -15.57]
Subtotal (95% CI)	**159**		**160**			**100.0 %**	**-37.24 [-55.67, -18.82]**
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)							
2 Epi LA vs epi opioid							
Asantila 1991	20	46 (12)	20	55 (7)		29.1 %	-9.00 [-15.09, -2.91]
Liu 1995	14	40 (7.5)	14	71 (15)		27.5 %	-31.00 [-39.78, -22.22]
Scheinin 1987	15	66 (28)	30	93 (28)		21.2 %	-27.00 [-44.35, -9.65]
Thorn 1989	11	22 (16)	11	56 (22)		22.2 %	-34.00 [-50.08, -17.92]
Subtotal (95% CI)	**60**		**75**			**100.0 %**	**-24.42 [-38.81, -10.03]**
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 = 0.00088)							
3 Epi LA vs epi LA/opioid							
Asantila 1991	20	46 (12)	20	62 (19)		48.6 %	-16.00 [-25.85, -6.15]
Liu 1995	14	40 (7.5)	12	43 (14)		51.4 %	-3.00 [-11.84, 5.84]
Subtotal (95% CI)	**34**		**32**			**100.0 %**	**-9.31 [-22.05, 3.42]**
Heterogeneity: Tau^2 = 61.70; Chi^2 = 3.71, df = 1 (P = 0.05); I^2 =73%							
Test for overall effect: Z = 1.43 (P = 0.15)							

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

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

Heterogeneity: Tau² = 573.76; Chi² = 116.86, df = 6 (P<0.00001); I² =95%

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

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

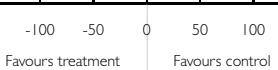
Comparison: 1 Epidural local anaesthetic (LA) vs opioid based regimens

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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
2 Epi LA vs epi opioid						
Asantila 1991	20	46 (12)	20	55 (7)		-9.00 [-15.09, -2.91]
Liu 1995	14	40 (7.5)	14	71 (15)		-31.00 [-39.78, -22.22]
Scheinin 1987	15	66 (28)	30	93 (28)		-27.00 [-44.35, -9.65]
Thorn 1989	11	22 (16)	11	56 (22)		-34.00 [-50.08, -17.92]
Subtotal (95% CI)	**60**		**75**			**-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 = 0.00088)



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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
3 Epi LA vs epi LA/opioid						
Asantila 1991	20	46 (12)	20	62 (19)		-16.00 [-25.85, -6.15]
Liu 1995	14	40 (7.5)	12	43 (14)		-3.00 [-11.84, 5.84]
Subtotal (95% CI)	**34**		**32**			**-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)

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

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

Heterogeneity: Tau² = 2940.86; Chi² = 208.17, df = 4 (P<0.00001); I² =98%

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

2 Epi LA vs epi opioid							
Asantila 1991	20	46 (12)	20	62 (19)		64.1 %	-16.00 [-25.85, -6.15]
Scheinin 1987	15	66 (28)	30	93 (28)		25.9 %	-27.00 [-44.35, -9.65]
Thorn 1989	11	57 (44)	11	92 (22)		10.0 %	-35.00 [-64.07, -5.93]
Subtotal (95% CI)	**46**		**61**			**100.0 %**	**-20.75 [-30.17, -11.33]**

(*Continued . . .*)

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Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Heterogeneity: Tau² = 10.77; Chi² = 2.28, df = 2 (P = 0.32); I² =12%							
Test for overall effect: Z = 4.32 (P = 0.000016)							
3 Epi LA vs epi LA/opioid							
Asantila 1991	20	46 (12)	20	62 (19)		100.0 %	-16.00 [-25.85, -6.15]
Subtotal (95% CI)	**20**		**20**			**100.0 %**	**-16.00 [-25.85, -6.15]**
Heterogeneity: not applicable							
Test for overall effect: Z = 3.18 (P = 0.0015)							

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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
1 Epi LA vs syst opioid						
Ahn 1988	16	57 (12)	14	192 (36)	-135.00 [-154.75, -115.25]	
Bredtmann 1990	57	71 (36)	59	96 (29)		-25.00 [-36.92, -13.08]
Riwar 1992	24	21 (19)	24	110 (35)		-89.00 [-104.93, -73.07]
Wallin 1986	12	82 (16)	15	74 (11)		8.00 [-2.63, 18.63]
Wattwil 1989	20	70 (44)	20	103 (26)		-33.00 [-55.40, -10.60]
Subtotal (95% CI)	**129**		**132**			**-54.49 [-102.61, -6.38]**
Heterogeneity: Tau² = 2940.86; Chi² = 208.17, df = 4 (P<0.00001); I² =98%						
Test for overall effect: Z = 2.22 (P = 0.026)						

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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
2 Epi LA vs epi opioid						
Asantila 1991	20	46 (12)	20	62 (19)		-16.00 [-25.85, -6.15]
Scheinin 1987	15	66 (28)	30	93 (28)		-27.00 [-44.35, -9.65]
Thorn 1989	11	57 (44)	11	92 (22)		-35.00 [-64.07, -5.93]
Subtotal (95% CI)	**46**		**61**			**-20.75 [-30.17, -11.33]**

Heterogeneity: $Tau^2 = 10.77$; $Chi^2 = 2.28$, df = 2 (P = 0.32); $I^2 = 12\%$

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

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

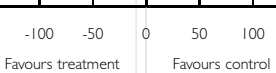
Comparison: 1 Epidural local anaesthetic (LA) vs opioid based regimens

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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
3 Epi LA vs epi LA/opioid						
Asantila 1991	20	46 (12)	20	62 (19)		-16.00 [-25.85, -6.15]
Subtotal (95% CI)	**20**		**20**			**-16.00 [-25.85, -6.15]**

Heterogeneity: not applicable

Test for overall effect: Z = 3.18 (P = 0.0015)

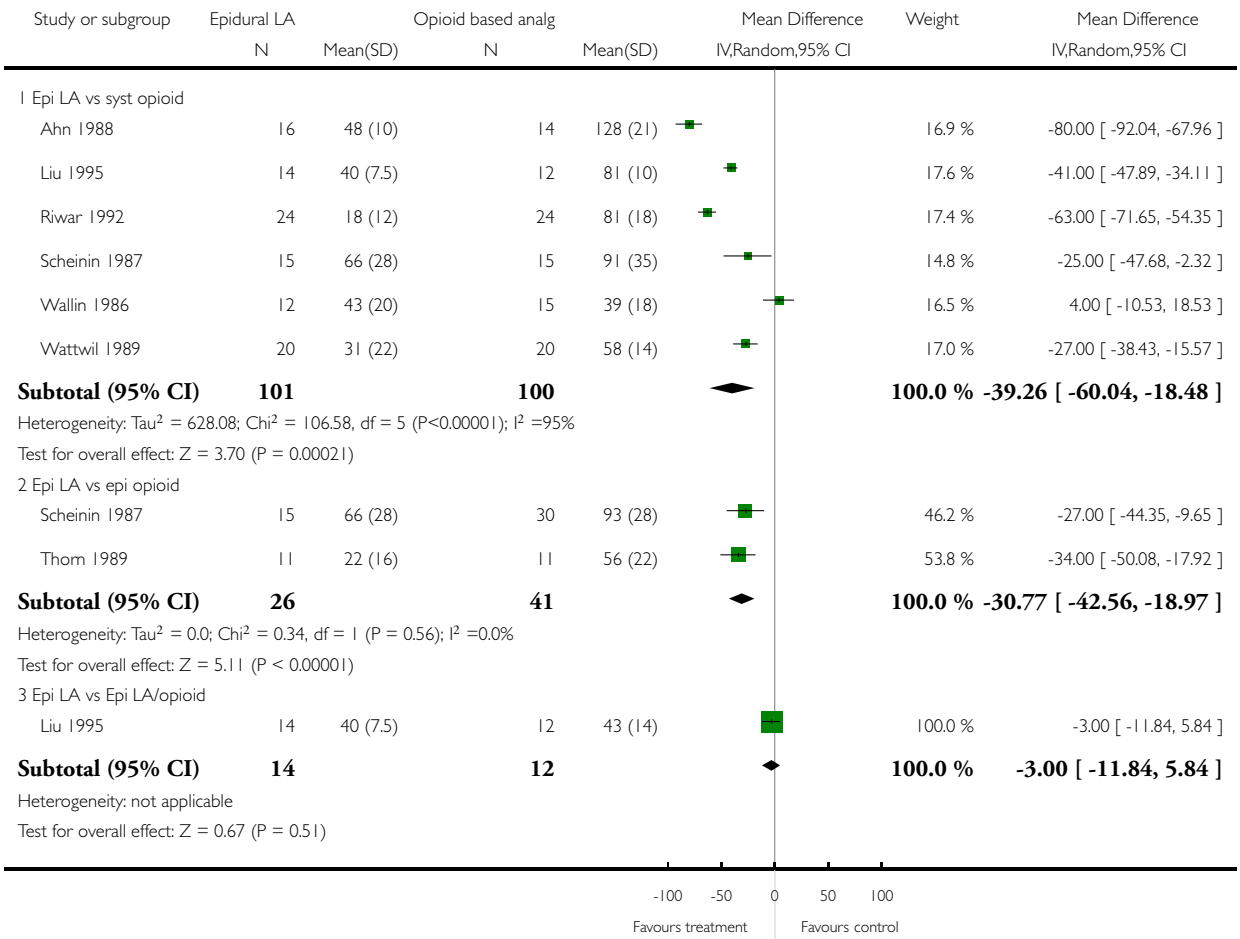


Analysis 1.5. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 5 Effect on time to first passage of flatus - subgroups.

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



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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
1 Epi LA vs syst opioid						
Ahn 1988	16	48 (10)	14	128 (21)		-80.00 [-92.04, -67.96]
Liu 1995	14	40 (7.5)	12	81 (10)		-41.00 [-47.89, -34.11]
Riwar 1992	24	18 (12)	24	81 (18)		-63.00 [-71.65, -54.35]
Scheinin 1987	15	66 (28)	15	91 (35)		-25.00 [-47.68, -2.32]
Wallin 1986	12	43 (20)	15	39 (18)		4.00 [-10.53, 18.53]
Wattwil 1989	20	31 (22)	20	58 (14)		-27.00 [-38.43, -15.57]
Subtotal (95% CI)	**101**		**100**			**-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)

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

Study or subgroup	Epidural LA N	Mean(SD)	Opioid based analg N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
2 Epi LA vs epi opioid						
Scheinin 1987	15	66 (28)	30	93 (28)		-27.00 [-44.35, -9.65]
Thorn 1989	11	22 (16)	11	56 (22)		-34.00 [-50.08, -17.92]
Subtotal (95% CI)	**26**		**41**			**-30.77 [-42.56, -18.97]**

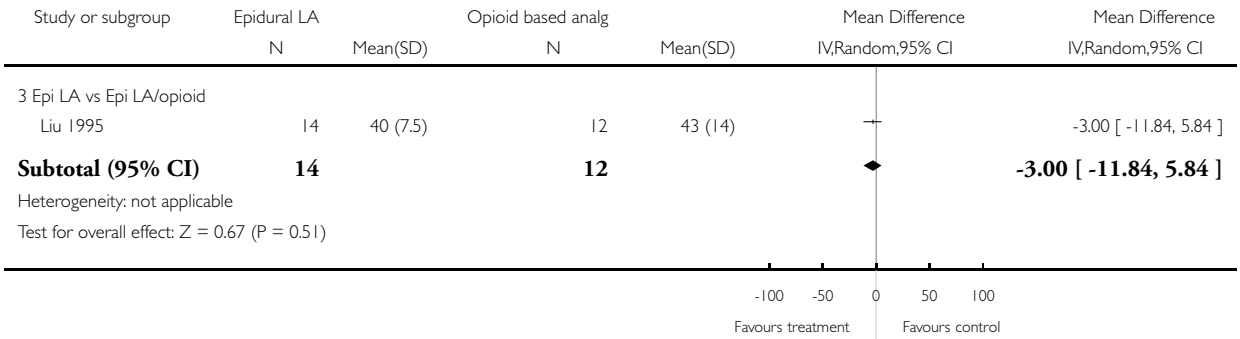
Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.34$, df = 1 (P = 0.56); $I^2 = 0.0\%$

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

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

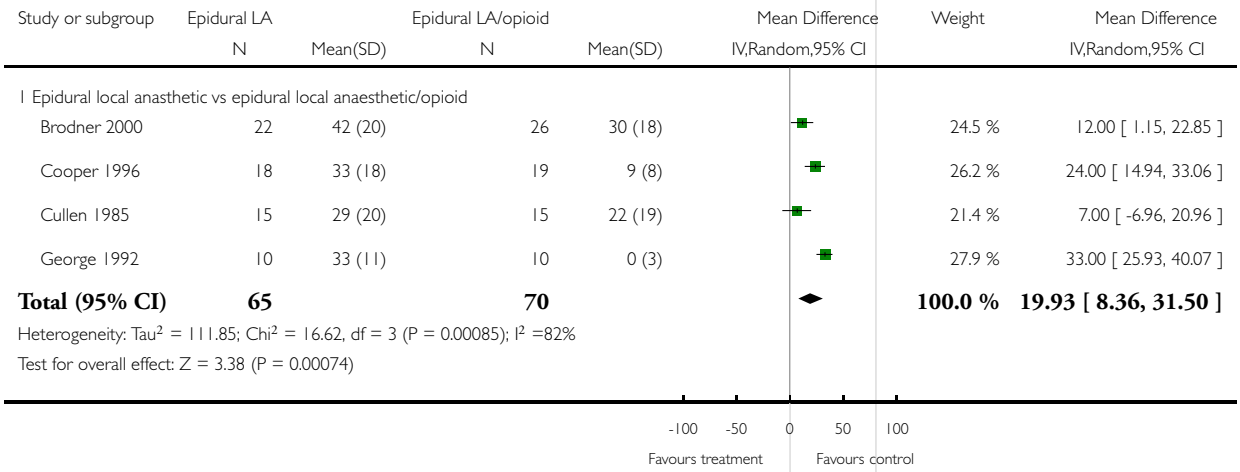


Analysis 1.6. Comparison 1 Epidural local anaesthetic (LA) vs opioid based regimens, Outcome 6 Postoperative pain (VAS score). Epidural local anaesthetic versus epidural local anaesthetic/opioid.

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: 6 Postoperative pain (VAS score). Epidural local anaesthetic versus epidural local anaesthetic/opioid

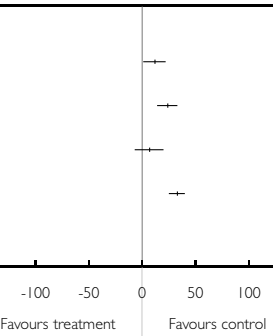


Review: Epidural local anaesthetics versus opioid-based analgesic regimens for postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery

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

Outcome: 6 Postoperative pain (VAS score). Epidural local anaesthetic versus epidural local anaesthetic/opioid

Study or subgroup	Epidural LA N	Mean(SD)	Epidural LA/opioid N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
1 Epidural local anasthetic vs epidural local anaesthetic/opioid						
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.

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: 7 Effect on the incidence of postoperative nausea

Study or subgroup	Epidural LA n/N	Opioid based analg n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
Asantila 1991	5/20	8/40		13.5 %	1.34 [0.37, 4.86]
Beeby 1984	0/10	2/23		2.4 %	0.23 [0.01, 4.87]
Brodner 2000	5/22	13/81		14.8 %	1.58 [0.46, 5.44]
Cooper 1996	2/18	0/38		2.5 %	23.78 [1.19, 475.13]
Delilkan 1993	3/20	14/38		16.2 %	0.35 [0.11, 1.15]
George 1992	3/10	7/20		9.0 %	0.80 [0.17, 3.92]
Lee 1988	12/20	19/40		19.9 %	1.64 [0.56, 4.75]
Liu 1995	2/14	6/38		8.0 %	0.89 [0.17, 4.80]
Thorn 1989	0/11	5/11		5.9 %	0.08 [0.01, 0.59]
Wattwil 1989	0/20	6/20		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: Chi^2 = 21.61, df = 9 (P = 0.01); I^2 =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 incidense 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

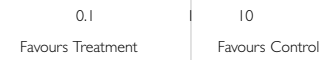
Outcome: 8 Effect on the incidense of postoperative vomiting

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

Total events: 5 (Epidural LA), 24 (Opioid based analg)

Heterogeneity: Chi^2 = 4.69, df = 3 (P = 0.20); I^2 =36%

Test for overall effect: Z = 1.89 (P = 0.059)



WHAT'S NEW

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

Date	Event	Description
23 July 2008	Amended	Converted to new review format.

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