Caesarean section wound infiltration with local anaesthetic for postoperative pain relief – any benefit?

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Delivery by caesarean section (CS) is becoming more frequent. Childbirth is an emotion-filled event, and the mother needs to bond with her baby as early as possible. Any intervention that leads to improvement in pain relief is worthy of investigation. Local anaesthetics have been employed as an adjunct to other methods of postoperative pain relief, but reports on the effectiveness of this strategy are conflicting. This review attempted to assess the effects of local anaesthetic agent wound infiltration and/or abdominal nerve blocks on pain after CS and the mother's well-being and interaction with her baby.

Methods. We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (April 2009).The selection criteria were randomised controlled trials of local analgesia during CS to reduce pain afterwards. Twenty studies (1 150 women) were included.

Results. Women who had wound infiltration after CS performed under regional analgesia had a decrease in morphine consumption at 24 hours compared with placebo (morphine dose -1.70 mg; 95% confidence interval (CI) –2.75 to –0.94). Women who had wound infiltration and peritoneal spraying with local anaesthetic after CS under general anaesthesia (1 study, 100 participants) had a reduced need for opioid rescue (risk ratio (RR) 0.51; 95% CI 0.38 to 0.69). The numerical pain score (0 -10) within the first hour was also reduced (mean difference (MD) -1.46; 95% CI –2.60 to –0.32). Women with regional analgesia who had local anaesthetic and non-steroidal anti-inflammatory cocktail wound infiltration consumed less morphine (1 study, 60 participants; MD –7.40 mg; 95% CI –9.58 to –5.22) compared with those who had local anaesthetic control. Women who had regional analgesia with abdominal nerve blocks had decreased opioid consumption (4 studies, 175 participants; MD –25.80 mg; 95% CI –50.39 to –5.37). For outcome in terms of the visual analogue pain score (0 - 10) over 24 hours, no advantage was demonstrated in the single study of 50 participants who had wound infiltration with a mixture of local analgesia and narcotics versus local analgesia.

Conclusions. Local anaesthetic infiltration and abdominal nerve blocks as adjuncts to regional analgesia and general anaesthesia are of benefit in CS by reducing opioid consumption. Non-steroidal anti-inflammatory drugs may provide additional pain relief.

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Delivery by caesarean section (CS) is becoming more frequent and is one of the most common major operative procedures performed worldwide. In the USA a CS rate of 26% for all births is reported.[1] The rate approaches 25% in Canada and is over 20% in England, Wales and Northern Ireland.[2] In the private health sector in South Africa, one study noted a much higher figure of 57%.[3]

Childbirth is an emotional experience for a woman and her family. The mother needs to bond with the new baby as early as possible and initiate early breastfeeding, which helps to contract the uterus and accelerates the process of uterine involution in the postpartum period.[4] Any form of intervention that leads to improvement in pain relief can positively impact on early breastfeeding. Prompt and adequate postoperative pain relief is therefore an important component of caesarean delivery that can make the period immediately after the operation less uncomfortable and more emotionally gratifying.

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Postoperative pain after CS is usually managed with opioids in combination with other forms of analgesics.

CS is performed under spinal anaesthesia, spinal epidural, epidural block or general anaesthesia. Short- or medium-acting sedatives, narcotics and local anaesthesia have been employed during the operation as an adjunct to anaesthesia or to alleviate postoperative pain. Local anaesthetics cause reversible blockade of impulse propagation along the nerve fibres by preventing the influx of sodium ions through the cell membrane of the fibres. Several studies have reported on use of pre-emptive local anaesthetics (local anaesthetic given during the operation to prevent or reduce pain afterwards) to relieve postoperative pain, with results ranging from being beneficial[5,6] to conferring no benefit.[7,8]

The local anaesthetic may be administered by pre- or post-incisional abdominal nerve block (local anaesthetic injected to block the nerves before cutting the skin at the beginning of the operation, or after closing the skin at the end[9]) or pre- or post-incisional abdominal wound infiltration.[5,10] It may also be administered by continuous wound irrigation.[11] Commonly used local anaesthetic agents have side-effects, although these are very rare, ranging from allergy to cardiovascular and central nervous system effects. Local anaesthetics eventually get absorbed systemically and secreted in breastmilk, but their effects on breastfed babies have not yet been documented. This is in sharp contrast to morphine or pethidine, both of which have significant transfer to breastmilk and may have a sedative effect on the baby.[4]

It is also important to consider the cost implications of local anaesthetic administration. Should it prove to be of benefit, the actual cost of the local anaesthetic and the additional time needed to carry out the procedure may be justified, considering the long-term sequelae of pain and immobility immediately after CS.

Objectives

The objectives of the study were to assess the effects of local anaesthetic agent wound infiltration/irrigation and/or abdominal nerve blocks on pain relief after CS, on the mother's physical, social and mental well-being, and on her ability to meet the physical, psychological and nutritional needs of the baby.

Methods

Prospective randomised controlled trials in women undergoing CS, either electively or as an emergency, were considered for inclusion in the review.

The types of interventions that were sought were local anaesthetic agent wound infiltration versus placebo/no infiltration, ilio-inguinal/iliohypogastric nerve block versus placebo/no treatment, local anaesthetic agent versus other methods of pain relief, and comparisons of different local anaesthetic agent techniques. Outcome measures assessed included postoperative pain scores, postoperative analgesia requirement, time to first rescue analgesia, postoperative fever, duration of CS, onset of mobilisation, onset of breastfeeding, duration of breastfeeding, duration of exclusive breastfeeding, side-effects of the local anaesthetic, duration of hospital stay, postoperative wound infection, women's satisfaction with regard to pain relief, occurrence of postnatal depression or neurotic/psychotic disorders, chronic pelvic pain, and caregiver satisfaction.

Studies were searched for and identified through the Cochrane Pregnancy and Childbirth Group's Trials Register by contacting the Trials Search Co-ordinator (April 2009). Details of the search strategies for CENTRAL and MEDLINE, the list of hand-searched journals and conference proceedings, and the list of journals reviewed via the current awareness service can be found in the 'Specialized Register' section in the editorial information about the Cochrane Pregnancy and Childbirth Group.[12] There was no language restriction. We assessed for inclusion all potential studies we identified via the search strategy, and designed a form to extract data. No major discrepancies were identified. We used the Review Manager software[13] to double-enter all the data, assessed the validity of each study using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions*,[14] and described methods used for generation of the randomisation sequence for each trial.

For each individual study we described the method used to generate allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups. We assessed the method as either adequate (any truly random process, e.g. random number table; computer random number generator), inadequate (any non-random process, e.g. odd or even date of birth; hospital or clinic record number), or unclear. Method of allocation concealment (checking for possible selection bias), blinding, completeness of data and selective reporting bias were all assessed.

We carried out statistical analysis using the Review Manager software.[13] We used fixed-effect meta-analysis for combining data in the absence of significant heterogeneity if trials were sufficiently similar. When heterogeneity was found, we used random-effects analysis. For dichotomous data, we presented results as summary risk ratios (RRs) with 95% confidence intervals (CIs), and for continuous data we used the mean difference if outcomes were measured in the same way between trials. We used the standardised mean difference to combine trials that measured the same outcome but used different methods.

We applied tests of heterogeneity between trials, if appropriate, using the I^2 statistic. In the event of significant heterogeneity, we used a random-effects meta-analysis as an overall summary if we determined that this was appropriate. Subgroup analysis was for women who had general anaesthesia versus regional analgesia. We excluded studies of poor quality (those rating B, C or D) in order to assess for any substantive difference to the overall result.

Results

We identified 40 studies. Twenty studies, involving 1 150 women, carried out in both developed and developing countries and spanning almost two decades, met the inclusion criteria (Table I). The outcome of interventions is shown in Table II.

Wound infiltration with local anaesthetics only v. control

Women who underwent CS under regional anaesthesia and had wound infiltration had a decrease in morphine consumption at 24 hours (3 studies, 126 participants; standardised mean difference (SMD) –1.70 mg; 95% CI –2.75 to –0.94) compared with placebo. There was no difference in visual analogue pain.

Peritoneal spraying/instillation and abdominal wound infiltration involving all layers

Women who underwent CS under general anaesthetic, who had the wound infiltrated and peritoneal spraying with local anaesthetic (1 study, 100 participants), had a reduced need for opioid rescue (RR 0.51; 95% CI 0.38 to 0.69). The numerical pain score (0 - 10) within the first hour was reduced (MD –1.46 mg; 95% CI –2.60 to –0.32).

The amount of oral Tramacet (375 mg paracetamol + 150 mg tramadol) consumed was reduced in the local anaesthetic group compared with controls who received saline (MD –2.35 mg; 95% CI –3.62 to –1.08).

Local anaesthetic v. local anaesthetic and non-steroidal anti-inflammatory drug (NSAID) mixture

Women operated on under regional anaesthesia and who had a local anaesthetic and NSAID cocktail wound infiltration

Table I. Characteristics of included studies

Author	Methods	Participant	Intervention	Outcome
Bamigboye *et al*.[15]	Randomised double-blind, placebo-controlled trial	100 consenting women, elective CS	50 women received 225 mg ropivacaine if 64 kg or more and 3 mg/kg if less. Controls received an equivalent volume of saline. All layers of anterior abdominal incision infiltrated, including peritoneum	Postoperative pethidine, diclofenac injection and Tramacet
Bell *et al*.[16]	Randomised double-blind placebo-controlled trial	59 women, randomised to receive nerve block or saline placebo	31 women had ilio-inguinal-iliohypogastric nerve block with 0.5% bupivacaine with adrenaline and 28 had saline placebo	Postoperative morphine use and visual analogue pain scores
Caulry *et al*.[17]	Randomised placebo-controlled trial	30 women, spinal anaesthesia, randomised into 10 each of saline, ropivacaine and diclofenac	Wound irrigation in each group	Visual analogue pain scores and use of morphine
Chen *et al*.[18]	Randomised clinical trial	36 women, randomised into 12 no treatment, 12 plain Marcaine and 12 Marcaine with adrenaline	Ilio-inguinal nerve block after CS	Pain, times of pethidine injection, first time and dosage of pethidine injection, postpartum haemorrhage and uterine atony
Ganta *et al*.[5]	Randomised single-blind placebo-controlled trial	62 women, elective CS under general anaesthesia	21 women had bilateral ilioinguinal nerve block with 0.5% bupivacaine, 20 had wound infiltration with 0.5% bupivacaine, and 21 received no local anaesthetic	Visual analogue scale pain scores in first 24 hours and mean morphine consumption in 24 hours
Givens *et al*.[11]	Randomised double-blind placebo-controlled trial	36 women, planned CS	20 women with wound irrigation with 0.25% bupivacaine v. 16 with normal saline solution irrigation	Postoperative morphine use and visual analogue pain scores
Kumar *et al*.[10]	Randomised controlled trial	50 ASA I and II women, elective CS	24 women received pre-incisional 0.5% bupivacaine 40 ml v. 26 receiving bupivacaine 40 ml and 2 mg morphine mixture	Visual analogue pain scores at different hours in the first 24 hours and side-effects of vomiting, nausea and pruritus
Kuppuvelumani *et a*l.[19]	Randomised controlled trial	60 women, CS under general anaesthesia	Mixture of 0.5% bupivacaine with adrenaline with 1% xylocaine injected to block the ilio-inguinal/iliohypogastric nerve in 30 women v. 30 controls who did not receive abdominal nerve block	Time to breastfeeding, total pethidine requirement over 24 hours and duration of action of the block
Lacrosse *et al*.[20]	Prospective randomised trial	55 healthy parturients, CS under spinal anaesthesia	19 women had wound irrigation with 300 mg diclofenac for 48 hours, 18 had ropivacaine 0.2%, 18 controls had saline	Local ropivacaine wound infiltration superior to diclofenac only in the first 24 hours, but diclofenac has a better opioid-sparing effect
Lanvand'homme *et al*.[21]	Randomised double-blind placebo-controlled trial	90 women randomly allocated to receive saline, diclofenac or 0.2% ropivacaine, 30 in each group	Continuous wound infiltration with the allocated interventions	Postoperative morphine consumption, parietal and visceral visual analogue pain scores
Marbaix *et al*.[22]	Randomised prospective trial	55 healthy parturients, elective CS under spinal anaesthesia	19 women had wound irrigation with 300 mg diclofenac for 48 hours, 18 had ropivacaine 0.2%, 18 controls had saline	Visual analogue pain scores and morphine consumption
McDonnell *et al*.[23]	Randomised controlled trial	50 women, CS under spinal anaesthesia	1.5 mg/kg ropivacaine per side injected into the transversus abdominis plane (TAP) versus saline TAP block	Morphine requirement, prolonged and superior analgesia up to 36 hours postoperatively

Table I. Characteristics of included studies (continued)

Mecklem *et al*.[24]	Randomised double-blind placebo-controlled trial	79 women, CS under spinal analgesia	Patients allocated to receive either saline or 0.25% bupivacaine	Visual analogue pain scores, morphine consumption and gastro-intestinal side-effects
Pavy *et al*.[25]	Randomised trial	40 women for elective CS	20 patients received 0.5% bupivacaine, 20 received saline	Pain scores, pruritus and nausea
Pirbudak *et al*.[26]	Randomised double-blind	60 women, CS under spinal anaesthesia	40 ml 0.25% bupivacaine + 100 mg tramadol + 20 mg tenoxicam v. normal saline	Reduction in postoperative analgesic use and prolongation of analgesic requirement time
Rosaeg *et al*.[27]	Randomised controlled trial	40 women, elective CS	Experimental group received intrathecal morphine, incisional bupivacaine and ibuprofen and acetaminophen, v. IVI morphine weaned to acetaminophen and codeine. Both groups received 0.75% bupivacaine spinal analgesia	Visual analogue pain scores at rest and at mobilisation. Time to first walking, eating, bowel movement and voiding
Solak *et al*.[28]	Randomised trial	30 women, elective CS	Patients randomised to receive either 20 ml 0.5% bupivacaine or saline	Visual analogue pain scale scores, analgesic requirement and cortisol level
Trotter *et al*.[9]	Randomised double-blind trial	28 women, elective CS	0.5% bupivacaine v. saline	Morphine consumption, pain scores, sedation level and nausea
Zohar *et al*.[29]	Prospective randomised double-blind study	50 term parturients, CS under spinal anaesthesia	A multi-holed device was placed in the wound and connected to a patient-controlled pump. Bupivacaine v. bupivacaine combined with ketamine	Visual analogue scale for pain, rescue morphine, patient satisfaction
Zohar *et al*.[30]	Prospective, randomised, double-blind, placebo-controlled trial	90 parturients (ASA 1 & 2), elective CS	30 women had wound instillation with 0.25% bupivacaine and 75 mg intravenous diclofenac via a patient-controlled analgesic infusion pump, 30 only bupivacaine instillation, 30 only diclofenac infusion	Rescue analgesic required, visual analogue pain scale, nausea and patient satisfaction

consumed less morphine in the first 18 hours (1 study, 60 participants; MD –7.40 mg; 95% CI –9.58 to –5.22) compared with controls who received a local anaesthetic only. There was no difference in the occurrence of vomiting or reduction in anti-emetic use (RR 1.40 mg; 95% CI 0.90 to 2.16).

Anterior abdominal nerve block with local anaesthetic v. control

Women who had regional anaesthesia and an abdominal nerve block had decreased opioid consumption (4 studies, 175 participants; MD –25.80 mg; 95% CI –50.39 to –5.37) but no difference in visual analogue pain score (0 - 10) (2 studies, 83 participants; MD –1.82 (95% CI –2.74 to –0.90)).

Local anaesthetics v. local anaesthetics + narcotics

In terms of the visual analogue scale over 24 hours, no advantage was demonstrated in the single study of 50 participants who had wound infiltration with a mixture of local anaesthetic and narcotics versus local anaesthetic.

Local anaesthetics v. local anaesthetics + ketamine

Addition of ketamine to the local anaesthetic in women receiving regional anaesthesia does not confer any advantage in terms of narcotic consumption or patient satisfaction (1 study, 50 participants).

Discussion

Minimising pain after CS is best achieved using a multimodal approach. Local anaesthetics, from lidocaine to the more recent ropivacaine, have been used as pre-emptive analgesics since the 1980s. Clinical trials were only published in the early 1990s. Local anaesthetic has been used in women receiving general anaesthesia and regional anaesthesia, and rarely local anaesthesia alone has been used when other anaesthesia was unavailable or unsafe. Various routes of administration have been tested, such as subcutaneous wound infiltration, infiltration through all layers of the abdomen, continuous wound instillation or iliohypogastric/ilio-inguinal nerve blocks. Ultrasound-guided nerve blocks may soon be explored. Local anaesthesia has been used alone and in combination with NSAIDs or ketamine.

This review showed that women undergoing CS under regional analgesia who had local anaesthetic infiltration or abdominal nerve block had a reduced need for postoperative opioids. Addition of NSAIDs to the local anaesthetic for wound infiltration conferred additional advantage, perhaps because these analgesics have a different mode of action. Opioid consumption may not be the optimal method of pain assessment because of being influenced by patient fear of dependency, but this effect is balanced by the randomisation

Table II. Data and analyses

Outcome or subgroup	Studies	Participants	Statistical method	Effect estimate
Wound infiltration with local anaesthetic only v. control				
Total morphine consumption as defined by trial author in the first 24 hours	3	126	SMD (IV, random, 95% CI)	–1.72 (–2.35 to –1.09)
General anaesthesia	0	0	SMD (IV, random, 95% CI)	Not estimable
Regional anaesthesia	3	126	SMD (IV, random, 95% CI)	–1.72 (–2.35 to –1.09)
Visual analogue scale (0 - 10) at 24 hours	2	56	MD (IV, fixed, 95% CI)	–0.39 (–1.72 to 0.94)
Regional anaesthesia	2	56	MD (IV, fixed, 95% CI)	–0.39 (–1.72 to 0.94)
General anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Total morphine consumption as defined by trial author, in the first 12 hours	1	28	MD (IV, fixed, 95% CI)	–0.39 (–0.68 to –0.10)
General anaesthesia	1	28	MD (IV, fixed, 95% CI)	–0.39 (–0.68 to –0.10)
Regional anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Wound infiltration with local anaesthetic and peritoneal spraying v. placebo				
Need for pethidine rescue within 1 hour of delivery	1	100	RR (M-H, fixed, 95% CI)	0.51 (0.38 to 0.69)
General anaesthesia	1	100	RR (M-H, fixed, 95% CI)	0.51 (0.38 to 0.69)
Regional anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Numerical pain score (0 - 10) at 1 hour	1	100	MD (IV, fixed, 95% CI)	–1.46 (–2.60 to –0.32)
General anaesthesia	1	100	MD (IV, fixed, 95% CI)	–1.46 (–2.60 to –0.32)
Regional anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Numerical pain score (0 - 10) at 8 hours	1	100	MD (IV, fixed, 95% CI)	–0.58 (–3.29 to 2.13)
General anaesthesia	1	100	MD (IV, fixed, 95% CI)	–0.58 (–3.29 to 2.13)
Regional anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Numerical pain score at 24 hours	1	97	MD (IV, fixed, 95% CI)	0.19 (–0.67 to 1.05)
General anaesthesia	1	97	MD (IV, fixed, 95% CI)	0.19 (–0.67 to 1.05)
Regional anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Total pethidine consumed 24 hours after delivery	1	97	MD (IV, fixed, 95% CI)	–44.00 (–108.31 to 20.31)
General anaesthesia	1	97	MD (IV, fixed, 95% CI)	–44.00 (–108.31 to 20.31)
Regional anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Severe pain 15 minutes after delivery	1	100	RR (M-H, fixed, 95% CI)	0.19 (0.09 to 0.42)
General anaesthesia	1	100	RR (M-H, fixed, 95% CI)	0.19 (0.09 to 0.42)
Regional anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Severe pain 2 hours after delivery	1	98	RR (M-H, fixed, 95% CI)	0.31 (0.11 to 0.88)
General anaesthesia	1	98	RR (M-H, fixed, 95% CI)	0.31 (0.11 to 0.88)
Regional anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Severe pain 4 hours after delivery	1	98	RR (M-H, fixed, 95% CI)	0.58 (0.28 to 1.19)
General anaesthesia	1	98	RR (M-H, fixed, 95% CI)	0.58 (0.28 to 1.19)
Regional anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Severe pain (0 - 10) 8 hours after delivery	1	100	RR (M-H, fixed, 95% CI)	0.71 (0.35 to 1.45)
General anaesthesia	1	100	RR (M-H, fixed, 95% CI)	0.71 (0.35 to 1.45)
Regional anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Severe pain 16 hours after delivery	1	96	Odds ratio (OR) (M-H, fixed, 95% CI)	0.35 (0.11 to 1.11)
General anaesthesia	1	96	OR (M-H, fixed, 95% CI)	0.35 (0.11 to 1.11)
Regional anaesthesia	0	0	OR (M-H, fixed, 95% CI)	Not estimable
Severe pain 24 hours after delivery	1	97	RR (M-H, fixed, 95% CI)	0.82 (0.27 to 2.50)
General anaesthesia	1	97	RR (M-H, fixed, 95% CI)	0.82 (0.27 to 2.50)
Regional anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Number of Tramacet (375 mg paracetamol + 150 tramadol) tablets used	1	95	MD (IV, fixed, 95% CI)	–2.35 (–3.62 to –1.08)
General anaesthesia	1	95	MD (IV, fixed, 95% CI)	–2.35 (–3.62 to –1.08)
Regional anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Amount of rescue diclofenac (mg) used during hospitalisation	1	95	MD (IV, fixed, 95% CI)	–43.79 (–66.95 to –20.63)
General anaesthesia	1	95	MD (IV, fixed, 95% CI)	–43.79 (–66.95 to –20.63)
Regional anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable

Table II. Data and analyses (continued)

Wound infiltration with local anaesthetic + NSAIDs v. control				
No. of attempts to activate PCA	1	60	MD (IV, fixed, 95% CI)	–15.00 (–30.22 to 0.22)
General anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Regional anaesthesia	1	60	MD (IV, fixed, 95% CI)	–15.00 (–30.22 to 0.22)
Total morphine (mg) used in the first 18 hours	1	60	MD (IV, fixed, 95% CI)	–7.40 (–9.58 to –5.22)
General anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Regional anaesthesia	1	60	MD (IV, fixed, 95% CI)	–7.40 (–9.58 to –5.22)
Need for anti-emetic	1	60	RR (M-H, fixed, 95% CI)	0.38 (0.17 to 0.83)
General anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Regional anaesthesia	1	60	RR (M-H, fixed, 95% CI)	0.38 (0.17 to 0.83)
Patient satisfaction good/excellent	1	60	RR (M-H, fixed, 95% CI)	1.26 (1.02 to 1.55)
General anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Regional anaesthesia	1	60	RR (M-H, fixed, 95% CI)	1.26 (1.02 to 1.55)
Nausea	1	40	RR (M-H, fixed, 95% CI)	1.40 (0.90 to 2.16)
General anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Regional anaesthesia	1	40	RR (M-H, fixed, 95% CI)	1.40 (0.90 to 2.16)
Pruritus	1	40	RR (M-H, fixed, 95% CI)	1.81 (1.01 to 3.23)
General anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Regional anaesthesia	1	40	RR (M-H, fixed, 95% CI)	1.81 (1.01 to 3.23)
Abdominal nerve blocks with local anaesthetic v. placebo block or no block				
Mean visual analogue scale at 24 hours	2	83	MD (IV, fixed, 95% CI)	–1.82 (–2.74 to –0.90)
General anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Regional anaesthesia	2	83	MD (IV, fixed, 95% CI)	–1.82 (–2.74 to –0.90)
Postoperative opioid use (mg), as defined by trial authors	4	175	MD (IV, fixed, 95% CI)	–25.80 (–50.39 to –1.21)
General anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Regional anaesthesia	4	175	MD (IV, fixed, 95% CI)	–25.80 (–50.39 to –1.21)
No. of times mother breastfed in 24 hours	1	60	RR (M-H, fixed, 95% CI)	0.20 (0.02 to 1.61)
General anaesthesia	1	60	RR (M-H, fixed, 95% CI)	0.20 (0.02 to 1.61)
Regional anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable
Wound infiltration with local anaesthetic v. local anaesthetic + narcotics				
Mean visual analogue score				
at 2 hours	1	50	MD (IV, fixed, 95% CI)	0.69 (–0.08 to 1.46)
General anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Regional anaesthesia	1	50	MD (IV, fixed, 95% CI)	0.69 (–0.08 to 1.46)
Mean visual analogue score at 12 hours	1	50	MD (IV, fixed, 95% CI)	0.18 (–0.59 to 0.95)
Regional anaesthesia	1	50	MD (IV, fixed, 95% CI)	0.18 (–0.59 to 0.95)
General anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Mean visual analogue score at 24 hours	1	50	MD (IV, fixed, 95% CI)	–0.15 (–0.92 to 0.62)
General anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Regional anaesthesia	1	50	MD (IV, fixed, 95% CI)	–0.15 (–0.92 to 0.62)
Wound infiltration with local anaesthetic v. local anaesthetic + ketamine				
Total morphine consumed in the first 6 hours	1	50	MD (IV, fixed, 95% CI)	0.10 (–2.74 to 2.94)
General anaesthesia	0	0	MD (IV, fixed, 95% CI)	Not estimable
Regional anaesthesia	1	50	MD (IV, fixed, 95% CI)	0.10 (–2.74 to 2.94)
Patient satisfaction good/excellent	1	50	RR (M-H, fixed, 95% CI)	1.20 (0.42 to 3.43)
General anaesthesia	1	50	RR (M-H, fixed, 95% CI)	1.20 (0.42 to 3.43)
Regional anaesthesia	0	0	RR (M-H, fixed, 95% CI)	Not estimable

PCA = patient-controlled analgesia; IV = inverse variance, used when analysis model is random effect; M-H = Mantel-Haenszel statistical method, used when analysis model is fixed effect.

process. Significant results must be regarded with caution because of testing at multiple times, and the results are mostly based on single trials involving few women. None of the trials addressed chronic pelvic pain or cost implications.

Conclusions

In general, we conclude that local anaesthesia is of benefit in women having a CS because it reduces opioid consumption. It can be recommended as part of the multimodal approach to pain relief, but in terms of affordability a cost-benefit analysis is needed as theatre time will be increased and there is a cost attached to the local anaesthetic and accessories. This cost increase may be offset by less use of postoperative analgesia. A pharmacokinetic study of local anaesthetic absorption after wound and peritoneal infiltration is necessary. Ultrasound-guided direct block of the anterior abdominal wall nerves in CS should be explored. An important field of investigation will also be the effect of the intervention on chronic pelvic pain.

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