# Abdominal blockage of iliohypogastric and ilio-inguinal nerves for management of post-caesarean pain: A novel method

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**Objective.** The aim of this study was to compare pain relief after caesarean section achieved by an intra-abdominal iliohypogastric and ilio-inguinal (IHII) nerve block with levobupivacaine with that in patients given a placebo.

**Study design.** A total of 60 healthy women scheduled for caesarean delivery under general anaesthesia were enrolled in the study. The patients were randomised to an abdominal IHII nerve block with levobupivacaine (levobupivacaine group) or administration of saline (placebo group). Instead of the classic percutaneous method, the block was administered intra-operatively from the peritoneal aspect. Scores on a visual analogue scale (VAS) at 2, 6, 12 and 24 hours, adverse effects, morphine consumption and success of blockage by a pinprick test were recorded.

**Results.** In the levobupivacaine group, the pinprick test showed there to be successful bilateral block in 22 patients and unilateral block in 5, while the block failed in 3. No block was recorded in the placebo group. When morphine consumption at 12 and 24 hours were compared, consumption was found to be significantly low for both time points in the levobupivacaine group. VAS scores 2, 6 and 12 hours after the operation were also significantly lower in the levobupivacaine group.

**Conclusion.** A block of the IHII nerves from inside the abdomen just before abdominal closure appears to be an effective and safe way of relieving pain after caesarean section.

The number of deliveries by caesarean section (CS) is increasing worldwide. One of the major post-procedural problems is pain. Effective analgesia following caesarean delivery is important in terms of making the mother comfortable, increasing her mobility, which reduces her risk of deep-vein thrombosis, and aiding in her ability to care for her baby.[1]

Somatic pain after a Pfannenstiel incision corresponds to the L1 - L2 dermatomes and is transmitted by the iliohypogastric and ilio-inguinal (IHII) nerves.[2] However, visceral pain cannot be relieved by blockage of these nerves, and additional analgesia is needed. The most commonly used and effective way of relieving pain is opiate use, but opiates are of concern because of addiction potential and adverse effects such as nausea, vomiting, constipation, sedation and respiratory depression. The main analgesic strategy is to minimise the opiate dose in order to reduce or to eliminate these adverse effects.[3-5] Additional local anaesthetics such as levobupivacaine may be helpful.[4,5]

IIHI nerve blockage has previously been used in trials of ways to relieve post-CS pain, but findings have been inconsistent, possibly due to methodological differences.[6-9] The aim of this study was to compare pain relief achieved by intra-abdominal IHII nerve blockage with levobupivacaine with that in patients given a placebo.

## Materials and methods

The randomised, controlled, double-blind study was approved by the local Ethics Committee for Human Research (date 30 November 2010, No. 10/11). The subjects were 60 pregnant women aged 18 - 40 years, with American Society of Anesthesiologists (ASA) I - II risk classification, undergoing CS between December 2010 and February 2011. Exclusion criteria were any of the following: pre-eclampsia, eclampsia, a history of substance abuse, allergy to any local anaesthetics, progressive neurological disease, coagulation disorder, unregulated hypertension or diabetes mellitus, inability to use a patient-controlled analgesia (PCA) (GemStarR, Abbott Hospira, USA) device, a history of CS with non-standard techniques, unwillingness to participate, or infection at the site of the IHII nerve block.

During a visit before surgery, the patients were told about the study, including information on the visual analogue scale (VAS) and use of the PCA device; verbal and written consent was then obtained from all participants. They were divided into two groups ($N$=30 in each), placebo and levobupivacaine, by simple randomisation. Patients were not informed about their groups. No premedication was used in any patient. In the operating room, electrocardiography and non-invasive blood pressure monitoring were performed and peripheral oxygen saturation ($SaO_2$) measured. In all patients anaesthesia was induced and maintained using the same standard technique.

CS was performed using a standard Pfannenstiel incision and transverse incision of the inferior uterine segment. A standardised IHII nerve block was performed before abdominal closure.

### Iliohypogastric and ilio-inguinal nerve block

A standardised method for performing the IHII nerve block was used. The anterior superior iliac spine (ASIS) was palpated within the abdomen and a 25-gauge Whitacre needle (B Braun Melsungen AG, Germany) was inserted at a point 4 - 5 cm medial to the ASIS by the peritoneum (Fig. 1). The blunt tip of the Whitacre needle allows identification of the muscle fascia and serves to push away the untethered peripheral nerves in the loose connective tissue between the muscle layers. The needle was advanced until loss of resistance was noted upon piercing the fascia of the internal oblique muscle. The needle was directed and advanced to the ASIS, and after a negative aspiration test 3 ml of 0.5% levobupivacaine was infiltrated into the internal oblique muscle layers. The needle was then returned to the peritoneum, and using the same loss of resistance technique, directed and advanced 5 cm posterocranial to the ASIS; again after a negative aspiration test, another 3 - 4 ml of anaesthetic solution was infiltrated into the area between the internal oblique and transverse abdominal muscles. The needle was then returned to the peritoneum and directed superiorly and then inferiorly at angles of 15 - 20° degrees on the same horizontal plane, and another 3 - 4 ml of anaesthetic solution was infiltrated into each side after a negative aspiration test. The quadrangular area in Fig. 2, especially the area marked in red, was blocked at the internal oblique and transverse plane by infiltration from the peritoneal side. The same infiltration procedure was repeated on the contralateral side. In total, 30 ml of local anaesthetic solution was injected. In all patients the intra-abdominal bilateral IHII nerve block was performed in a sterile fashion by the same surgeon under the supervision of an anaesthesiologist.

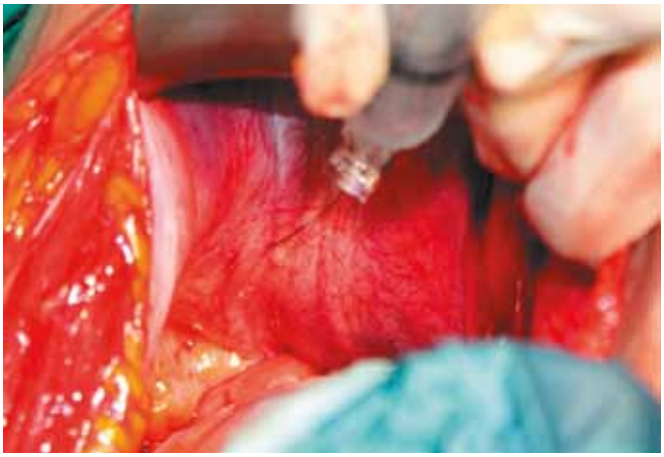

*Fig. 1. Administration of an IHII block using a peritoneal approach.*

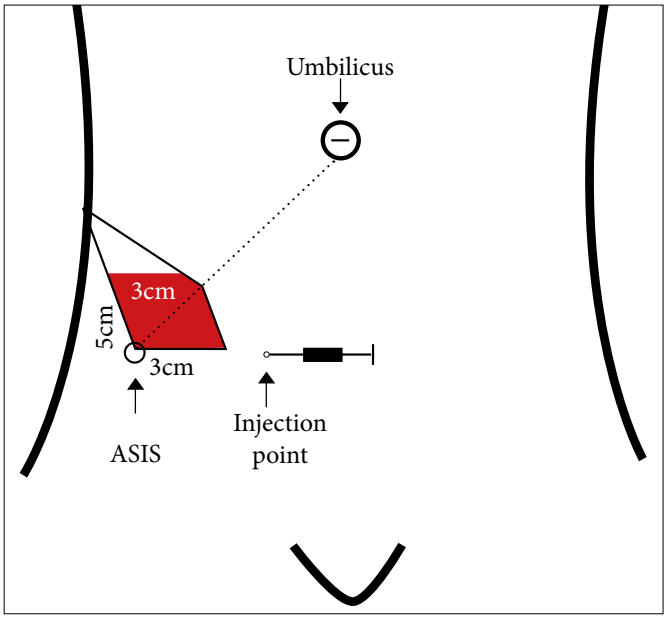


*Fig. 2. Schematic view of the site of injection and of the area blocked (red).*

### Postoperative monitoring

All patients received a PCA device upon arrival in the recovery room and were given a loading dose of intravenous morphine, 0.1 mg/kg, by PCA for initiation. The PCA device was set for a 1 mg bolus dose with a 10-minute lock-up interval. Presence and adequacy of the IHII block were blindly assessed by the pinprick test in the recovery room, after the patient had completely gained consciousness. VAS scores were recorded by the patients on a blank line measuring 100 mm, satisfaction scores were recorded (1 = dissatisfaction, 2 = moderate dissatisfaction, 3 = satisfaction and 4 = complete satisfaction), and adverse effects (nausea, vomiting, itching) were noted at the 2nd, 6th, 12th and 24th postoperative hours. In all patients PCA was terminated at the end of the 24th postoperative hour. Morphine consumption at 12 and 24 hours was noted. These observations were carried out by a single anaesthesiologist, who was blinded to the patients' groups.

It was planned to administer 75 mg intramuscular diclofenac sodium to patients who had a VAS score of ≥5 during the first 12

postoperative hours and 500 mg oral paracetamol to those who had VAS score of ≥5 after 12 hours, and these drugs were used when indicated.

## Statistical analysis

Morphine consumption at 24 hours was the primary end-point for statistical analysis. A power analysis based on a previous study,[6] in which the mean amount of postoperative morphine consumption was found to be 67 mg (standard deviation (SD) 28 mg) with a placebo block and 48 mg (SD 27 mg) with an IHII block, showed that two groups of 29 patients each would be required to demonstrate a 25% difference in postoperative morphine consumption with α=0.01, β=0.20. Data were presented as mean (SD). The age, height, weight, gravidity and parity of the patients, the duration of the operations, VAS scores and morphine consumption were analysed using a *t*-test (all were distributed normally as tested by the Kolmogorov-Smirnov (K-S) test), while the chi-square test was used for the analysis of nausea, vomiting, itching, additional analgesic requirement and satisfaction. A *p*-value of less than 0.05 was considered significant.

# Results

The study was brought to an end after 30 patients in each group had been treated. No patient was excluded from the study in either group. There was no significant difference between the groups with regard to demographic data, duration of the surgery, gravidity or parity (Table I). The age range of the patients was 18 - 46 years. Indications for surgery were as follows: repeat CS, cephalopelvic disproportion, breech presentation in a primipara, fetal distress, placenta praevia and previous uterine surgery. Indications were similar in the two groups.

When blockage was assessed by the pinprick test in the levobupivacaine group, it was found to be successful in 25 patients (83.3%) on the right side and in 24 patients (80.0%) on the left. Blockage was successful bilaterally in 22 patients (73.3%) and failed bilaterally in 3 (10%). Blockage was successful on one side in the remaining 5 patients (16.7%). In the placebo group, no block was recorded.

Morphine consumption at 12 and 24 hours was found to be significantly lower in the levobupivacaine group than in the placebo group at both time points ($p<0.05$ for both) (Table II).

VAS scores at the 2nd, 6th and 12th postoperative hours were found to be significantly lower in the levobupivacaine group ($p<0.05$). There was no significant difference in VAS scores at the 24th postoperative hour ($p>0.05$) (Fig. 3).

When postoperative adverse effects and patient satisfaction were assessed, nausea was present in 5 patients (16.7%), vomiting in 1 (3.3%) and itching in 1 (3.3%) in the levobupivacaine group, while in the placebo group 12 patients (40%) experienced nausea, 2 (6.7%) vomiting and 3 (10%) itching. There was no significant difference between the groups with regard to itching or vomiting; the incidence of nausea was significantly lower in the levobupivacaine group, but the difference was slight ($p=0.045$). Of the patients in the levobupivacaine group, 5 (16.7%) expressed moderate dissatisfaction, 17 (56.7%) satisfaction and 8 (26.7%) complete satisfaction. In the placebo group, 7 (23.3%) expressed moderate dissatisfaction, 17 patients (56.7%) satisfaction and 6 (20.0%) complete satisfaction. No patient in either group was dissatisfied, and no significant difference was found in terms of satisfaction.

**Table I. Demographic data (mean (SD))**

| | Levobupivacaine (*N*=30) | Placebo (*N*=30) |
|---|---|---|
| Age (yrs) | 28.1 (6.8) | 28.4 (4.9) |
| Height (cm) | 160.2 (5.6) | 159.7 (7.5) |
| Weight (kg) | 74.2 (13.3) | 75.6 (17.9) |
| Duration of operation (min) | 38.7 (7.9) | 35.8 (9.2) |
| Gravidity | 2.6 (1.4) | 2.6 (1.1) |
| Parity | 1.3 (1.1) | 1.2 (0.8) |

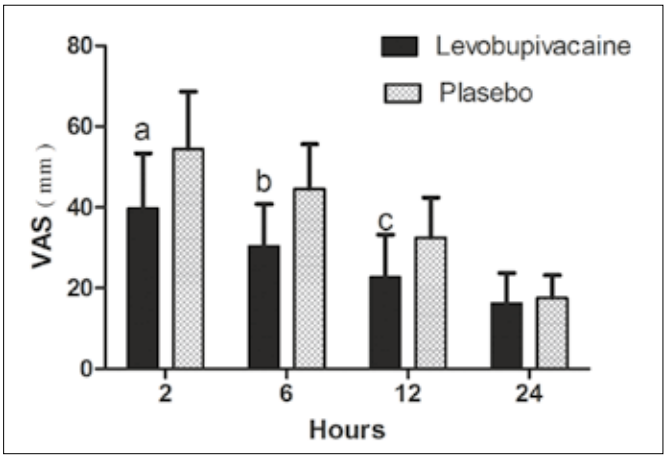


*Fig. 3. VAS scores of the study groups (a, b, c = p<0.05 v. placebo group).*

**Table II. Postoperative data**

| | Levobupivacaine (*N*=30) | Placebo (*N*=30) |
|---|---|---|
| Morphine consumption, 12 hours (mg) (mean (SD)) | 26.70 (6.4)[a] | 34.10 (8.9) |
| Morphine consumption, 24 hours (mg) (mean (SD)) | 34.36 (8.1)[b] | 52.23 (11.5) |
| Nausea (+/-) | 5/25[c] | 12/18 |
| Vomiting (+/-) | 1/29 | 2/28 |
| Itching (+/-) | 1/29 | 3/27 |
| Diclofenac during first 12 hours (+/-) | 6/24[d] | 15/15 |
| Paracetamol after 12 hours (+/-) | 2/28 | 3/27 |

a, b, c, d = $p<0.05$, when groups were compared.

The need for additional analgesic (diclofenac sodium) at the 6th postoperative hour was significantly lower in the levobupivacaine group than in the placebo group ($p<0.05$), but there was no significant difference between the groups at the 12th hour (need for paracetamol) (Table II).

## Discussion

The findings of this study show that intra-abdominal IHII nerve blockage with levobupivacaine during CS is a safe and effective way of reducing postoperative pain and analgesic drug requirement. The VAS score and morphine consumption at the 12th postoperative hour in the levobupivacaine group were significantly lower than in the placebo group.

Percutaneous IHII nerve blockage has been used previously for postoperative pain management after CS.[7,8] We did an IHII nerve block from inside the abdominal wall instead of percutaneously. We believe that the intra-abdominal approach has some advantages: it is easy to access between the internal oblique and transverse muscles; as the nerves run a parallel course on the coronal plane between these muscle, the likelihood of a successful block increases because of infiltrative local injection at a perpendicular plane to the abovementioned course; and complications reported with percutaneous methods, such as colon perforation[10] or pelvic haematoma,[11] should not occur with the intra-abdominal approach. To our knowledge this is the first study to explore the efficacy of an IHII block after CS using levobupivacaine administered intra-abdominally.

Failure rates of up to 50% reported in a previous study using the classic percutaneous method medial to the ASIS[9] prompted the investigators to explore various methods involving different injection points and doses or ultrasound-guided injection. Bell *et al.* recommended a new technique including multi-level injections for IHII blockage, reporting a success rate of up to 95%.[6] In a study investigating benefits and limitations of multi-level IHII nerve blockage in the control of post-CS pain, Bell *et al.* suggested that two variables had hindered complete assessment of the technique in the previous studies: (*i*) blockage method; and (*ii*) follow-up after intervention.[6] It is evident that there are some difficulties in blocking the II and IH nerves.

A study evaluating the efficacy of a block at the transversus abdominis plane (TAP)[12] reported that the risk of puncturing the peritoneum, which applies to all blind techniques, was a limitation of the procedure.[12] A further study evaluated an ultrasound-guided block at the TAP.[13] Eichenberger *et al.* marked the II and IH nerves with ultrasound guidance in cadavers, achieving a success rate of 95%, and proposed a new injection point 5 cm cranial and posterior to the ASIS for ultrasound-guided or blind percutaneous blockage of these nerves. However, they noted that as the study was conducted on cadavers with low body mass indices (BMI), there is doubt whether the findings can be extrapolated to the general population.[14]

In the classic IHII nerve block the target point for the block is 2 - 2.5 cm medial and superior to the ASIS. Currently it seems possible to block these nerves with ultrasound guidance. However, we suggest that difficulties in IHII nerve block in a pregnant patient raise certain questions, two of which are whether weight gain in pregnancy complicates the visualisation of these nerves by ultrasonography, and whether the target points for the procedure are displaced in term pregnancy. Huffnagle *et al.*[9] found it moderately difficult to place II nerve blocks in patients before CS because the gravid uterus markedly distorts the anatomy in the area of the block. Willschke *et al.*[15] showed a change in the depth of the II nerve in association with body weight in children. In a preliminary evaluation, working with a radiologist, we were unable to visualise the IHII nerves in pregnant women by ultrasonography. Intra-operative ultrasonography is associated with additional problems. We therefore decided to use the blinded method in the study, as it is safe and easy.

The above considerations raise the question of how likely these two nerves are to run together on the same plane. In considering investigations[7,12-15] of this issue, we concluded that these nerves run together on the same plane in a quadrangular area, which is limited by lines linking the following points: points at the ASIS, at 3 cm medial to the ASIS and at 5 cm cranial and posterior to the ASIS, and the point located on the third centimeter of the line plotted from the ASIS to the umbilicus (Fig. 2). While these nerves have a greater probability of being in the internal oblique muscle at the caudal part of this quadrangle, they run between the transverse abdominal and internal oblique muscles at the cranial part. We therefore recommend our technique, as we consider that blinded blockage on the internal oblique and transverse abdominal muscle plane by infiltration using a needle inserted from 4 - 5 cm medial to the ASIS in this quadrangular area will be most effective. As the paths of these nerves may be shifted in a medial direction during term pregnancy, we recommend performing the blockage more medially. On this plane, we recommend targeting the internal oblique muscle at the caudal part of the quadrangle, while the space between the internal oblique and transverse muscle at the cranial part is the target area.

It is obvious that an IHII block will not relieve visceral pain after CS. In addition, reduction in postoperative pain scores is a matter of debate in the studies[6,9] evaluating IHII blockage in CS under spinal anaesthesia. When two studies were assessed, it was evident that both emphasised difficulties with the IHII technique in pregnant patients.[6,9] We also saw that Huffnagle *et al.* noted that differences in the postoperative pain scores should be due to the duration of action of the local anaesthetic and the effect of spinal anaesthesia in reducing postoperative pain.[9] Our postoperative pain scores were similar to those measured by Bell *et al.*,[6] and this may be explained by similar methods employed in doing the nerve block. Our success rate was 73%, while Bell *et al.* achieved a success rate of 95% using a multi-level blockage technique. On the other hand, our results are inconsistent with those of Huffnagle *et al.*,[9] and this may be due to factors such as method of doing the block, amount of local anaesthetic, experience of the operator, and CS under spinal anaesthesia. In addition, Bunting and McConachie[8] studied the analgesic effects of an II nerve block with 10 ml bupivacaine in women undergoing a caesarean delivery under general anaesthesia. Our results are in agreement with the results of that study in terms of pain scores and analgesic consumption; however, method of doing the block and amount and type of local anaesthetic differ. This could explain the difference in the pain score at the 12th postoperative hour in our study, as we performed

the block before abdominal closure by using 15 ml levobupivacaine, which seems to have the advantage of prolonging analgesia, as well as being performed after delivery of the baby. Our results in terms of reduction in postoperative pain scores, morphine consumption and additional analgesic requirement are in agreement with other studies investigating IHII blockage in patients undergoing CS under general anaesthesia.[16,17]

We therefore propose that intra-abdominal IHII blockage just before closure of the abdomen for relieving pain after CS is an effective and safe method without adverse effects.

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