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Comparison of transversus abdominis plane block *vs* spinal morphine for pain relief after Caesarean section

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Editor's key points

- Transversus abdominis plane (TAP) blocks are increasingly used for analgesia after abdominal surgery.
- This study assessed whether TAP blocks provide additional analgesia to spinal morphine after Caesarean section.
- Pain scores and analgesia requirements were lowest in those receiving spinal morphine 100 μg.
- Bilateral TAP blocks using bupivacaine 2 mg kg^{-1} had no extra analgesic effects.

Background. Transversus abdominis plane (TAP) block is an alternative to spinal morphine for analgesia after Caesarean section but there are few data on its comparative efficacy. We compared the analgesic efficacy of the TAP block with and without spinal morphine after Caesarean section in a prospective, randomized, double-blinded placebo-controlled trial.

Methods. Eighty patients were randomized to one of four groups to receive (in addition to spinal anaesthesia) either spinal morphine 100 μg (S_M) or saline (S_S) and a postoperative bilateral TAP block with either bupivacaine (T_{LA}) 2 mg kg^{-1} or saline (T_S).

Results. Pain on movement and early morphine consumption were lowest in groups receiving spinal morphine and was not improved by TAP block. The rank order of median pain scores on movement at 6 h was: S_MT_{LA} (20 mm)<S_MT_S (27.5 mm)<S_ST_S (51.5 mm)<S_ST_{LA} (52.0 mm) ($P<0.05$, highest *vs* lowest). The rank order of median morphine consumption at 6 h was: S_MT_S (4.0 mg)<S_MT_{LA} (5.0 mg)<S_ST_{LA} (8.0 mg)<S_ST_S (12.0 mg) and at 24 h was: S_MT_{LA} (5.0 mg)<S_MT_S (6.0 mg)<S_ST_S (9.5 mg)<S_ST_{LA} (15.0 mg) ($P<0.05$, highest *vs* lowest). Sedation scores and patient satisfaction did not differ between groups. Anti-emetic use and pruritus were highest in the S_MT_{LA} group.

Conclusions. Spinal morphine—but not TAP block—improved analgesia after Caesarean section. The addition of TAP block with bupivacaine 2 mg kg^{-1} to spinal morphine did not further improve analgesia.

Keywords: anaesthesia, spinal; anaesthesia regional; bupivacaine; Caesarean section; morphine; nerve block; pain, postoperative

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Caesarean section is one of the most commonly performed surgical procedures. It is estimated that 15% of births worldwide and 21.1% of those in the developed world occur by Caesarean section.[1] Caesarean rates of up to 31.9% have been reported in the UK in 2008[2] and over 1 million are thought to be carried out annually in the USA alone.[3] The optimum form of postoperative analgesia is not known, but many procedures are carried out under spinal anaesthesia and patients typically receive spinal, systemic, or both opioids as components of multimodal analgesia in the postoperative period. However, opioids, whether given via the spinal or systemic route, are frequently associated with adverse effects such as nausea, pruritus, sedation, and occasionally respiratory depression.[4] It has been recommended recently that patients should be monitored extensively to detect respiratory depression[5] after receiving hydrophilic opioids via the spinal route. Thus, knowledge about alternative (non-opioid) analgesia is important.

The transversus abdominis plane (TAP) block is a regional analgesic technique which blocks T6–L1 nerve branches and has an evolving role in postoperative analgesia for lower abdominal surgeries.[6–8] It is a simple and safe technique and is a potential alterative to spinal opioid for analgesia after Caesarean section, whether guided by traditional anatomic landmarks or by ultrasound.[9–12] It has been shown to be effective in Caesarean section and after hysterectomy, open prostatectomy, laparoscopic cholecystectomy, and appendicectomy.[13–16] However, there are few studies comparing TAP block with spinal opioids or with epidural analgesia.[17] If superior to spinal opioids, TAP block would have the advantage of improved analgesia, a reduction in opioid-associated adverse effects, and the absence of motor blockade. Furthermore, local anaesthetic-based techniques may provide comparable resting analgesia but superior analgesia on movement compared with systemic opioids and may be synergistic with neuraxial opioids.

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Therefore, we performed a prospective study to compare the relative analgesic efficacy of TAP block with local anaesthetic to spinal morphine after Caesarean section. Our aims were (i) to determine the analgesic efficacy of TAP block, (ii) to compare TAP block to spinal morphine, and (iii) to determine whether a TAP block, when administered in addition to spinal morphine, provided any incremental benefit. We hypothesized that a TAP block with local anaesthetic would result in less pain on movement than spinal morphine at 6 h after operation.

Methods

After approval by the hospital ethics committee, the Irish Medicine Board, and written informed consent, we studied 80 ASA physical status I–III subjects undergoing elective Caesarean delivery, in a prospective double-blind placebo-controlled clinical trial. Patients were excluded if there was a history of relevant drug allergy, tolerance to opiates, BMI>35 kg m^{-2} at initial hospital visit, pre-eclampsia, or contraindication to neuraxial anaesthesia.

Patients received a standard spinal anaesthetic comprising hyperbaric bupivacaine 11–12.5 mg with fentanyl 10 μg and were randomized using sealed envelopes to one of four groups (n=20 in each group) to a combination of spinal morphine (S_M) or saline (S_S) with TAP block containing local anaesthetic (T_{LA}) or saline (T_S), as follows: S_MT_S, S_MT_{LA}, S_ST_{LA}, or S_ST_S.

Patients also received preservative-free spinal morphine 100 μg (SNS Pharmaceuticals, London) or an equivalent volume (0.l ml) of saline, co-administered with the spinal anaesthetic. Bilateral TAP blockade was performed with bupivacaine 2 mg kg^{-2} (based on weight at first presentation to hospital), equivalent volume of 0.9% saline, or both (Table 1).

The volume of 0.375% bupivacaine to be injected on each side to provide a total dose of 2 mg kg^{-1} solution was calculated by the following formula:

$$\text{Volume per syringe (ml)} = \frac{\text{weight (kg)}}{3.75}$$

The group allocation information was given in a sealed envelope to the pharmacist who delivered the study drugs to the operating theatre in a sealed package labelled with the subject name and number. All staff providing direct care and the subjects were blinded to the group assignment.

All subjects received standard monitoring including electrocardiogram, non-invasive arterial pressure, and arterial oxygen saturation. All subjects received rectal paracetamol 1 g and diclofenac 100 mg immediately after operation. Each patient received bilateral TAP blocks in the operating theatre immediately after completion of surgery by one of two investigators (R.C.N.McM. and J.P.R.L.). The bilateral TAP blocks were performed with an 18 G Tuohy needle (80 mm Smiths Medical Portex®; BS6196) using the mid-axillary landmark technique as described by McDonnell and colleagues.[11]

All patients were prescribed a standard postoperative analgesic regime of regular oral paracetamol 1 g 6 hourly, rectal diclofenac 100 mg 18 hourly and morphine via patient-controlled analgesia (PCA): 1 mg bolus with a 5 min lockout through a dedicated i.v. line. Prochlorperazine 12.5 mg i.m. was prescribed for nausea or vomiting as required.

The primary outcome was pain on movement, defined as elevation of the head and shoulders from the pillow, in the supine position. Secondary outcomes were pain at rest, morphine consumption, the proportion of patients who achieved adequate analgesia,[18] satisfaction, sedation, nausea, and pruritus. Patients were assessed at 6, 12, 24, 36, and 48 h after TAP block. At the 6, 24, and 48 h reviews, subjects were assessed for pain, satisfaction, nausea, sedation, pruritus, and morphine use. At each of the three assessments, patients were asked to record their average pain at rest and on moving over the previous 6, 18, and 24 h, respectively, covering the period between assessments on an ungraduated 100 mm visual analogue scale with 'none' and 'worst imaginable' at the extremes. They were then asked to rate their overall satisfaction with the quality of their postoperative pain relief over the same time period on a centre marked but otherwise ungraduated 100 mm visual analogue scale with 'extremely dissatisfied' and 'extremely satisfied' at the extremes; the centre mark was labelled 'neither'. Patients' nausea and pruritus was rated using a categorical scale (0, none; 1, mild; 2, moderate; and 3, severe). A sedation score was assigned by the assessor using a sedation scale (1, awake and alert; 2, slightly drowsy, easily roused; 3, drowsy, drifts off to sleep during conversation; and 4, somnolent, minimal, or no response to physical stimulation). Requirement for anti-emetics was also noted.

Using data from a previous audit of morphine use after Caesarean delivery in our hospital, we determined that a study with 16 subjects in each of four arms would have a 90% power to detect a mean reduction in pain score (scale 0–100 mm) of 40 mm with an SD of 29 mm. To allow for drop outs, we recruited an additional four patients per group.

Statistical analyses were performed using Sigma Stat (Version 2.0; Jandel Corporation, San Rafael, CA, USA). Normally distributed data were analysed by one-way analysis of variance. Categorical data were analysed using the χ^2 or Fisher's exact test. Non-parametric data were compared with ANOVA on ranks. Planned intergroup comparisons were made with the Student–Newman–Keuls or the Dunn method. Normally distributed data are presented as mean (SD). Data which did not fit a normal distribution are presented as median [inter-quartile range (IQR)]. The α level for analyses was set as $P \leq 0.05$. Correction for multiple comparisons was made using the Bonferroni method where appropriate.

Table 1 Group allocation and treatment. S_M, spinal morphine; S_S, spinal saline; T_S, transversus abdominis plane block with saline; T_{LA}, transversus abdominis plane block with local anaesthetic

Group	Spinal	TAP	*n*
S_MT_S	Morphine 100 μg	Saline	20
S_MT_{LA}	Morphine 100 μg	Bupivacaine 2 mg kg^{-1}	20
S_ST_{LA}	Saline	Bupivacaine 2 mg kg^{-1}	20
S_ST_S (control)	Saline	Saline	20

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