

Ultrasound-Guided Transversus Abdominis Plane Block versus Ilioinguinal/Iliohypogastric Nerve Block for Postoperative Analgesia in Open Inguinal Hernia Repair: An Observational Study

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Abstract

Background

Open inguinal hernia repair is commonly associated with moderate-to-severe postoperative pain. Ultrasound-guided regional techniques such as the transversus abdominis plane (TAP) block and the ilioinguinal/iliohypogastric (II/IH) nerve block are used as adjuncts to systemic analgesia, but comparative evidence on their relative efficacy remains mixed.

Objective

To compare the postoperative analgesic efficacy of ultrasound-guided TAP block with ultrasound-guided II/IH nerve block in patients undergoing open inguinal hernia repair.

Methods

In this observational study, 66 patients undergoing open inguinal hernia repair under spinal anaesthesia were assigned by convenience sampling to receive either a TAP block (n=33) or an II/IH nerve block (n=33), each performed under ultrasound guidance with 20 mL of 0.5% ropivacaine. Postoperative pain was assessed using the visual analogue scale (VAS) at 4, 8, 12 and 24 hours, and the requirement for rescue analgesia (intravenous tramadol 50 mg, given for VAS >6) was recorded.

Results

Mean VAS scores were significantly lower in the TAP block group than in the II/IH group at 4 hours (1.94 ± 0.35 vs 2.48 ± 1.23 , $p=0.017$) and at 8 hours (2.30 ± 0.73 vs 4.13 ± 1.96 , $p=0.0001$). No significant between-group difference was seen at 12 hours (3.94 ± 1.77 vs 4.74 ± 1.58 , $p=0.072$) or 24 hours (4.22 ± 1.16 vs 4.64 ± 1.14 , $p=0.215$). Rescue analgesia was required by 4 patients in the TAP group versus 10 in the II/IH group, a difference that did not reach statistical significance ($p=0.071$).

Conclusion

Ultrasound-guided TAP block provided superior early postoperative analgesia (up to 8 hours) compared with II/IH nerve block in open inguinal hernia repair, with no significant difference between the two techniques thereafter. TAP block may be preferred where reduction of early postoperative pain and opioid-sparing effect are prioritized.

Keywords

Transversus abdominis plane block; ilioinguinal/iliohypogastric nerve block; open inguinal hernia repair; postoperative analgesia; ultrasound-guided regional anaesthesia; ropivacaine.

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Introduction

Inguinal hernia repair is among the most frequently performed surgical procedures and open repair is commonly associated with moderate-to-severe postoperative pain^{1,2}. Unrelieved acute pain triggers a neuroendocrine stress response with release of catabolic and immunosuppressive hormones and sympathetic activation, and may predispose to chronic persistent postsurgical pain. Traditional systemic analgesics — opioids, paracetamol and non-steroidal anti-inflammatory drugs — provide adequate analgesia but their side-effect profile limits use, particularly in older adults and those with comorbidities.

The anterolateral abdominal wall relevant to inguinal hernia surgery is innervated predominantly by the T12–L1 thoracolumbar nerve roots, which travel in the plane between the internal oblique and transversus abdominis muscles before reaching the skin and deeper structures^{3,4}. Local anaesthetic deposition in this plane, or selective blockade of the ilioinguinal and iliohypogastric nerves as they emerge near the anterior superior iliac spine, both provide effective regional analgesia with a favourable systemic side-effect profile. Ultrasound guidance allows direct visualization of the relevant fascial planes and nerves, improving block success and reducing complications compared with landmark-based techniques⁵.

The TAP block, first described by Rafi as a landmark technique performed through the triangle of Petit⁶, has since been adapted to ultrasound guidance and used for postoperative analgesia in a range of abdominal and inguinal procedures. The II/IH nerve block, similarly amenable to ultrasound guidance, targets the same T12–L1 dermatomal distribution more selectively at the level of the nerves themselves. Existing comparative studies of the two techniques in inguinal hernia surgery have produced inconsistent results, with some favouring TAP block, some favouring II/IH block, and others showing no difference. This study was undertaken to compare the postoperative analgesic efficacy of ultrasound-guided TAP block with ultrasound-guided II/IH nerve block in patients undergoing open inguinal hernia repair.

Aim and Objective

To compare the postoperative analgesic efficacy of ultrasound-guided transversus abdominis plane block with ultrasound-guided ilioinguinal/iliohypogastric nerve block in patients undergoing open inguinal hernia repair.

Methods

Study design and setting

This was a single-centre observational study conducted in the Department of Anaesthesiology, MES Medical College and Hospital, Perinthalmanna, Kerala, over a 12-month period (1 January 2021 to 31

December 2021), following approval by the Institutional Ethics Committee (IEC/MES/18/2019) and written informed consent from all participants.

Participants

Patients aged 18–70 years, of American Society of Anesthesiologists (ASA) physical status I or II, undergoing open inguinal hernia repair under spinal anaesthesia were eligible. Patients were excluded if they were unable to give consent, had a body mass index >40 kg/m², had skin infection at the injection site, had significant neuromuscular, cardiac, renal or hepatic disease, had a coagulopathy, or were hypersensitive to local anaesthetics.

Sample size

Sample size was calculated from a previously reported proportion of rescue analgesic use of 12.24% in the TAP group and 48.4% in the II/IH group⁷, using a two-independent-proportion formula with $\alpha=0.05$ and $\beta=0.20$, yielding 33 patients per group (total n=66).

Grouping and technique

Group allocation (TAP block vs II/IH nerve block) was determined by the attending consultant anaesthesiologist independent of the investigator, and patients were enrolled by convenience sampling into consecutive TAP block or II/IH nerve block groups of 33 each. After institution of subarachnoid block with hyperbaric bupivacaine 0.5% (15 mg) at the L2–L3 or L3–L4 interspace, patients underwent the assigned regional block under aseptic precautions:

Group 1 (TAP block): the ultrasound probe was placed between the lower costal margin and the iliac crest, and 20 mL of 0.5% ropivacaine was deposited in the plane between the internal oblique and transversus abdominis muscles using a 23-gauge Quincke–Babcock needle, confirmed by an elliptical hydrodissection pattern.

Group 2 (II/IH nerve block): the ultrasound probe was placed over the iliac crest and moved medially to visualize the ilioinguinal and iliohypogastric nerves between the internal oblique and transversus abdominis muscles, and 20 mL of 0.5% ropivacaine was deposited around the nerve fibres using the same needle.

Outcome assessment

Postoperative pain was assessed by an observer using the visual analogue scale (VAS, 0–10) at 4, 8, 12 and 24 hours. Rescue analgesia (intravenous tramadol 50 mg by slow infusion) was administered for VAS >6, and its use was recorded for each group.

Statistical analysis

Data were analysed using SPSS version 17.0. Continuous variables were expressed as mean $\pm$ standard deviation and compared using the independent-samples t-test; categorical variables were compared using the chi-square test (Fisher's exact test

where appropriate). A p value <0.05 was considered statistically significant.

Results

Sixty-six patients were included, 33 in each group. Baseline demographic characteristics were comparable between groups (Table 1), although the distribution of ASA physical status differed significantly between groups ($p=0.02$), with a higher proportion of ASA II patients in the TAP block group.

Table 1. Demographic, clinical and surgical characteristics

Characteristic	TAP block (n=33)	II/IH block (n=33)	p value
Age, years, mean (SD)	50.45 (9.51)	45.45 (13.83)	0.177
Sex, M/F	31 / 2	33 / 0	0.092
Weight, kg, mean (SD)	69.21 (7.42)	68.48 (6.59)	0.675
ASA class, I / II	15 / 18	24 / 9	0.020
Operative side, L / R	19 / 14	14 / 19	0.218

Postoperative analgesic efficacy

Mean VAS scores were significantly lower in the TAP block group at 4 hours (1.94 ± 0.35 vs 2.48 ± 1.23 , $p=0.017$) and at 8 hours (2.30 ± 0.73 vs 4.13 ± 1.96 , $p=0.0001$) (Table 2, Figure 1). No statistically significant difference was observed at 12 hours (3.94 ± 1.77 vs 4.74 ± 1.58 , $p=0.072$) or 24 hours (4.22 ± 1.16 vs 4.64 ± 1.14 , $p=0.215$).

Table 2. Visual analogue pain scores at 4, 8, 12 and 24 hours

Time point	TAP block, mean (SD)	II/IH block, mean (SD)	p value
4 hours	1.94 (0.35)	2.48 (1.23)	0.017
8 hours	2.30 (0.73)	4.13 (1.96)	0.0001
12 hours	3.94 (1.77)	4.74 (1.58)	0.072
24 hours	4.22 (1.16)	4.64 (1.14)	0.215

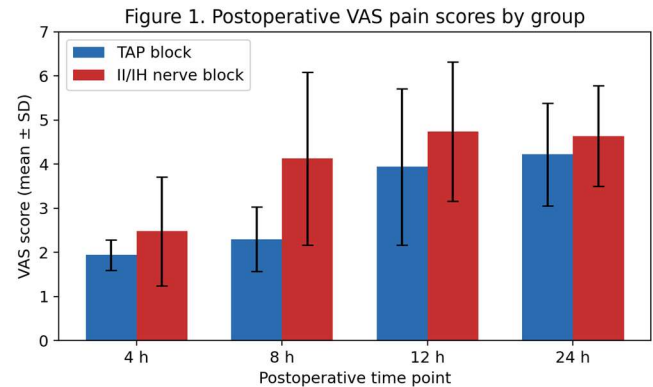


Figure 1. Postoperative VAS pain scores (mean ± SD) at 4, 8, 12 and 24 hours in the TAP block and II/IH nerve block groups.

Requirement of rescue analgesia

Rescue analgesia (intravenous tramadol) was required in 4 of 33 patients (12.1%) in the TAP block group compared with 10 of 33 patients (30.3%) in the II/IH block group; this difference did not reach statistical significance ($p=0.071$) (Table 3, Figure 2).

Table 3. Requirement of rescue analgesia

Rescue analgesia	TAP block (n=33)	II/IH block (n=33)	p value
Not required	29	23	
Required	4	10	0.071

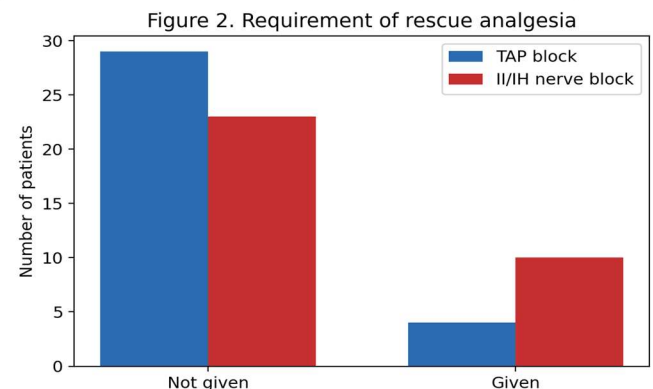


Figure 2. Number of patients requiring rescue analgesia in each group.

ASA physical status distribution

As noted above, the two groups differed significantly in ASA physical status distribution ($p=0.02$), with more ASA II patients allocated to the TAP block group (Figure 3). This imbalance, an inherent limitation of convenience sampling in an observational (non-randomized) design, is considered further in the Discussion.

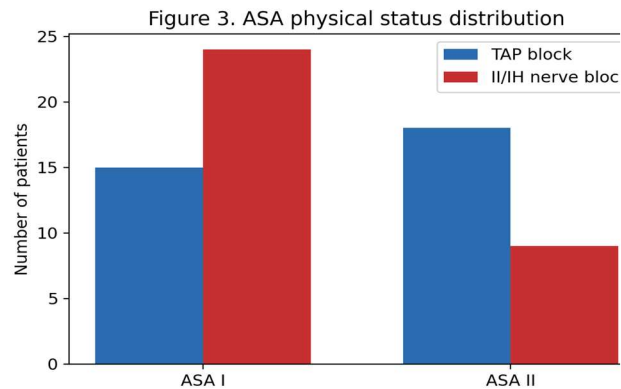


Figure 3. Distribution of ASA physical status class I and II between the two study groups.

Discussion

In this observational comparison of ultrasound-guided TAP block and II/IH nerve block for open inguinal hernia repair, TAP block was associated with significantly lower pain scores in the early postoperative period (4 and 8 hours), with no significant difference at 12 or 24 hours. This pattern is consistent with several prior comparative studies. Venkatraman et al⁸ demonstrated effective early analgesia with ultrasound-guided TAP block using 0.2% ropivacaine, and Aveline et al⁹, comparing ultrasound-guided TAP block with blind II/IH nerve block in 273 patients, similarly found lower VAS scores with TAP block at 4, 12 and 24 hours and lower postoperative morphine requirement.

Conversely, Faiz et al¹⁰ reported lower numeric rating scale scores with II/IH nerve block compared with TAP block, and Okur et al¹¹ found both techniques reduced pain scores and additional analgesic requirement relative to a control group without a clear superiority of one block over the other. Stav et al¹² and Wang et al¹³ likewise reported mixed findings depending on technique and local anaesthetic volume used. Taken together with the present findings, the comparative efficacy of TAP and II/IH blocks appears to depend on technique-specific factors such as dermatomal spread, local anaesthetic volume and concentration, and possibly on operator experience with each approach.

A plausible explanation for the early advantage of TAP block observed here is that the plane between the internal oblique and transversus abdominis muscles allows wider longitudinal spread of local anaesthetic across multiple thoracolumbar dermatomes, whereas the II/IH nerve block targets a more localized nerve distribution. The loss of statistical significance at 12 and 24 hours in both groups is consistent with the expected duration of action of a single-shot peripheral block with ropivacaine, after which systemic absorption and metabolism limit further benefit.

The requirement for rescue analgesia was numerically lower in the TAP block group (4 vs 10 patients) but did not reach statistical significance, likely reflecting the modest sample size. A larger sample may be needed to confirm whether this represents a true reduction in opioid-sparing requirement.

This study has several limitations. First, group allocation was not randomized; it was determined by the attending anaesthesiologist and patients were recruited by convenience sampling, which resulted in a significant imbalance in ASA physical status between groups (more ASA II patients in the TAP group) despite no significant difference in age, sex or weight. This raises the possibility of residual confounding, and the direction of any such bias is not straightforward to predict. Second, the sample size, while adequate for the primary comparison based on prior data, was relatively small, limiting the precision of secondary outcomes such as rescue analgesia requirement. Third, follow-up was limited to 24 hours, and longer-term outcomes such as chronic postsurgical pain were not assessed. Fourth, no continuous catheter technique or adjuvants were used, which may have limited the duration of analgesia in both groups. Future randomized controlled trials with larger samples, extended follow-up, and standardized dosing would help clarify these findings.

Conclusion

Ultrasound-guided transversus abdominis plane block provided more effective early postoperative analgesia (up to 8 hours) than ilioinguinal/iliohypogastric nerve block in patients undergoing open inguinal hernia repair, with no significant difference between the two techniques at 12 or 24 hours or in overall rescue analgesic requirement. TAP block may be a preferable adjunct where early postoperative pain control is a priority, though the observational design and baseline ASA imbalance warrant confirmation in a randomized trial.

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