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"A COMPARATIVE STUDY OF ULTRASOUND-GUIDED PRE-INCISIONAL AND POST-INCISIONAL TRANSVERSUS ABDOMINIS PLANE BLOCK"

Anaesthesiology

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ABSTRACT

Introduction: Transversus abdominis plane (TAP) block has been included as a part of multimodal analgesia post lower abdominal surgeries. The patients undergoing total abdominal hysterectomy suffer significant postoperative pain and TAP block is a described approach to providing analgesia to the anterior abdominal wall. The aim of this study was to compare the analgesic efficacy of pre-incisional and post-incisional TAP blocks in patients undergoing total abdominal hysterectomy. **Methods:** After obtaining the institutional ethical committee approval and patient consent, a total of 56 American Society of Anaesthesiologists (ASA) physical status I and II patients aged between 30 - 60 years who underwent total abdominal hysterectomy under spinal anaesthesia were enrolled for the study. The patients satisfying the inclusion criteria were either given a bilateral pre-incisional or post-incisional transversus abdominis plane block. Postoperatively, pain was assessed using Numeric Rating Scale (NRS) and the time for need of rescue analgesia was noted. **Results:** The pain scores were significantly lower ($P < 0.05$) in the pre-incisional TAP block group from the 2nd postoperative hour onwards till 14 h, and thereafter it was comparable between both the groups. The mean time to the first rescue analgesia was significantly longer in patients belonging to the pre-incisional TAP block group (P-value of 0.00). Also, the total analgesic requirement was significantly lesser in the pre-incisional TAP group (P-value 0.001). **Conclusion:** TAP blocks administered pre-incisional are more effective than post-incisional ones with better analgesia up to 14 postoperative hours after elective total abdominal hysterectomy.

KEYWORDS

Post-incisional transversus abdominis plane block; pre-incisional transversus abdominis plane block; total abdominal hysterectomy, Levobupivacaine

INTRODUCTION

Total abdominal hysterectomy is a commonly performed major gynaecological procedure that is associated with significant postoperative pain and discomfort.[1] The pain experienced after abdominal surgery is mainly derived from the anterior abdominal wall incision. Postoperative analgesia after surgery is usually provided by a multimodal pain treatment regimen consisting of systemic opioids, nonsteroidal anti-inflammatory drugs and central neuraxial blocks with or without opioids. Other alternative effective techniques include transversus abdominis plane (TAP) blocks and paravertebral blocks.[2,3] Ultrasound-guided transversus abdominis plane (TAP) nerve block is a common analgesic method given for surgeries involving the abdominal wall. TAP block is limited to somatic anaesthesia of the abdominal wall and highly dependent on inter-fascial spread.[[21] The abdominal wall sensory afferents course through the transversus abdominis (neuro-fascial) plane superficial to the transversus abdominis muscle.[19] To provide postoperative pain relief, ultrasound-guided TAP block could be given either before the surgical incision or after the surgery.[20] The purpose of this prospective study was to compare the postoperative analgesic efficacy of pre-incisional versus post-incisional ultrasound-guided TAP block.

METHODS

Ethical approval for the study was provided by the institutional Ethics Committee. A written-informed consent was obtained from all patients enrolled in the study. 56 American Society of Anaesthesiologists physical status (ASA-PS) I and II patients aged between 30 and 60 years undergoing elective total abdominal hysterectomy using a Pfannenstiel incision under spinal anaesthesia were chosen for the study. Patients with bleeding disorders, cardio-respiratory compromise, failed TAP block, patients who did not consent for the procedure and in whom surgery was done under general anaesthesia were excluded from the study.

Patients enrolled in the study, satisfying the inclusion criteria were alternately allocated to undergo TAP block either after the spinal anaesthesia and about 15-20 min prior to the surgical incision (pre-incisional) (Group A) or immediately after the surgery (post-incisional) (Group B). All patients received a standardized anaesthesia with standard monitoring. Subarachnoid block with 18 mg 0.5% hyperbaric bupivacaine using 25 G Quincke-Babcock's spinal needle was administered to all patients in the lateral position. Furthermore, a standardized postoperative analgesic regimen was followed as part of multimodal analgesia, comprising of Inj. Paracetamol 1g, and Inj. Tramadol hydrochloride 100mg administered intravenously to all patients.

The transversus abdominis plane (TAP) block was performed under real-time ultrasound guidance using a linear array probe of 6–13 MHz (GE Logiq-C5), either before surgery (pre-incision) or at the end of surgery (post-incision), bilaterally just above the level of the iliac crest using the lateral and anterior approaches of TAP block by a trained anaesthesiologist. The total volume of the local anaesthetic injected for TAP block was 40 mL of 0.375% Inj. levobupivacaine hydrochloride (20 mL-bilaterally) with dose not exceeding 2 mg/kg. Those patients in whom the stipulated volume could not be given due to toxicity concerns were excluded from the study.

After completion of the surgical procedure, patients were transferred to the post-operative care unit. Vitals- heart rate, respiratory rate, and non-invasive blood pressure were monitored postoperatively. Successful block was confirmed by loss of cold sensation in the distribution of T8-L1 dermatomes on the side of the block.[2,3] Pain severity was assessed by using the Numeric Rating Scale (NRS) (0 = no pain and 10 = worst possible pain). Rescue analgesia was given to patients when the pain score was >3, received a titrated dose of morphine (2 mg bolus at 5-min intervals) until the NRS was ≤3. The time of first rescue analgesia and the total dose of morphine received during the 24 hour postoperative period were recorded. Postoperative nausea and vomiting (PONV), sedation, and respiratory depression were monitored in all patients given rescue analgesia. These assessments were performed at ½, 1, 2, 4, 6, 12, and 24 h after the surgical procedure.

PONV was measured using a categorical scoring system (none = 0; mild = 1; moderate = 2; severe = 3) Sedation scores were rated using a sedation scale (awake and alert = 0; quietly awake = 1; asleep but easily arousable = 2; deep sleep = 3). Respiratory depression was defined as respiratory rate <8 breaths per min and / or $PaCO_2$ >45 mmHg.

The primary outcome measures included the Numeric Rating Scale (NRS) for pain, duration of TAP blockade, and any complications of TAP block. The secondary outcome measures included postoperative opioid consumption in the first 24 h, PONV, sedation, and respiratory depression.

Sample size calculation

Based on the previous study by *Yasser Mohamed Amr and Sabry M. Amin*,[4] which compared the effects of pre-incisional versus post-incisional TAP block on acute and chronic post-abdominal hysterectomy pain, the time to first rescue analgesic requirement was 135±18 minutes in the pre-incisional group and 120±16 minutes in the post-incisional group. Using this data for power analysis, we

determined that a sample size of 28 patients per group would be required to achieve 90% power with a 5% alpha error. Therefore, a total of 56 patients were enrolled in the study.

Statistical analysis

Data collected was analysed using IBM SPSS Statistics-29. Data were assessed with independent t-test and Mann-Whitney test. All results were presented in the form of mean ± standard deviation or number and percentage as appropriate, p value ≤ 0.05 was considered statistically significant.

RESULTS

This study consisted of 56 patients, and Table 1 presents the demographic characteristics of these individuals. Statistical analysis indicated no significant differences between the groups in terms of demographic variables or the duration of the operative procedure.

Table 1: Demographic data

	Pre-incisional TAP: Group A (n=28)	Post-incisional TAP: Group B (n=28)
Age (year) (mean SD)	50.92 3.53	50.02 3.93
Weight (kg) (mean SD)	60.75 4.30	58.41 5.61
Height (cm) (mean SD)	158.16 3.53	159.62 2.97
BMI (kg/m^2) (mean SD)	21.38 2.82	21.25 2.79
Mean duration of surgery (h) (mean SD)	1.85 0.53	1.80 0.59

Figure 1 displays the mean pain scores recorded at different time intervals. From the 2nd hour to 12 hours post-operation, the pre-incisional TAP block group exhibited significantly lower pain scores ($P < 0.05$). Subsequently, pain scores became comparable between both groups. Additionally, rescue analgesic requirement was significantly lower in the pre-incisional TAP block group ($P = 0.001$).

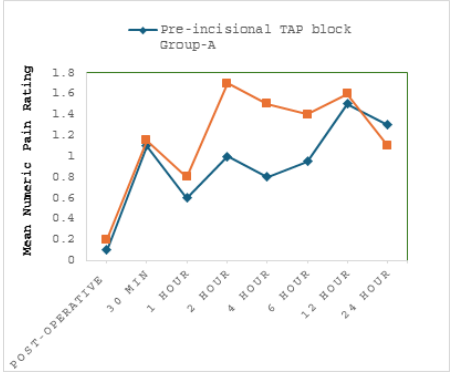

Figure 1: Comparison of the mean value of pain scores in Group-A vs Group-B

The mean time to first rescue analgesia was significantly longer in Group A (pre-incisional TAP block group) at 10.35 ± 2.81 hours compared to Group B (post-incisional TAP block group) at 3.20 ± 3.27 hours, with a P-value of 0.002 [Figure 2]. In Group B, 67.8% of patients required rescue analgesia, whereas in Group A, only 17.8% of patients needed it.

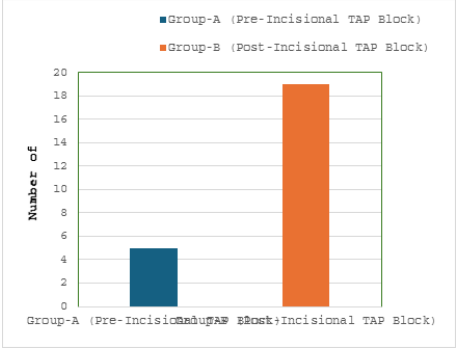

Figure 2: Comparison of the total number of patients in both groups requiring rescue analgesia

Sedation scores in the postoperative period were comparable in both groups, except at the 4thhour, where it was significantly higher (*P*-value of 0.024) in Group-B (post-incisional TAP block group). Respiratory depression was not recorded in any patient.

DISCUSSION

Major gynaecological surgeries like total abdominal hysterectomies are associated with significant postoperative pain. Providing adequate postoperative pain relief is important to prevent adverse outcomes like tachycardia, hypertension, myocardial ischemia, decrease in alveolar ventilation, and poor wound healing[5] A significant source of pain following total abdominal hysterectomy stems from the incision in the abdominal wall. Thus, blocking the sensory nerves supplying the anterior abdominal wall should aid in reducing postoperative pain. Using a transversus abdominis plane block can effectively block the entire sensory supply of the anterior abdominal wall, [6] which can be enhanced when performed under ultrasound guidance.[8] Research has demonstrated the use of both pre-incision and post-incision transversus abdominis plane (TAP) blocks. Our objective was to compare the efficacy of these two methods in terms of postoperative pain relief and assess any associated adverse effects. Our study on 56 patients revealed a notable reduction in pain scores among patients receiving the pre-incisional TAP block starting from the second hour onward. The initial similarity in pain levels can be attributed to the effects of spinal anaesthesia.

The reasons for achieving greater postoperative pain relief with the pre-incisional TAP block can be attributable to:

1. Preemptive analgesia: By administering analgesia before the surgical procedure begins, preemptive analgesia can mitigate the physiological responses to nociceptive signals, potentially leading to more effective pain relief postoperatively compared to analgesia initiated after surgery [9,10].

2. Minimized drug leakage: When the TAP block is performed prior to surgical incision, there is less likelihood of drug leakage. In contrast, administering the block after the incision may result in leakage of some drug through the surgical wound. This observation was supported by findings from a cadaveric study where methylene blue injected after the surgical incision leaked through the incision sites in cadavers bilaterally[20].

These factors suggest that initiating the TAP block before the surgical incision could optimize the distribution and efficacy of the local anaesthetic, thereby potentially enhancing postoperative pain management.

In the pre-incisional TAP block group, pain scores were lower, and only 17.8% of patients required rescue analgesia, compared to 67.8% in the post-incisional TAP block group. The significantly longer time to first request for rescue analgesia in the pre-incisional group (*P*-value of 0.003) reflects the extended duration of analgesia provided by this approach. Furthermore, total morphine consumption was higher in the post-incisional TAP block group, potentially contributing to increased unpleasant side effects of parenteral opioids such as nausea and vomiting. Sedation scores were comparable between both groups, except at the 4th hour when scores were higher in the post-incisional TAP block group. This difference may be attributed to the early administration of rescue analgesia (morphine) for pain relief in that group.

While many studies have highlighted the effectiveness of ultrasound-guided TAP blocks using the classical approach[12,13,14,15,16], only a few have explored different approaches under ultrasound guidance[18]. If a post-incisional TAP block is necessary, we recommend considering a more posterior approach to potentially reduce drug leakage through the surgical incision[20]. However, further research is needed to evaluate the efficacy of this approach Additionally, while previous research noted higher sedation scores in the post-incisional TAP block group[4], which could be attributed to the use of morphine boluses (0.1 mg/kg) for rescue analgesia, our study differed by administering morphine in 2 mg increments until pain scores reached ≤3. This method was adopted to achieve comparable pain relief while potentially mitigating sedation-related effects observed in other studies[20].

One potential limitation of our study is the duration of observation, which was limited to 24 hours. Previous studies have indicated that the effects of TAP blocks can persist for up to 48 hours postoperatively. Therefore, extending the observation period could have provided a more comprehensive understanding of the duration and sustainability

of pain relief offered by TAP blocks. Another limitation is that our study focused solely on one type of surgery, without including other abdominal surgeries. Examining the efficacy of TAP blocks across a broader range of abdominal procedures could have provided insights into their applicability and effectiveness in different surgical contexts.

Addressing these limitations in future research could further enhance our understanding of the optimal use and duration of TAP blocks in perioperative pain management across various surgical settings.

CONCLUSIONS

In conclusion, transversus abdominis plane (TAP) blocks, integrated within a multimodal analgesic approach, represent a viable option for managing postoperative pain following lower abdominal surgeries. Our study demonstrated that administering a pre-incisional TAP block resulted in significant reductions in acute pain levels, analgesic requirements, and the incidence of postoperative nausea and vomiting (PONV) compared to blocks performed after the surgical procedure. These findings highlight the potential benefits of preemptive TAP blocks in optimizing postoperative pain management and improving patient outcomes in this surgical population.

REFERENCES

1. Ng A, Swami A, Smith G, Davidson AC, Emembolu J. The analgesic effects of intraperitoneal and incisional bupivacaine with epinephrine after total abdominal hysterectomy Anesth Analg. 2002;95:158–62
2. Carney J, McDonnell JG, Ochana A, Bhinder R, Laffey JG. The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy Anesth Analg. 2008;107:2056–60
3. Melnikov AL, Bjoergo S, Kongsgaard UE. Thoracic paravertebral block versus transversus abdominis plane block in major gynecological surgery: A prospective, randomized, controlled, observer-blinded study Local Reg Anesth. 2012;5:55–61
4. Amr YM, Amin SM. Comparative study between effect of pre- versus post-incisional transversus abdominis plane block on acute and chronic post-abdominal hysterectomy pain Anesth Essays Res. 2011;5:77–82
5. Vadivelu N, Mitra S, Narayan D. Recent advances in postoperative pain management Yale J Biol Med. 2010;83:11–25
6. McDonnell JG, O'Donnell BD, Farrell T, Gough N, Tuite D, Power C, et al Transversus abdominis plane block: A cadaveric and radiological evaluation Reg Anesth Pain Med. 2007;32:399–404
8. Atim A, Bilgin F, Kilickaya O, Purtuloglu T, Alanbay I, Orhan ME, et al The efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing hysterectomy Anesth Intensive Care. 2011;39:630–4
9. Woolf CJ, Chong MS. Preemptive analgesia-treating postoperative pain by preventing the establishment of central sensitization Anesth Analg. 1993;77:362–79
10. Dahl JB, Moiniche S. Pre-emptive analgesia Br Med Bull. 2004;71:13–27
12. Chaudhuri S, Goyal S. Ultrasound-guided transversus abdominis plane block: A technically easier analgesic option in obese compared to epidural Anesth Essays Res. 2012;6:226–8
13. El-Dawlatly AA, Turkistani A, Kettner SC, Machata AM, Delvi MB, Thallaj A, et al Ultrasound-guided transversus abdominis plane block: Description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy Br J Anaesth. 2009;102:763–7
14. Belavy D, Cowlishaw PJ, Howes M, Phillips F. Ultrasound-guided transversus abdominis plane block for analgesia after Caesarean delivery Br J Anaesth. 2009;103:726–30
15. Mukhtar K, Singh S. Transversus abdominis plane block for laparoscopic surgery Br J Anaesth. 2009;102:143–4
16. Niraj G, Searle A, Mathews M, Misra V, Baban M, Kiani S, et al Analgesic efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing open appendicectomy Br J Anaesth. 2009;103:601–5
18. Escudero-Fung M, Lehman EB, Karamchandani K. Timing of Transversus Abdominis Plane Block and Postoperative Pain Management Local Reg Anesth. 2020;13:185–193
19. Netter FH Back and Spinal Cord. In: Netter FH, ed. Atlas of Human Anatomy Summit. New Jersey, USA: The Ciba-Geigy Corporation, 1989:145–55
20. Ambooken, Emy; Chirayath, Joe John; Raghavan, P.. A comparison of preincisional and postincisional ultrasound guided transversus abdominis plane block. Journal of Anaesthesiology Clinical Pharmacology 37(3):p 406-410, July–September 2021. | DOI: 10.4103/joacp.JOACP_283_19
21. Hesham Elsharkawy and Thomas F. Bendtsen. Ultrasound-Guided Transversus Abdominis Plane and Quadratus Lumborum Nerve Blocks, NYSORA.
22. McDonnell JG, O'Donnell B, Curley G, Heffernan A, Power C, Laffey JG. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: A prospective randomized controlled trial. Anesth Analg. 2007;104:193–7.
23. Soliman LM, Narouze S. Ultrasound-guided transversus abdominus plan block for the management of abdominal pain: An alternative to differential epidural block. Techniques in Regional Anesthesia and Pain Management. 2009;13:117–20.