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RESEARCH ARTICLE
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COMPARISON OF PERINEURAL AND INTRAVENOUS DEXAMETHASONE ADDED TO BUPIVACAINE FOR ULTRASOUND GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK IN HYSTERECTOMY PATIENTS FOR POST OPERATIVE ANALGESIA: A PROSPECTIVE STUDY

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Abstract

Background: Abdominal wall incision is a major contributor to the pain experienced by patients after abdominal surgery. Various adjuvants have been used to improve the quality and increase the duration of the local anesthetic action in different peripheral nerves and regional block techniques.
Aim: To compare the effectiveness between perineural and intravenous dexamethasone as an adjuvant in ultrasound guided bilateral transversus abdominis plane block for post hysterectomy pain control.
Methods: Seventy-five adult patients undergoing elective abdominal hysterectomy under spinal anaesthesia were included in this observational study. The study was conducted in the Department of Anesthesiology and Critical Care, GMCH Kathua. Patients were randomly divided into three groups using chit method, with 25 patients in each group. Patients were grouped as TAP-alone (n =25), TAP-IVD (n =25), and TAP-PD (n=25). TAP-alone group were considered as a control group. The primary outcome was postoperative pain, as evaluated by visual analog scale (VAS) for pain scoring at 0,2,4,6,8,10,12,18 and24 h postoperatively, whereas the secondary outcomes were time to first analgesia (TFA), total number of analgesic doses in 24 hours following surgery and the occurrence of nausea, vomiting and shivering.
Result:(VAS score of group III (TAP-PD) was lower than VAS score of group II (TAP-IVD) than group I (TAP alone).Time to first analgesic request was significantly longer ($p<0.05$) in group III(TAP-PD) than group II (TAP-IVD)than group I (TAP alone).The total analgesic consumption in first 24 hours was significantly lower in group III(TAP-PD) than group II(TAP-IVD) than group I (TAP alone).There were no statically differences with regard to postoperative nausea, vomiting and shivering.

Conclusion: Addition of dexamethasone perineurally to bupivacaine in bilateral TAP block is more effective than intravenous dexamethasone, it prolongs the duration and provides potent analgesia and reduces analgesic consumption with decreased incidence of nausea, vomiting and shivering.

Keywords: Abdominal surgery, TAP block, VAS, spinal anaesthesia, postoperative pain, analgesia.

Introduction:

A significant proportion of pain experienced by patients undergoing abdominal surgeries is related to somatic pain signals derived from the abdominal wall.[1] The anterior abdominal wall components (skin, muscles and parietal peritoneum) are supplied by sensory neurons derived from the anterior rami of spinal nerves T6 to L1, which include the intercostal nerves (T6 to T11), the subcostal nerve (T12) and the ilioinguinal and iliohypogastric nerves(L1). These neurons traverse through the neurofascial plane between the internal oblique and the transversus abdominis muscles.[2] Transversus abdominis plane (TAP) block is aimed to access these nerves in this neuro fascial plane through the lumbar triangle of Petit.[3] This triangle is bounded anteriorly by the external oblique muscle and posteriorly by the latissimus dorsi muscle, whereas the base is formed by the iliac crest.[4]

Inadequate control of postoperative pain leads to several unwanted adverse events ranging from patient discomfort, prolonged immobilization, to thromboembolic phenomenon and pulmonary complications [5].

This leads to chronic postsurgical pain (CPSP), which is a largely unrecognized problem that occurs in 10–65% of postoperative patients, with 2–10% of these patients experiencing severe CPSP. CPSP leads to long-term behavioral and neurobiological changes [6]. Analgesic multimodalities have been recommended to relieve the postoperative pain [7].

Various adjuvants have been used to improve the quality and increase the duration of the local anesthetic action in different peripheral nerves and regional block techniques. [8,9]

Dexamethasone is easily affordable, accessible, cheap, and safe. So that, both intravenously and perineurally has been used as an adjuvant to bupivacaine in transversus abdominis plane block in the study area to enhance quality and duration of analgesia.

To date, it is unclear whether the perineural administration confers advantages over the IV administration of this drug [10,11]. The primary objective of this study was to compare the effectiveness between perineural and intravenous dexamethasone as an adjuvant on bilateral transversus abdominis plane block for postoperative pain control for patients undergone hysterectomy operated under spinal anesthesia. The secondary objective was to compare the total number of analgesic doses required in 24 hours following surgery and to compare the incidence of complications (nausea, vomiting, and shivering) among the study population.

Methods:

This observational study was conducted in the Department of Anesthesiology and Critical Care, GMCH Kathua after taking clearance from ethical committee (IEC/GMCK/176/ pharma, Dated: 15/11/2022) on patients who presented for abdominal hysterectomy under spinal anesthesia with following inclusion and exclusion criteria.

Inclusion criteria: -

- Patients between age group of 40 to 55 years who underwent elective abdominal hysterectomy under spinal anaesthesia.
- ASA class I and II.

Exclusion criteria: -

- Patients with any chronic medical illness, allergic to any drug, any bleeding abnormalities were excluded from the study.

On arrival of the patients to the operative theatre, and after application of the routine hospital monitoring protocol, HR, non-invasive blood pressure, and SPO2 have been recorded before giving spinal anesthesia, then all patients were given spinal anesthesia using 3.5ml of 0.5% bupivacaine using 27-Gauge quinckes spinal needle.
After this, all patients were repositioned in a supine position and level of sensory and degree of motor block were assessed. Then, the necessary intraoperative data was recorded.

Anesthetic procedure was standardized for all the patients and the patients selected for study were divided into three groups:
1st group: TAP alone group in which patients received bilateral TAP block with 40 ml of 0.25% bupivacaine (20ml each side)
2nd group: TAP-IVD group in which patient received bilateral TAP block with 40 ml of 0.25% bupivacaine + 8 mg of i.v dexamethasone
3rd group: TAP-PD group in which patient received bilateral TAP block with 40 ml of 0.25% bupivacaine + 8 mg of perineural dexamethasone.
The block was performed under ultrasound guidance immediately after skin closure.
Postoperative pain was assessed in all groups using a VAS score. The scale consists of horizontal lines ranging from 0 (no pain) to 10 (worst imaginable pain). Patients were asked to report their pain based on 11 points VAS score. The pain intensity was rated as no pain (VAS: 0), mild (VAS: 1-3), moderate (VAS: 4-6), and severe (VAS: 7-10). The first VAS score was recorded at 0 hr of the procedure and then at 2nd, 4th 6th, 8th, 10 th, 12th 18th, and 24th hr. The time to the first request of analgesia (i.e the time elapsed between end of surgery to first analgesic dose) and total number of rescue doses of analgesia of tramadol and diclofenac in 24 hours following surgery were recorded. At the times of pain evaluation, the heart rate, the mean arterial blood pressure, respiratory rate, and SPO2 were assessed. Any postoperative adverse events such as nausea, vomiting, and shivering were recorded and managed accordingly.

Statistical analysis
Before the study, a power analysis was performed to determine the necessary number of patients in each group based on postoperative VAS score for pain. With a two-sided type I error of 5% and study power at 80%, it was estimated that 25 patients in each group would be enough to detect a 25% difference in the VAS score for pain based on detection of a 10-mm difference between the groups. The Kolmogorov-Smirnov test was used to verify normal distribution of continuous variables. Continuous variables are expressed as mean±standard deviation or median with interquartile range as appropriate. Statistical analysis was done by using Statistical version 6 (StatSoft Inc.; Tulsa,) and Graph Pad Prism version 4 (Graph Pad Software Inc.; San Diego, CA, USA) software. Normally distributed continuous variables were compared using Student's unpaired "t"-test, whereas the Mann Whitney U test was used for comparison of opoid and NSAIDS requirements. Categorical variables were compared bythe Chi-square test or Fisher's exact test, as appropriate. All analyses were two-tailed and $P<0.05$ was considered statistically significant.

Conflict of interest: Nil
Funding: Nil

Results:
Seventy-five (75) patients participated in this study based on whether they received TAP-IVD (transversus abdominis plane block with intravenous dexamethasone) or TAP-PD (transversus abdominis plane block with perineural dexamethasone) at the end of surgery for postoperative analgesia as exposed group and those with TAP (transversus abdominis plane block) alone during postoperative period as a control group. There was no significant difference among the three groups with regard to demographic profile among the study population (p value > 0.05) [Table 1].

Table 1: Demographic characteristics among the study population

Parameters	Group I (n=25)	Group II (N=25)	Group III (n=25)	P value
Age(years)	45.6±14.13	45.4±15.03	46.2±12.97	0.981
Weight(kg)	63.4±4.02	65.1±3.93	63.2±3.51	0.159
ASA status I/II	16/9	18/7	15/10	0.954
Duration of surgery	58.1±18.25	55.9±16.47	61.9±13.57	0.949

The difference in intraoperative vitals (heart rate, systolic blood pressure, diastolic blood pressure means arterial pressure and SpO_2) between the three groups was statistically insignificant(p-value>0.05) [Table 2].

Table 2: Intraoperative vitals among the study population

Parameters	**Group I**	**Group II**	**Group III**	**P value**
HR	**82.31±8.66**	**83.21±8.65**	**79.16±9.49**	**0.193**
SBP	**116.76±11.69**	**116.82±10.17**	**117.42±9.63**	**0.853**
DBP	**70.24±7.73**	**69.06±5.83**	**70.61±6.50**	**0.617**
MAP	**85.75±8.23**	**84.97±6.40**	**86.21±6.80**	**0.691**
Spo_2	**98.83±1.36**	**98.91±1.26**	**98.81±1.19**	**0.925**

Median VAS score of group III (TAP-PD group) was statistically lower than median VAS score of group I(TAP alone group) and group II (TAP-IVD group). The VAS score at 0hr, 2hr,4hr, 6hr, 10hr and 18hr was statistically significant and the VAS score at 8hr, 12hr and 24hr was comparable [Table 3].

Table 3: Comparison of VAS scores among the three groups

Time interval	**Group I**	**Group II**	**Group III**	**P value**
0 Hour	**1.37±0.63**	**0.83±0.70**	**0.08±0.27**	**<0.001***
2 Hour	**2.56±1.55**	**1.67±1.67**	**0.54±0.51**	**<0.001***
4 Hour	**3.54±1.49**	**2.42±1.36**	**0.85±0.88**	**<0.001***
6 Hour	**2.41±1.44**	**3.38±1.47**	**2.08±1.29**	**0.005***
8 Hour	**2.67±1.98**	**2.33±1.46**	**2.84±1.66**	**0.192**
10 Hour	**3.57±1.72**	**2.25±1.65**	**1.04±1.48**	**0.002***
12 Hour	**2.63±1.62**	**2.21±1.53**	**1.81±1.44**	**0.157**
18 Hour	**2.85±1.81**	**1.65±1.82**	**1.58±1.74**	**0.019***
24 Hour	**0.93±0.78**	**0.88±0.61**	**0.73±0.53**	**0.536**

The mean duration of analgesia in patients of Group I was 4.1±1.66 hours. The mean duration of analgesia in patients of Group II was 5.6±1.67 hours. However, the mean duration of analgesia in patients of Group III was 7.8±1.18 hours. The duration of analgesia in all the groups was statistically significant [Fig 1].

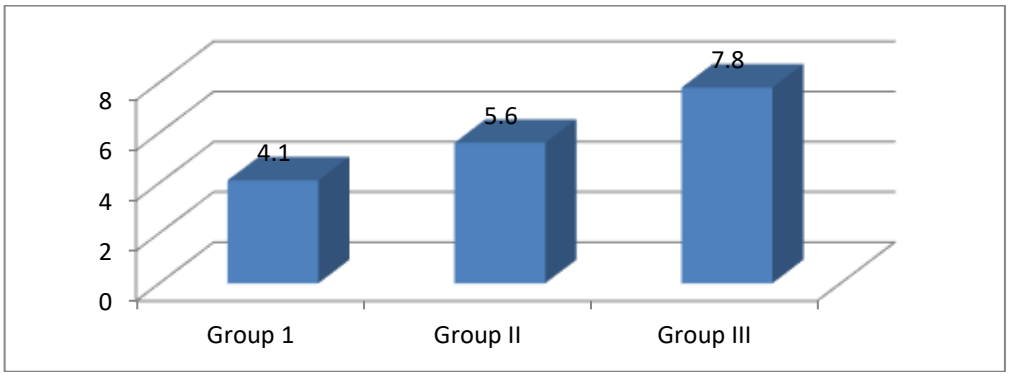

Fig 1.

The patients requiring Tramadol in Group I was 90%, Group II was 75% and in Group III was 46.2%. The difference in percentage of patients requiring Tramadol was statistically significant with a p-value of <0.001. The patients requiring diclofenac in Group I was 70.4%, Group II was 8.3%and in Group III was 0%. The difference in percentage of patients requiring diclofenac was statistically significant with p-value of <0. 001 [Fig 2].

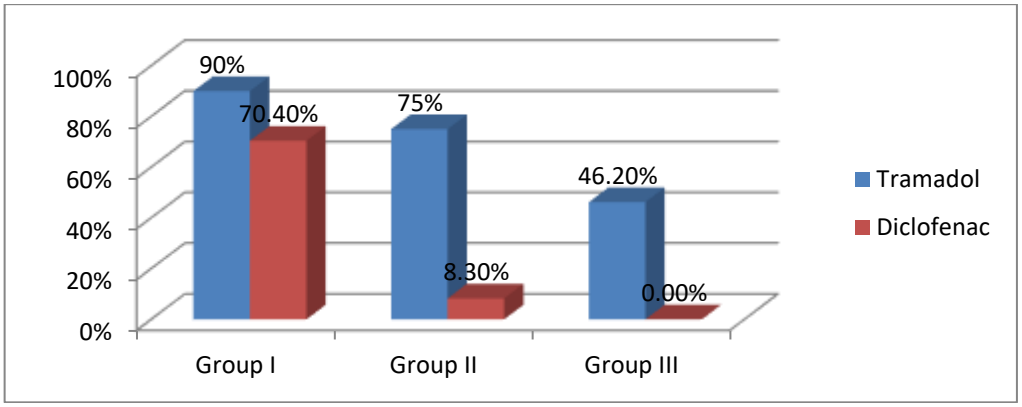

Fig 2.

The difference in side effects between three groups was statistically insignificant with a p-value of >0.001 [Fig 3].

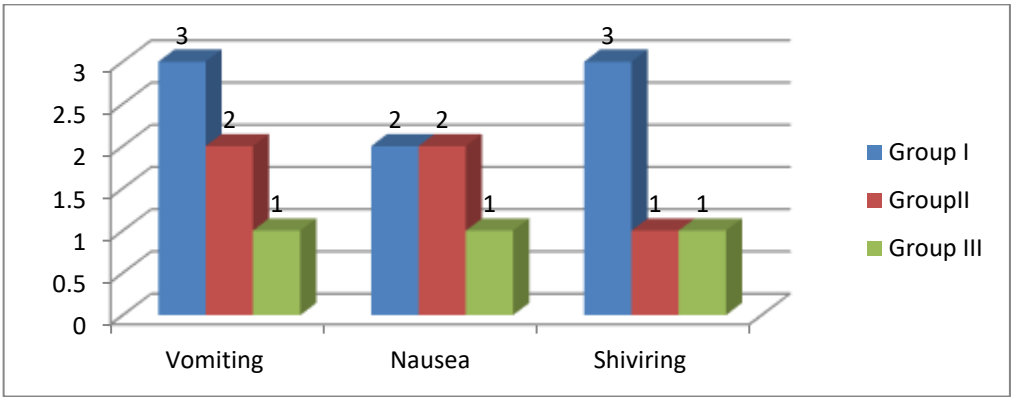

Fig 3

Discussion:

The enhanced recovery after surgery society recommended the multimodal regime regarding postoperative pain control. They stated that multimodal, evidence based, and procedure specific analgesic regimens should be the standard of care, with the aim to achieve optimal analgesia with

minimal adverse effects and to facilitate the achievement of important enhanced recovery after surgery milestones such as early mobilization and oral feeding [12].
The use of the peripheral regional analgesic technique as a single or continuous infusion can provide analgesia superior to that with systemic opioids and result in the reduction of undesired adverse effects of opioids such as sedation, respiratory depression, nausea, and vomiting and improvement in some outcomes [13,14].
TAP block is considered a straightforward and efficient regional anesthetic technique that minimizes pain and demand for analgesics in abdominal surgeries. Using local anesthetic alone is satisfactory; however, adding an adjuvant to local anesthesia was found to prolong the duration of the sensory block provided by regional anesthesia and has shown promising results in reducing postoperative pain and improving the quality of analgesia [15].

In our study, TAP-PD and TAP-IVD significantly decreased postoperative pain, reduced total analgesic consumption, and prolonged the median time to first analgesic request in the postoperative period after elective abdominal hysterectomy under spinal anesthesia.
We found that Median VAS score of group III (TAP-PD group) was statistically lower than median VAS score of group I (TAP alone group) and group II (TAP-IVD group). The VAS score at 0hr, 2hr,4hr, 6hr, 10hr and 18hr was statistically significant and the VAS score at 8hr, 12hr and 24hr was comparable with a p value of < 0.0005.
Similar to our finding, in a study by Fouad et al. evaluating the efficacy of dexamethasone added to bupivacaine in ultrasound-guided transversus abdominis plane block showed that time to first analgesic request (TFA) was significantly longer in the dexamethasone group when compared to control (TAP alone) group (438.2 ± 24.95 min vs. 272.04 ± 37.51 min, $P < 0.002$) [16]. In agreement with our finding Uma Datt Sharma [17] also studied the effectiveness of perineural dexamethasone as an adjuvant to ropivacaine on transversus abdominis plane block showed that the dexamethasone group showed statistically significant prolongation in time to first analgesic request when compared to the control (TAP alone) group with a median time of (547.5 vs 387.5, $p < 0.001$).
A prospective cohort study by Molla Y and his colleagues in Gondar, Ethiopia also evaluated the effectiveness of transversus abdominis plane block after abdominal surgery and showed the median (IQR) time to first analgesic request for TAP block was360(500) minutes, which was comparable with our finding [18].
Furthermore, another study also showed perineural and intravenous dexamethasone has equivalent analgesic benefits and similar safety profiles when used as an adjuvant to peripheral nerve block [19]. Rosenfeld et al. [20] also showed only there was a mean1.3 h difference between intravenous and perineural dexamethasone in terms of time to first analgesic request, which is comparable with our study which showed only median 1.5 h difference.
Our study showed statistically significant differences in VAS scores between TAP- PD and TAP alone ($p < 0.05$) and TAP-IVD and TAP alone ($p < 0.05$) groups at different time intervals. There was no statistically significant difference in VAS score between TAP-PD and TAP- IVD group at all times during 24 h with p-value of <0.0001. This is in line with a study by Mamatha Raghukumar et al. [21] which showed a higher VAS score in TAP alone and lower VAS score in TAP with perineural dexamethasone groups at 24th-hour postoperatively after caesarean delivery. In agreement with our finding Kertalov A et al. also studied the effect of adding dexamethasone as a ropivacaine adjuvant in ultrasound-guided transversus abdominis plane block showed that the there is a statistically significant difference in median VAS score between TAP with perineural dexamethasone and TAP alone group at 6th (1 vs 2, $p < 0.001$) and 24th hours (1 vs 2, $p < 0.001$) respectively [22].
The results of our study found a significantly reduced post-operative analgesic consumption (tramadol and diclofenac) in both dexamethasone groups when compared to the control (TAP alone) group.

In agreement with our finding a RCT by Sachdeva and Sinha on70 patients investigated the effect of dexamethasone as an additive to Ropivacaine on ultrasound-Guided Transversus abdominis plane block in Cesarean Section and showed decreased tramadol requirement postoperatively in dexamethasone when compared tothe non-dexamethasone group (100.00 ± 0.00 vs. 140.00 ± 50.26 mg, P < 0.046) [23].

Ammar and mahmoud [24] also studied the effect of adding dexamethasone to bupivacaine on TAP block and showed that the total postoperative 24 h morphine consumption was significantly reduced in dexamethasone group 19.2 (8.1-24.2) vs 4.1(1.7-6.2) p <0.01. This was comparable with our finding when an opioid conversion factor of morphine to tramadol was applied (1:10). Zhaoet al. also showed the two routes of administration (intravenous and perineural) did not show any significant difference in post-op analgesic consumption [25].

Desale et al. [26] in Asmara, Eritrea conducted a randomized control trial on effectiveness Transversus abdominis plane block after Caesarean section in an area with limited resources showed the mean ± SD Diclofenac consumption was 87.21 ± 51.20. This was comparable with our finding. Uma Datt Sharma [17] also studied the effectiveness of perineural dexamethasone as adjuvant to ropivacaine on transversus abdominis plane block after spinal anesthesia showed that there was a decrement in total tramadol consumption in 24 h when compared to control group (223.33 ± 56.83 vs 293.33 ± 25.7, p < 0.001) but this result is by much higher than our finding, 50(0-100) vs100(100-150). This difference could be justified by the difference in population, study design, sample size, and surgical procedure (hernia repair vs abdominal hysterectomy).

Our study showed the incidence of nausea and shivering was lower in the two dexamethasone groups when compared to the non-dexamethasone group but not statistically significant difference among the study population (p>0.5). This was comparable with a previous study showing a significantly lower incidence of nausea in TAP with perineural dexamethasone group when compared to TAP alone. This finding is also in agreement with a study showing a lower incidence of shivering in patients pretreated with dexamethasone without statistically significant differences (p>0.05) [27].

Conclusion:

We conclude that addition of dexamethasone perineurally to bupivacaine in bilateral TAP block is more effective than intravenous dexamethasone it prolongs the duration and provides potent analgesia and reduces analgesic consumption with decreased incidence of nausea, vomiting and shivering.

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