INTRODUCTION

Inguinal herniorrhaphy is a common day care surgical procedure, usually performed under regional anesthesia. Post-operative pain relief is challenging particularly during the immediate postoperative period to facilitate early mobilization and reduce the length of hospital stay. Inadequate control of pain can lead to adverse effects ranging from the discomfort of the patient to prolonged immobilization and thromboembolic phenomenon. Multimodal analgesia including regional nerve blocks is usually used as a part of opioid-sparing analgesic technique for pain management [1].

USG-guided transversus abdominis plane (TAP) block was first described by Hebbard et al. [2] Identification of the neurofascial plane between the internal oblique and transverse abdominis and deposition of local anesthetic in this plane inhibits the neural afferents from T7 to L1 and blocks the sensation from the skin, anterior abdominal wall, and parietal peritoneum [3].

Various local anesthetic along with different adjuvants has been used for peripheral nerve blocks to enhance the duration of postoperative analgesia. Levobupivacaine is the levororatory isomer of bupivacaine and has a safer pharmacological profile with a reduced risk of cardiac and neurological adverse effects [4]. In literature search, we did not reveal any study regarding the comparison of levobupivacaine with two different adjuvants (dexamethasone and dexmedetomidine) in USG-guided TAP block for post-operative analgesia.

This study aimed primarily to compare the postoperative analgesia in both groups in terms of pain measurement by visual analog score, time to first rescue analgesic and total number and total dose of rescue analgesic. Hemodynamic variables, Ramsay sedation score, adverse effects such as nausea, vomiting, shivering, sedation, pruritus, and any hematoma at the site of injection after block were considered as secondary objectives.

METHODS

This prospective double-blinded randomized study was conducted at a tertiary care center after obtaining approval from the Institutional Research Ethical Board and written informed consent. All patients of the American Society of Anaesthesiologists (ASA) class I and 2 between the age group of 18 and 60 years posted for unilateral inguinal hernia surgery under spinal anesthesia were included in the study. Patients with pre-existing cardiac disease, uncontrolled hypertension, asthma, diabetes mellitus, severe renal or hepatic dysfunction, chronic pain syndrome, obesity with body mass index above 35 kg/m², alcohol or drug abuse, infection at the site of injection, pain medications

ABSTRACT

Objectives: Ultrasonography (USG)-guided transversus abdominis plane (TAP) block is an effective technique for postoperative analgesia in patients undergoing intraabdominal surgery. This study aimed to compare the post-operative analgesia, hemodynamic variables, sedation, and adverse effects of levobupivacaine with two different adjuvants (dexamethasone and dexmedetomidine) in USG-guided TAP block for patients undergoing unilateral inguinal herniorrhaphy under subarachnoid block.

Methods: A double-blind randomized control study, conducted on 96 patients, allocated in three groups of 32 each. Patients in group C received 0.25% levobupivacaine (20 mL) with normal saline (2 mL), group D1 received 0.25% levobupivacaine (20 mL) added with 0.1 mg/kg dexamethasone (2 mL) and group D2 received 0.25% levobupivacaine added with 0.5 mcg/kg dexmedetomidine diluted in NS (2 mL). Pain was assessed using Visual Analog Scale (VAS). The time for request of first analgesia (TFA), total number and total dose of rescue analgesic in 24 h were recorded. Statistical analysis was done using unpaired Student’s t-test and ANOVA.

Results: At 12 and 24 h >30% of patients had VAS ≥4 in control group while it was <10% in groups D1 and D2 (p<0.001). TFA was earliest in control group (6.10±0.96 h) as compared to group D1 (7.26±1.22 h) and group D2 (7.49±1.02 h) (p<0.001). The total number and total dose of analgesic given were higher in the control group than other two groups (p<0.001). However, it was comparable between groups D1 and D2 (p<0.05).

Conclusion: Dexamethasone and dexmedetomidine when added as an adjuvant to levobupivacaine for TAP significantly prolonged the duration of post-operative analgesia as compared to levobupivacaine alone, however, it was found to be comparable between adjuvant groups.

Keywords: Ultrasonography guided transversus abdominis plane block, Postoperative analgesia, Levobupivacaine, Dexamethasone, Dexmedetomidine.
Sensory blockade was assessed by pinprick method in a caudal to the level of T10 dermatome, i.e., time between injection of intrathecal drug and absence of pain in T10 dermatome and maximum height of sensory block was noted. Surgery was allowed after the T10 level was achieved. Sensory level at the time of giving TAP block was also noted.

If patients complained of pain during surgery aliquots of fentanyl 50 mcg IV (one or two doses) was administered (partial failure) and if the pain persisted general anesthesia was administered (complete failure). Patients with partial and complete failure were not analyzed statistically.

Postoperatively pain assessment was done using Visual Analog Scale (VAS) score (0–10) at different time intervals (30, 60, 90 min and 2, 3, 4, 5, 6, 8, 10, 12, 24 h). Time to first request for rescue analgesia or VAS ≥ 4 was noted and ln diclofenac 7.5 mg was given intravenously as rescue analgesic. The total number and total dose of analgesic required in 24 h were also noted. Ramsay sedation scale (RSS) was noted at the same intervals where VAS was noted. Incidences of postoperative side effects such as nausea, vomiting, bradycardia, hypotension, hypertension, shivering, bleeding at the site of injection, hemotoma, and any other adverse effects such as headache and backache were recorded. ln endothetion 4 mg iv was given for nausea and vomiting. The patient’s satisfaction score was recorded at the time of discharge (<3= not satisfactory, 3–5 satisfactory, 5–7 good, 7–10 excellent).

Statistical Package for Social Sciences (SPSS) version 22 (SPSS, Chicago, IL) was used for statistical analysis. Quantitative data were analyzed using Student t-tests and ANOVA. Categorical data were analyzed using Chi-square test. p < 0.05 was considered statistically significant. The sample size was determined by power analysis with an alpha error 5% i.e. confidence level 95% and beta error to be 20%, i.e., power of study to be 80%. The minimum sample size was 30 in each group. With 6% clinically acceptable margin, we took 96 patients (considering dropouts) which were randomly divided into three groups of 32 each.

RESULTS
This prospective randomized double-blind study was conducted on 96 adult patients who underwent unilateral inguinal herniorrhaphy surgery under spinal anaesthesia. Out of these 2 patients in each group (total 6) were not included in statistical analysis because of failure of SAB (Fig. 1).

The patients in all three groups were comparable regarding demographic data and duration of surgery (Table 1).

VAS scores were <4 in all groups till 3 h postoperatively (p<0.05). However, after that control group showed an increase in VAS score. At 5 h on movement the number of patients with VAS ≥4 was 33.3% in the control group while only 10% of patients were with VAS ≥4 in adjuvant groups (p<0.05). At 12 and 24 h more than 30% of patients were with VAS ≥4 in the control group while it was <10% in adjuvant groups (p<0.001) (Fig. 2a and b).

Time (h) of first rescue analgesic requirement was earliest in the control group (6.10±0.96) as compared to adjuvants groups group D1 (7.26±1.22) and group D2 (7.49±1.02) (p<0.001). The total number and total dose of analgesic given was also highest in the control group than other two groups (p<0.001). However, it was comparable between adjuvant groups (D1 and D2) which was statistically nonsignificant (p>0.05) (Table 2).

Pertoperative hemodynamic changes were statistically insignificant between the three groups (p>0.05) (Figs. 3 and 4).

No patients were found to have RSS ≥3 in any groups at any time intervals. The mean RSS was higher in patients who received dexmedetomidine however it was found to be statistically insignificant.
Majority of the patients in groups D1 and D2 were satisfied and reported excellent analgesia (>50%) than group C (p>0.001). The number of patients having nausea and vomiting was more in group C (16%) than in group D2 (10%) and group D1 (6.6%).

DISCUSSION

Postoperative pain is experienced by majority of patients. Adequate control of pain plays an essential role in facilitating early recovery to normal function and improves patient satisfaction. A multimodal approach which includes the administration of two or more drugs through same or different routes, each acting at different sites of pain pathway has been suggested as the optimal combination for the pain relief along with reducing opioids requirements [5,6]. Recently USG guided transverses abdominis plane block (TAPB) has been performed as an alternative modality in abdominal surgeries with different drug combinations for effective postoperative analgesia. The addition of adjuvants to the local anesthetics have been used to improve the quality and duration of analgesia in different peripheral nerve block techniques [7].

Dexmedetomidine, an imidazole compound is the pharmacologically active dextroisomer of medetomidine that exhibits selective alpha 2-adrenoceptor agonist action [8]. Activation of the receptors in the brain and spinal cord by dexmedetomidine inhibits neuronal firing causing hypotension, bradycardia, sedation, and analgesia [9].

Dexamethasone, a glucocorticoid, is emerging as a potent adjunct to local anesthetic. It produces analgesia through its anti-inflammatory and immunosuppressive actions [10,11]. It acts locally on nociceptive C-fibers to increase the activity of inhibitory potassium channels [12].
The analgesic efficacy of dexmedetomidine and dexamethasone in different doses with different local anesthetics has been evaluated in various studies [13-16]. In the present study, all patients in three groups were comfortable (VAS<4) till 4 h postoperatively which may be due to the additive effect of SAB to TAP block. At 5 h, the number of patients with VAS ≥4 on movement were highest (33.3%) in the control group as compared to adjuvant groups (10%). Similarly, at later, postoperative period (12 and 24 h) higher VAS score (≥4) was observed in majority of patients in the control group than the patients who received adjuvant with local anesthetic. Studies done by Qian et al. [17] and Sharma et al. [18] also showed similar results where VAS scores were significantly lower in adjuvant groups at 6–24th h in comparison to the control group.

Diclofenac sodium 75 mg iv was given once the patient complained of pain (VAS≥4) as a rescue analgesic. The total dose of rescue analgesic required in 24 h was lowest in patients who received dexmedetomidine (145±19.03 mg) as compared to dexamethasone (147.50±23.99 mg) and levobupivacaine alone (175.00±36.0 mg) (p<0.05). However, it was comparable between adjuvant groups (p>0.05). These results are in consistent with observations of other authors in different studies [16,18,19].

Table 2: Comparison of requirement of Rescue analgesic between three groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group C (n=30) Mean±SD</th>
<th>Group D1 (n=30) Mean±SD</th>
<th>Group D2 (n=30) Mean±SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to first rescue analgesic (h)</td>
<td>6.10±0.96</td>
<td>7.26±1.22</td>
<td>7.49±1.02</td>
<td>&lt;0.001 (HS)</td>
</tr>
<tr>
<td>Total no. of rescue analgesic doses in 24 h (n)</td>
<td>2.33±0.48</td>
<td>1.97±0.32</td>
<td>1.93±0.25</td>
<td>&lt;0.001 (HS)</td>
</tr>
<tr>
<td>Total dose of rescue analgesics in 24 h (mg)</td>
<td>175.00±36.0</td>
<td>147.50±23.99</td>
<td>145.00±19.03</td>
<td>&lt;0.001 (HS)</td>
</tr>
</tbody>
</table>

Data=Mean±SD; HS=highlySignificant (p<0.001), Rescue analgesic inj. Diclofenac 75 mg

In contrast to the present study, Singla et al. [1] reported the superiority of dexmedetomidine over dexamethasone in TAP block which can be attributed to a higher dose of dexmedetomidine (1mcg/kg) used in their study.

Fig. 2: (a) Graphical representation of changes in VAS on rest between three groups. (b) Graphical representation of changes in VAS on movement between three groups

Fig. 3: Graphical representation of changes in mean arterial pressure between three groups

Fig. 4: Graphical representation of changes in heart rate between two groups
All patients were hemodynamically stable in three groups in the present study (p>0.05), however, the incidence of bradycardia was recorded more in patients receiving dexamethasone (10%) than dexamethasone (3.3%) and none of the patient in the control group. This can be explained by the action of dexamethasone on presynaptically mediated inhibition of norepinephrine release at the neuroreceptor junction and its vagomimetic action. These effects are more significant when given intravenously than with other routes. Similar results were also observed by other authors in their studies [14,17].

Dexamethasone also has anxiolytic and sedative effects which can be beneficial in patients undergoing long-duration surgeries, while higher sedation scores may be harmful in elderly and high-risk patients owing to risk of respiratory depression [22]. In the present study Ramsay Sedation Score (RSS) was compared amongst three groups at different time intervals which was found to be statistically insignificant (p>0.05). However, patients who received dexamethasone had increased mean RSS as compared to the control and dexamethasone group. Similarly higher sedation score in patients receiving dexamethasone as adjuvant was also reported in different studies [14,21,23].

Incidence of complications is more in blind TAP block technique than USG-guided TAP blocks. USG-guided drug administration allows accurate deposition of local anesthetic in the correct neurovascular plane and avoid procedure-related complications such as injury to surrounding viscera, transient femoral nerve palsy, and high volume of drug used which can cross the serum toxic levels [23-25].

The number of patients having nausea and vomiting was more in control group (16%) than in patients receiving dexamethasone (10%) and dexamethasone (6.6%) Gupta et al. [15], Deshpande et al. [16], and Secervi et al. [19] also reported decreased incidence of nausea and vomiting in the dexamethasone group. The antiemetic effect of dexamethasone can be attributed to its anti-inflammatory effect or direct central action at the solitary tract nucleus [26]. Shivering was observed in 10% of patients of group C while it was only 6.6% in adjuvants groups (p<0.05). Other side effects such as headache and backache were also reported in group C (16%) while it was 13% in each adjuvant group which could be due to the SAB. No other drug or procedure-related side effects like injury to surrounding viscera, hematoma, or LA toxicity were not reported in any group. The observations of other studies [15,18,20] are in accordance to present study which strengthens the efficacy and safety of USG-guided TAP block.

In the present study, all patients were satisfied regarding postoperative analgesia. However, majority of patients in group D1 and D2 reported excellent analgesia (p<0.05) than group C (15%). Similarly, studies were done by Sachdeva and Sinha [20] and Abdelaal et al. [5] also reported that the addition of dexamethasone and dexamethasone as adjuvant in TAPB resulted in excellent patient satisfaction score as compared to the control group.

Major strengths of the present study were the prospective randomized double-blind trial design with a follow-up until 24 h and extensive literature search. However, the study has few limitations. First, a relatively small sample size of ASA grade 1 and 2 patients only who were operated under SAB. A larger sample size including high-risk patients under general anesthesia and using different doses of adjuvants to local anesthetics may be needed to investigate the extent and efficacy of TAPB. Second, the time at which the TAPB began to work and the time at which the sensory effect of intrathecal block began to wear off could not be differentiated, which may be important in assessing a successful TAPB.

CONCLUSION

TAP B is effective and safe method for providing postoperative analgesia following inguinal herniorrhaphy. Dexamethasone and dexametomidine both prolonged the duration of postoperative analgesia when used as adjuvant to levobupivacaine and found to have no statistically significant difference.

AUTHORS’ CONTRIBUTION

All the authors contributed to the preparation of the final manuscript.

CONFLICT OF INTEREST

There is no conflict of interest.

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Nil.

REFERENCES


