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EFFECT OF ADDITION OF DEXAMETHASONE TO ROPIVACAINE ON POST-OPERATIVE ANALGESIA IN ULTRASONOGRAPHY GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK IN PATIENTS UNDERGOING LSCS

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ABSTRACT **Introduction:** A common regional anaesthetic method for postoperative analgesia in patients having various abdominal procedures, such as lower segment cesarean section (LSCS), is transversus abdominis plane (TAP) block. In order to block the sensory nerves supplying the anterior abdominal wall, local anesthetics are deposited into the space between the transversus abdominis and internal oblique muscles. **Aims:** The aim of our study is to clearly depict the adjuvant efficacy of dexamethasone with 0.2% Ropivacaine on the duration of postoperative analgesia and its quality. **Materials and methods:** This is a Randomized comparative study. It's conducted from February 2023-August 2023. Patients undergoing caesarean section in hospitals attached to Bangalore medical college and research institute, Bangalore. This prospective, randomized comparative study will be performed after obtaining institutional and informed consent from the patients. In this patients will be allocated into two groups, randomly. Each group comprised of patients 90. **Result:** The demographic parameters were comparable within both groups. In our study, the meantime for the first request of rescue analgesic was 10.2±2.5 hrs in group D when compared with 6.1±1.1 hrs in group R, the difference of 4 hrs with $p < 0.0001$ which was statistically significant. Group D also had lower pain scores and required fewer doses of rescue analgesia compared to Group R in 24 hr study period. **Conclusion:** The addition of dexamethasone to 0.2% ropivacaine in a Transverse Abdominis Plane (TAP) block for patients undergoing lower abdominal cesarean sections significantly extended postoperative analgesia and reduced the need for opioid consumption. This combination not only provided prolonged pain relief but also demonstrated notable opioid-sparing effects, enhancing overall patient recovery and comfort.

KEYWORDS : Dexamethasone, Ropivacaine, Post-operative analgesia and Patients

INTRODUCTION

Minimizing opioid usage during surgery and preventing opioid-related adverse effects—the most significant of which are postoperative nausea, vomiting, and respiratory depression—are two issues faced by anesthesiologists. Another is postoperative pain from abdominal procedures, which, if not adequately managed, can have detrimental immediate effects such as abnormal physiological reactions and long-term consequences such as chronic pain and delayed recovery.[1] As a result, several strategies have been used, including peripheral nerve blocks, NSAIDS, neuraxial painkillers, and systemic opioids. It has been discovered that systemic opioids do not produce as good of an analgesic as epidural and peripheral procedures employing local anesthetic agents. Moreover, the use of these techniques may significantly lower morbidity and mortality.[2]

Peripheral nerve blockade has become more widely used these days due to its ability to reduce postoperative pain as measured by visual analog scale scores, reduce the need for both perioperative and postoperative analgesics, reduce the incidence of nausea, reduce the length of stay in the post-anesthesia care unit, and improve patient satisfaction.[3]

Postoperative pain is one of the difficulties to manage. Around 75% of patients are in pain, even after discharge. Surgical procedures cause local tissue damage, which leads to the release of prostaglandins, histamine, serotonin, bradykinin, substance P, and other mediators, production of noxious stimuli, and irritation of free nerve endings and nociceptors leading to nociceptive pain. To block the anterior division of T7-L1 nerves, a transversus abdominis plane block involves applying local anesthetic in the space between the transversus abdominis and internal oblique muscles. It is advised to employ this strategy while doing lower abdominal procedures.[4,8] The USG-guided technique and the double pop technique are the two TAP block approaches. The triangle of petit, which is palpably positioned in the flank next to the iliac crest, is where the double pop technique is used. After inserting a needle through the triangle perpendicular to the skin, which will cause a popping sound, LA is injected. With USG-guided imaging, the injected fluid, the advancing needle, and the muscle layers are all immediately visible.[5] The benefits include low adverse effects, long duration, opioid-sparing, good analgesic efficacy, and technical simplicity. A voltage-gated sodium channel blocker is ropivacaine. More thoroughly than A beta fibers, which regulate motor function, it inhibits A-delta and C fibers, which transmit pain.[6]

As an adjuvant to local anaesthetics in different nerve blocks, dexamethasone is a highly selective glucocorticoid and a strong anti-inflammatory medication that can prolong the duration of analgesia and motor block with minimal side effects, such as post-operative nausea and vomiting.[7]

MATERIALS AND METHODS

This randomized comparative study was carried out between February 2023 and August 2023 following approval from the Institutional Ethics Committee. The study included 90 parturients classified as American Society of Anesthesiologists (ASA) physical status II, all of whom underwent lower segment cesarean section (LSCS) under spinal anesthesia. The participants were between 18 and 35 years old and provided informed consent to participate. Exclusion criteria were refusal to participate, known allergies to paracetamol, diclofenac, or tramadol, hypersensitivity to local anesthetics, history of bleeding disorders, use of anticoagulants, chronic pain, severe systemic diseases, infection at the site of the transversus abdominis plane (TAP) block, undergoing any additional surgical procedures other than LSCS, or requiring general anesthesia for the procedure.

Participants were randomly divided into two groups of 45 using computer-generated random numbers. Both groups received a bilateral TAP block after one hour of spinal anaesthesia. Group R received a TAP block at the T10 level with 20 ml of 0.2% ropivacaine, while Group D received the same dose of 0.2% ropivacaine with the addition of 4 mg (1 ml) of dexamethasone. Demographic data, including age, weight, height, body mass index (BMI), ASA grade, and relevant medical history (such as diabetes and cardiovascular disease), were collected. Additionally, all participants were preoperatively instructed on how to use the visual analog scale (VAS) for pain assessment.

Upon arrival in the operating theatre, baseline measurements of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and oxygen saturation (SpO_2) were recorded and continuously monitored. An 18-gauge intravenous cannula was used to establish vascular access, and all patients received 20 ml/kg of crystalloid solution (Ringer's lactate) before spinal anaesthesia. Spinal

anaesthesia was performed in the left lateral position using 2 ml of 0.5% bupivacaine heavy at the L3-L4 level with a Quincke spinal needle. Patients were positioned supine with a 15-degree wedge under the right buttock, and supplemental oxygen was administered at 4 L/min via face mask until the conclusion of surgery. The level of the sensory block was checked every two minutes using cold ethyl chloride spray, and surgery commenced once the block reached the T6 level.

After the surgery, approximately one hour after the administration of spinal anaesthesia, a bilateral TAP block was performed under strict aseptic conditions using ultrasound guidance. The ultrasound probe was placed transversely on the abdominal wall and slid towards the mid-axillary line between the costal margin and iliac crest, visualizing the muscle layers. The needle was inserted in-plane from the anteromedial side of the probe, passing through the adipose tissue and the external and internal oblique muscles. The tip was positioned in the superficial layer of the transversus abdominis plane, where the local anaesthetic solution (ropivacaine, with or without dexamethasone) was injected, visualized as a hypo echoic area between the internal oblique and transversus abdominis muscles. The same procedure was repeated on the opposite side.

Postoperatively, HR, SBP, DBP, SpO2, and VAS scores were recorded at regular intervals: 5, 10, 15, and 30 minutes, and at 1, 2, 3, 5, 7, 9, 12, and 24 hours. Rescue analgesia (50 mg tramadol in 100 ml normal saline over 20 minutes) was administered upon patient request or when the VAS score exceeded 4, with a minimum interval of 4 hours between doses. Data on the time to first rescue analgesia (the time between the end of block administration and the patient's first request for pain relief) and the total amount of rescue analgesia required within 24 hours were collected.

Pain severity was evaluated using the VAS scale (0 = no pain, 10 = worst possible pain), and assessments were conducted at the same time points mentioned earlier. The primary outcome of the study was to compare the time to first rescue analgesia between the two groups, while secondary outcomes included the total amount of rescue analgesia required and the VAS scores at different time points. A power analysis based on a previous study by Akkaya et al[11]. provided standard deviations of 4.8 and 7.8 hours for the time to rescue analgesia between the two groups. To detect a minimum difference of 4 hours between groups with 80% power, a sample size of 41 participants per group was calculated. To account for potential dropouts, 45 cases were included in each group. Statistical analysis was performed using SPSS version 17.0, with continuous variables presented as mean ± SD and categorical variables as numbers and percentages. Comparisons of normally distributed continuous variables were made using the Student's t-test, while categorical variables were compared using the Chi-square test or Fisher's exact test where appropriate. A p-value < 0.0001 was considered statistically significant.

RESULT

The study included 90 patients, with 45 in Group R, who received an ultrasound-guided TAP block using 20 ml of 0.2% ropivacaine, and 45 in Group D, who received 20 ml of 0.2% ropivacaine combined with 4 mg (1 ml) of dexamethasone. There were no significant differences between the two groups in terms of demographic characteristics such as age, weight, and height (Table 1). Additionally, there were no statistically significant differences between the groups regarding heart rate, systolic blood pressure, or diastolic blood pressure.

Table 1: Demographic data were comparable in both the groups

PARAMETER	GROUP R(n-45) Mean ±SD	GROUP D(n-45) Mean ±SD	P-VALUE
Age (years)	25.43±2.51	25.9±2.16	0.443
Weight (kg)	55.26±6.02	57.63±6.11	0.136
Height (cm)	154±4.05	155.5±3	0.237
Heart rate (/min)	79.04±4.2	78.68±3.46	0.261
SBP (mmHg)	126.43±5.67	126.91±4.58	0.237
DBP (mmHg)	78.24±4.50	78.98±4.20	0.433

SBP-systolic blood pressure ; DBP-Diastolic blood pressure

Table 2: time for first rescue analgesic and total tramadol consumption in 24hr

	GROUP R(n-45) Mean ±SD	GROUP D(n-45) Mean ±SD	P-VALUE
Time for first rescue analgesic	6.1±1.1	10.2±2.5	<0.0001
Total tramadol consumption	106.7±34.7	73.33±25.2	<0.0001

In our study, the duration of sensory blockade, measured by the time to first request for rescue analgesia, was significantly longer in Group D (10.2 ± 2.5 hours) compared to Group R (6.1 ± 1.1 hours), as illustrated in Figure 1.

Patients in Group D, who received a TAP block with 0.2% ropivacaine and 4 mg dexamethasone, had a markedly reduced need for additional analgesia compared to those in Group R, who received only 0.2% ropivacaine. The mean tramadol requirement was significantly lower in Group D (73.33 ± 25.2 mg) compared to Group R (106.7 ± 34.7 mg), with this difference being statistically significant (P = 0.0001) as shown in Figure 2.

When comparing pain scores between the two groups using the Visual Analogue Scale (VAS) at regular intervals—starting immediately after the block, every 15 minutes for the first hour, then hourly for the next four hours, and at 5, 7, 9, 12, and 24 hours postoperatively—a notable difference was observed. Group D, which received the ultrasound-guided TAP block with ropivacaine and dexamethasone, consistently exhibited significantly lower VAS scores compared to Group R (plain ropivacaine). This difference was most pronounced between the 5th and 7th postoperative hours, where Group D showed superior analgesic efficacy, with a p-value of less than 0.0001, confirming the enhanced pain control provided by the addition of dexamethasone to the TAP block. (Figure 3)

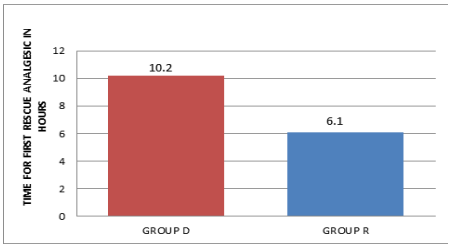

FIGURE 1: Time for first rescue analgesic in hours

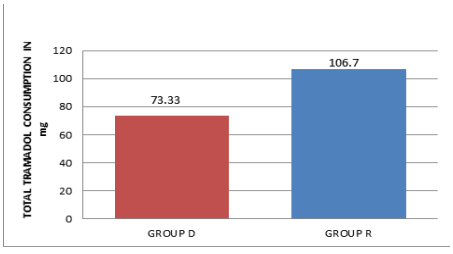

FIGURE 2: Mean tramadol requirement in milligrams in the first 24 h after caesarean delivery

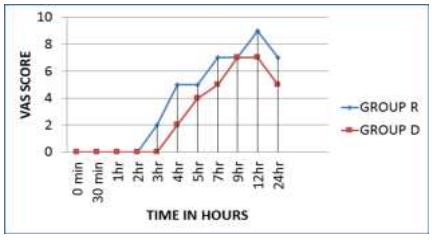

FIGURE 3: Comparison of visual analogue score between Group D and Group R

DISCUSSION

It's a randomized comparative investigation. The dates of operation are February 2023–August 2023. Patients having cesarean sections performed in hospitals affiliated with Bangalore Medical College and Research Institute. Once the patients' informed permission and institutional consent have been obtained, this prospective, randomized comparison study will proceed. Patients will be randomly assigned to one of two groups in this. Each group had ninety patients.

Caesarean section is a major surgery after which substantial postoperative pain is anticipated. The provision of effective analgesia is important to facilitate early ambulation, infant care and prevention of postoperative morbidity. [12]

A multimodal approach to postoperative analgesia after caesarean section is required. Postoperative pain is often treated with NSAIDS, systemic or neuraxial opioids. They are associated with side effects like nausea, vomiting and pruritus which reduces overall patient satisfaction.[12,13]

Direct blockade of the neural afferent supply of the abdominal wall such as abdominal field blocks, ilioinguinal and hypogastric nerve blocks provide significant postoperative analgesia in patients undergoing caesarean section. However, the lack of clearly defined anatomical landmarks make the abdominal wall blockade difficult in patients undergoing caesarean section and so ultrasonogram is used.

The use of ultrasound guided nerve blocks have become an integral part of post operative pain management in modern day practice ,unless there is a contraindication for it. Ultrasound guided Transverse abdominis plane(TAP) block has been commonly employed for pain relief in lower abdominal surgeries. The Transverse Abdominis Plane (TAP) block was first introduced by Kuppuvelumani et al. [14] in 1993, with its formal documentation occurring later in 2001 by Rafi[15]. Rafi's description involved delivering local anesthetic into the TAP using anatomical landmarks, specifically identifying the lumbar triangle of Petit, near the iliac crest. In 2007, Hebbard [5] and colleagues advanced this technique by introducing an ultrasound-guided (USG) approach, allowing for enhanced visualization. In this method, the ultrasound probe is placed transversely on the abdominal wall to clearly identify the three muscle layers. The probe is then moved toward the mid-axillary line just above the iliac crest, over the triangle of Petit. Using an in-plane technique, the needle is advanced medially. This posterior approach is the one utilized in our study.

Dexamethasone has long been utilized as an adjuvant in peripheral nerve blocks to enhance the effects of local anesthetics. However, a thorough review of the literature reveals an absence of studies specifically examining the use of dexamethasone to augment the analgesic efficacy of a TAP block with 0.2% ropivacaine in patients undergoing lower segment cesarean section (LSCS). Therefore, this study was designed to assess whether the addition of dexamethasone to ropivacaine improves both the quality and duration of analgesia in TAP blocks.

Results showed that adding dexamethasone significantly extended the duration of the TAP block (Group D: 10.2 ± 2.5 hours vs. Group R: 6.1 ± 1.1 hours), consistent with findings from previous studies. Dexamethasone likely exerts its analgesic effect by inhibiting the transmission and neural activity of nociceptive C-fibers, which prolongs the anesthetic duration. While the use of steroids as adjuvants in regional blocks is known to extend analgesia, the effects vary based on factors such as dexamethasone dosage, the type and concentration of local anesthetic, and the block site.

Our findings align with those of Shrama et al.[16], who demonstrated that the time to first analgesic request (TFA) was significantly longer in the dexamethasone group (547.50 minutes) compared to the ropivacaine-only group (387.50 minutes). This further supports the conclusion that adding dexamethasone to a TAP block extends the duration of sensory blockade. Similarly,[17] another study observed that dexamethasone significantly prolonged analgesia in interscalene blocks using ropivacaine [11.8 (9.7-13.8) hours vs. 22.2 (18.0-28.6) hours] and bupivacaine [14.8 (11.8-18.1) hours vs. 22.4 (20.5-29.3) hours]. It also found that dexamethasone had a more pronounced effect on prolonging analgesia when combined with ropivacaine than with bupivacaine.

Furthermore, our results are consistent with the study by Gupta et al.[10], where the time to first rescue analgesia was significantly longer in the dexamethasone group (19.04 ± 4.20 hours) compared to the ropivacaine-only group (11.62 ± 3.80 hours), with a highly significant p-value of 0.001. These findings highlight the enhanced duration of analgesia provided by the combination of dexamethasone with ropivacaine in TAP blocks, as compared to the use of ropivacaine alone.

The addition of dexamethasone to ropivacaine in TAP block led to a significant reduction in tramadol consumption, with Group D using 73.33 ± 25.2 mg compared to 106.7 ± 34.7 mg in Group R. This reduction in opioid use is consistent with the findings of Gupta et al.[10], who reported nearly a 50% decrease in analgesic consumption in the dexamethasone group (35.56 ± 39.54 mg) compared to the ropivacaine-only group (86.67 ± 30.55 mg). Additionally, Shrama et al.[16] noted that the cumulative opioid consumption over 24 hours was significantly lower in Group D (223.33 ± 56.83 mg), which closely aligns with our results, further supporting the analgesic benefit of adding dexamethasone to ropivacaine in TAP blocks.

In our study, the Visual Analogue Scale (VAS)[9] was utilized to measure postoperative pain, a well-established method for assessing pain in patients undergoing cesarean sections and other surgical procedures. Pain scores in both groups were similar in the immediate postoperative period and up to 3-5 hours post-surgery, indicating that both Group D and Group R were comparably effective in providing initial pain relief. However, from 5-7 hours postoperatively, pain scores were significantly higher in Group R, necessitating the administration of rescue analgesia.

Our study found that VAS scores were consistently lower in Group D compared to Group R at all observed time points up to 9-11 hours postoperatively, reflecting the superior analgesia provided by Group D. These findings align with those of Shrama et al.[16], who also reported significantly lower VAS scores in the group D from 6 to 24 hours postoperatively, further supporting the conclusion that Group D offers better and more sustained analgesia compared to Group R.

Additionally, our results are consistent with those of Gupta et al.[10], who reported significantly lower VAS scores for both somatic and visceral pain in Group D from 6 to 24 hours postoperatively. Similarly, a study[18] found that dexamethasone - bupivacaine in TAP block had significantly lower postoperative pain scores than bupivacaine in patients undergoing radical cystectomy.

The absence of block or drug-related complications, such as trauma to surrounding viscera, hematoma, or local anesthetic (LA) toxicity, in both groups highlights the potential benefits of using ultrasound guidance. By providing better visualization of the abdominal anatomy, real-time needle tracking, and monitoring of LA spread, ultrasound likely improves the accuracy and safety of the block, reducing the chances of failure.

CONCLUSION

We came to the conclusion that the research on the addition of dexamethasone to 0.2% ropivacaine significantly extends the duration of analgesia in transversus abdominis plane (TAP) blocks for patients undergoing lower segment cesarean sections (LSCS). This combination not only enhances pain control but also provides opioid-sparing effects, reducing the need for postoperative opioids. As a result, patients experience improved postoperative recovery, contributing to greater maternal satisfaction and overall comfort during the recovery period.

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