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Efficacy of Transversus Abdominis Plane Block for Post-operative Analgesia Following Lower Segment Cesarean Section

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Abstract

Background and Objective: Transversus abdominis plane (TAP) block is a recently introduced regional technique that blocks abdominal wall neural afferents between T6 and L1 and thus can relieve pain associated with an abdominal incision of lower segment cesarean section. This study was conducted in 60 female patients to assess visual analogue scale (VAS) for pain score, requirements of rescue analgesics, patient's and surgeon's satisfaction score, side effects and complications if any. *Method:* After institutional review board approval and informed written consent from patients, Patients were randomly allocated to one of the two groups of 30 patients each. In Group T (TAP block with 15 ml of 0.25% Bupivacaine bilateral + Diclofenac Sodium 75 mg intravenous 8 hourly) given and in Group C (Diclofenac Sodium 75 mg Intravenous 8 hourly) given. The assessment of presence and severity of pain was done for 24 hours. At any point of time if VAS is ≥ 4, intravenously Paracetamol 1 gm was given to the patient as a rescue analgesic. *Result:* The mean VAS pain Score was comparable in each group and difference was significant statistically at 6, 8, 10, 12 hours ($p<0.05$). Requirement of rescue analgesia was reduced in patients of group T as compared to patients of group C. Hemodynamics remained stable in both the groups. *Conclusion:* TAP block as a part of multimodal analgesic regimen for post cesarean delivery provided reliable and effective analgesia in this study, and no complications due to the TAP block were detected.

Keywords: Transversus abdominis plane (TAP); Visual analogue scale; Diclofenac; Postoperative pain; Analgesia.

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Introduction

Cesarean section is one of the most commonly performed surgical procedures [1]. It accounts for more than one-fourth of all births worldwide [2]. After cesarean delivery substantial postoperative discomfort and pain is usually described as moderate to severe by most patients [3]. The provision

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of effective postoperative analgesia is of key importance to reduce postoperative stress response and associated morbidity and accelerates recovery from surgery [4,5,6]. It facilitate early ambulation and infant care which includes breast feeding, care of baby and mother-baby bonding. Risk of thrombo-embolism is increased during pregnancy which is aggravated by immobility due to pain to the patients [7]. The analgesic regimen needs to meet the goals of providing safe, effective analgesia, with minimal side effects to the mother and her child [8].

Pain of cesarean section essentially has two components: somatic (from abdominal wall incision) and visceral (from the uterus). A significant component of pain experienced by the patients is derived from abdominal wall incision [9]. Systemic or neuraxial opioids are the mainstay for treating postoperative pain, as they are effective against both the components. However, they are associated with a number of undesirable side effects such as nausea, vomiting, pruritus, constipation, and respiratory depression [10,11].

Non- steroidal anti- inflammatory drugs (NSAIDS) like Diclofenac Sodium relieves visceral component of pain through their action via inhibition of Prostaglandin (PG) synthesis, but it is insufficient for relieving somatosensory pain of abdominal wall incision.

Transversus abdominis plane (TAP) block is a recently introduced regional technique that blocks abdominal wall neural afferents between T6 and L1 and thus can relieve pain associated with an abdominal incision [12,13].

TAP is a neurovascular plane located between the internal oblique and transverse abdominis muscles and nerves supplying abdominal wall pass through this plane before supplying anterior abdominal wall [14]. Therefore, if the local anaesthetic is deposited in this space, myocutaneous sensory blockade results [12,13]. The benefits of TAP block include the avoidance of neuraxial analgesic techniques and their associated risk, as well as a reduction in opioid consumption. As the side-effects of opioids are dose dependent, reducing postoperative opioid requirements could significantly reduce the incidence of opioid-related problems, such as sedation, nausea, vomiting, urinary retention, respiratory depression, delayed recovery of colonic mobility, and prolonged postoperative ileus [15,16].

This study was aimed to assess duration of post-operative analgesia, haemodynamic parameters & complications after lower segment cesarean section with primary objectives were,

1) Visual Analogue Scale (VAS) score to assess the quality of pain.
2) Frequency and duration of rescue analgesia required in 24 hours.
3) Patient's satisfaction score.
4) Surgeon's satisfaction score.
5) Time of ambulation & time of starting of breast feeding.

And the secondary objectives were,

1) Effect on hemodynamic variables like Heart Rate (HR), Mean Arterial Pressure (MAP), Oxygen saturation (SpO_2).
2) Side effects & Complications if any.

Materials and Methods

After Institutional Review Board (IRB) approval and informed written consent from the patient, this randomized controlled, double blind clinical study was carried out in sixty patients in tertiary care hospital from April 2016 to May 2017 with the following inclusion criteria.

1. Informed written consent for participation in study.

2. Age: 20-35 years.

3. Gender: Antenatal female patients scheduled for elective or non-urgent lower segment cesarean section.

4. ASA physical status I and II.

And the patients who refusing to give consent, have contraindications to Spinal anaesthesia like, local infection or sepsis at the site of Lumbar puncture, bleeding disorders, thrombocytopenia, space occupying lesions of the brain, anatomical disorders of the spine, hypovolaemia e.g. following massive haemorrhage, allergy to local anaesthetic drugs and NSAIDS, patient on any form of analgesics therapy and BMI ≥ 25 kg/m^2 were excluded from the study.

Preoperative preparation:

Patients were randomly allocated to one of the two groups of 30 patients each by computer generated random no.

Group T (n=30) – TAP block with 15 ml of 0.25 % Bupivacaine bilateral

+ Diclofenac Sodium 75 mg intravenous 8 hourly.

Group C (n=30) – Diclofenac Sodium 75 mg Intravenous 8 hourly.

In preanaesthetic preparation room, Standard monitoring for Heart Rate (HR), Non Invasive Blood Pressure (NIBP), Peripheral oxygen saturation (SpO_2) was established and baseline vital parameters was recorded then peripheral intravenous line was secured with 18G venous cannula.

Premedication

All patients were pre-loaded with Ringer Lactate (10 ml/ kg body weight) before starting the surgery and were received subarachnoid block with 2 ml of 0.5% heavy hyperbaric bupivacaine in L3-L4 Inter spinous space with 23 G spinal needle. Surgery was started after adequate sensory and motor block was achieved.

At the end of surgery, Patients in group T were received TAP block. After keeping the Patients in the supine position, the iliac crest was palpated from anterior to posterior until latissimus dorsi muscle insertion could be felt. Triangle of Petit was located (anteriorly bounded by external oblique and posteriorly by latissimus dorsi muscle and inferiorly by iliac crest). A 22 gauge 5 cm long blunt tip regional anesthesia needle was inserted in the triangle of Petit just above the iliac crest at right angle to the coronal plane until first resistance was felt. This indicated that the needle tip pierced external oblique muscle. The needle was further advanced gently in the same direction until "pop" sensation was felt, which signaled entry into facial plane between external and internal oblique muscles. Further advancement resulted in 2nd "pop" and this indicated entry into TAP. After careful negative aspiration 15 ml of 0.25% Bupivacaine (group T) was slowly injected in 5 ml increments. The block was given on the other side using the same method.

In all the patients, incision site was covered with a pressure dressing and was shifted to Post Anaesthetic Care Unit.

In both groups, the patients received standard analgesia according to obstetric department protocol consisting of Diclofenac sodium 75 mg intravenous 8 hourly, first dose was given at the end of surgery. (i.e. time 0).

The assessment of presence and severity of pain (both on rest and on passive Flexion of hip and knee) was done immediately after transfer to Post Anaesthetic Care Unit (PACU) and at 0, 1, 2, 4, 6, 8, 10, 12, 16, 20 and 24 hours after completion of surgery. Pain severity was measured by Visual Analog Scale (VAS 0=No pain, 10=Worst pain). At any point of time if VAS was ≥ 4, intravenously Paracetamol 1 gm was given to the patient as a rescue analgesic.

Visual Analogue Scale (VAS) For Pain

VAS is a continuous scale comprised of a horizontal (HVAS) or vertical (VVAS) line, usually 10 centimeters in length. It is self completed by the respondent, is asked to place a line perpendicular to the VAS line at the point that represents their pain intensity.

Scoring: Using a ruler, the score is determined by measuring the distance on the10 cm line. *Figure 1:*

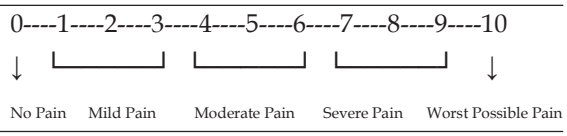

Fig. 1: Visual Analogue Scale (VAS) For Pain

Patient's and Surgeon's satisfaction score were shown in table below:

Table 1: Patient's and surgeon's satisfaction score

Score	Poor	Good	Excellent
Patient's satisfaction score	1	2	3
Surgeon's satisfaction score	1	2	3

Statistical analysis

Data collected was analysed as mean ± SD and % which ever applied. Statistical analysis was done by graph pad instat 3.0 software. Inter group comparison between two groups was done using the unpaired student T test for quantitative data and chi square test for qualitative data ($p < 0.05$ was considered as statistical significant).

Observations and results

Demographic profile

Age Distribution

Table 2: Mean age distribution in each group

Patient characteristic	Group T	Group C	p value
Age (years) (mean ± SD)	24.43 ± 2.70	23.5 ± 2.95	0.2068

The mean age of the patients in Group T and Group C was 24.43 ± 2.70 years and 23.5 ± 2.95 years respectively and difference was not significant

statistically (p>0.05) (Table 2).

Comparison of weight

Table 3: Mean weight distribution in each group

Patient characteristic	Group T	Group C	P value
Weight (kg) (mean ± SD)	55 ± 5.24	53.93 ± 4.38	0.3964

The mean weight in Group T and Group C was 55 ± 5.24 and 53.93 ± 4.38 kgs respectively and difference was not significant statistically (p>0.05) (Table 3).

VAS pain score

Table 4: Mean VAS pain score comparison in each group

Vas Score	Group T (n=30) (mean ± SD)	Group C (n=30) (mean ± SD)	p Value
0 hr	0.00 ± 0.00	0.00 ± 0.00	0.00
1 hr	0.00 ± 0.00	0.03 ± 0.18	0.00
2 hr	0.00 ± 0.00	0.73 ± 0.52	0.00
4 hr	0.00 ± 0.00	1.26 ± 0.44	0.00
6 hr	0.03 ± 0.18	1.9 ± 0.54	<0.0001
8 hr	0.1 ± 0.40	2.66 ± 0.95	<0.0001
10 hr	0.23 ± 0.56	1.2 ± 0.61	<0.0001
12 hr	1.16 ± 0.64	2.0 ± 0.45	<0.0001
16 hr	2.16 ± 1.02	2.46 ± 0.62	0.17
20 hr	1.56 ± 0.50	1.7 ± 0.46	0.29
24 hr	2.3 ± 0.46	2.3 ± 0.46	>0.99

The mean VAS pain Score at 0, 1, 2, 4, 6, 8, 10, 12, 16, 20, 24 hours was comparable in each group and difference was significant statistically at 6, 8, 10, 12 hours (p<0.05) (Table 4).

Rescue analgesics

Group T- Test group

Group C- Control group

In group T, 6 patients required rescue analgesia at 16 hours while in group C, 8 patients required rescue analgesia at 8 hours, 1 patient required rescue analgesia at 10 hours, 1 patient required rescue analgesia at 12 hours, 1 patient required rescue analgesia at 16 hours (Fig. 2).

Patient's satisfaction score:

Table 5: patient's mean satisfaction score comparison in each group

Patient's satisfaction Score	Group T (n=30) (mean ± SD)	Group C (n=30) (mean ± SD)	P Value
POD1	2.7 ± 0.46	2.5 ± 0.50	0.1177

Patient's mean satisfaction score at POD1 was comparable in each group and not significant statistically (p>0.05) (Table 5).

Surgeon's satisfaction score

Table 6: surgeon's mean satisfaction score comparison in each group

Surgeon's satisfaction Score	Group T (n=30) (mean ± SD)	Group C (n=30) (mean ± SD)	p Value
POD1	2.86 ± 0.34	2.83 ± 0.37	0.7232

Surgeon's mean satisfaction score at POD1 was comparable in each group and not significant

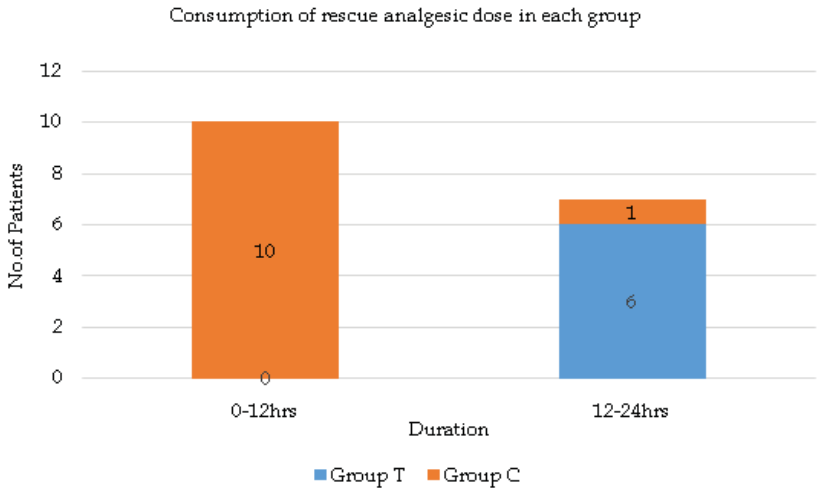

Fig. 2: Consumption of rescue analgesic dose in each group

statistically (p>0.05) (Table 5).

Comparison of Patients heart rate, mean arterial blood pressure and oxygen saturation at 0 min, 30 min, 1, 2, 4, 6, 8, 10, 12, 16, 20 and 24 hours was comparable in each group and difference was not significant statistically (p>0.05).

In our study there was no any side effects and complication noted after TAP block given.

Discussion

Effective postoperative pain control is an essential component of the care of the surgical patient. Inadequate pain control, may result in increased morbidity or mortality [21,22]. Evidence suggests that surgery suppresses the immune system and this suppression is proportionate to the invasiveness of the surgery [23,24]. Good analgesia can reduce this deleterious effect. The advantages of effective postoperative pain management include patient comfort and therefore satisfaction, early mobilization, fewer pulmonary and cardiac complications, a reduced risk of deep vein thrombosis, faster recovery with less development of neuropathic pain, and reduced cost of care.

Postoperative pain should be cured to alleviate nociception induced responses, such as the endocrine, metabolic and inflammatory responses to surgery which activates autonomic reflexes with adverse effects on organ function and reflexes leading to muscle spasm [25]. The autonomic over activity results in increase in heart rate, peripheral vascular resistance, arterial blood pressure and myocardial contractility which culminate in increased oxygen consumption from increased cardiac work. The combination of increased myocardial oxygen demand and decrease oxygen supply can be detrimental in patients with coronary artery disease and may lead to myocardial ischemia and infarction [26]. Untreated or poorly treated postoperative pain increases incidence of nausea and vomiting. Increased sympathetic activity can lead to increased urinary sphincter tone and subsequent urinary retention [26,27[. The somatic pathway stimulation activates hypothalamic-pituitary axis which is followed by secretions of pituitary hormones. The limitation of movement caused by pain lead to marked impairment in muscle metabolism resulting in muscle atrophy, fatigue and delayed return to normal muscle function [26,27]. Psychological consequences due to inadequate pain relief include anxiety, fear, anger, depression and reduced patient satisfaction as well. So, it is a prime duty of an anaesthesiologist to provide postoperative analgesia to make patient more comfortable and relax after surgery.

Pain after cesarean section is usually described as moderate to severe by most patients [17]. The provision of analgesic regimen needs to meet the goals of providing safe, effective analgesia, with minimal side effects to the mother and her child [8]. Pain of cesarean section essentially has two components: somatic (from abdominal wall incision) and visceral (from the uterus). A significant component of pain experienced by the patients is derived from abdominal wall incision [17].

A multimodal analgesic regimen is most likely to achieve these goals. single-shot neuraxial analgesic techniques using long-acting opioids, or patient-controlled epidural opioid administration produce effective analgesia but they are associated with a frequent incidence of side effects like nausea, vomiting and pruritus which reduce overall patient satisfaction.

Non- steroidal anti- inflammatory drugs (NSAIDS) like Diclofenac Sodium relieves visceral component of pain through their action via inhibition of Prostaglandin (PG) synthesis, but it is insufficient for relieving somatosensory pain of abdominal wall incision.

Transversus abdominis plane (TAP) block is a relatively new technique used in a multimodal approach that decreases the need of post operative analgesia after lower segment cesarean section by relieving somato sensory component of pain [20].

The present study was conducted to compare efficacy of TAP block along with Diclofenac sodium and Diclofenac sodium alone following lower segment cesarean section to assess post operative analgesia. We also compared amount of rescue analgesia required, patient's and surgeon's satisfaction score, side effects and Complications.

There is no significant difference statistically between the groups with regard to age and weight (p>0.05).

While comparing analgesic efficacy, in the present study VAS score was comparable in both the groups. The result was comparable with the previous study done by Uma Srivastava et al., [17] (2015) who showed vas scores were significantly lower up to 24 hours in patients received TAP block with 0.25% bupivacaine compared to no TAP block with 75 mg diclofenac 8 hourly and intravenous tramadol and the difference was found significant (p < 0.0001). The study done by John G. McDonnell et al., [8] (2008) showed

TAP block with ropivacaine compared with placebo reduced postoperative visual analogue scale pain scores. The study done by Mayank Chansoria et al., [18] (2015) showed the mean vas score was less in patients received TAP block with ropivacaine compared to patients received 0.9% saline and the difference was found highly significant ($p<0.05$) compared to control group. The study done by Maitreyi Gajanan Mankikar et al., [19] (2016) showed VAS score was reduced after TAP block with 0.5% ropivacaine for the first 8–10 hour post-operatively as compared to patients receiving placebo block. In the present study VAS score was comparable in both the groups and difference was significant statistically at 6,8,10,12 hours ($p<0.05$).

While comparing rescue analgesic requirement, in the present study, the number of patients requiring rescue analgesics compared in both the groups. The study done by Uma Srivastava et al., [17] showed requirement of rescue analgesia was reduced in study group as compared to control group and difference was significant statistically ($p < 0.0001$). The study done by John G. McDonnell et al., [8] showed requirement of rescue analgesia was reduced in study group as compared to control group and difference was significant statistically ($p < 0.001$). The study done by Roshan John et al. [28] (2017) showed the difference in mean time to rescue analgesia was not statistically significant when both the groups were compared ($p>0.05$). In the present study, the number of patients requiring rescue analgesics compared in both the groups, in group T, 6 (20%) patients against 11 (36.6%) patients in group C required rescue analgesics, though difference was not significant ($p>0.05$).

While comparing patient's and surgeon's mean satisfaction score, in the present study patient's mean satisfaction score at POD1 was comparable in each group ($p>0.05$). Surgeon's mean satisfaction score at POD1 was also comparable in each group ($p>0.05$).

Conclusion

This study concluded that, the Transversus abdominis plane block as a component of multimodal analgesic regimen provide reliable and effective post-operative analgesia, when combine with Diclofenac sodium relieves both somatosensory and visceral component of pain following lower segment cesarean section. It's also reduces requirements of rescue analgesia over 24 hours postoperatively. There were no any side effects and complication detected after TAP block given.

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