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ORIGINAL RESEARCH

A Comparison of Postoperative Analgesia after Caesarean Section between Ultrasound Guided Transversus Abdominis Plane (TAP) Block and Traditional Parenteral Opioid Analgesia

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ABSTRACT

Aim: To compare the effectiveness of post caesarean section pain relief between transversus abdominis plane block and conventional parenteral opioid analgesia by comparing visual analogue pain scores.

Material and methods: The current study is a prospective randomized interventional studyobservational study. The study was conducted over the period of DNB training for a period of three years. Total 100 patients of American Society of Anesthesiologists (ASA) Grade I and II aged 18 - 45 years scheduled to undergo lower segment caesarean section under spinal anesthesia were included in this study.

Results: It is observed that to compare the effectiveness of post caesarean section pain relief between ultrasound guided transversus abdominis plane block and conventional parenteral opioid analgesia by comparing visual analogue pain scores and total opioid consumption in 24 hours. A total of 100 patients, 50 in each group were included. The distribution of patients according to age between the groups. The mean age of patients of TAP and CONT groups was 25.62±2.19 and 25.64±2.31 years respectively. There was no significant (p>0.05) difference in age between the groups showing comparability of the groups in terms of age. Additionally, the distribution of patients according to ASA grade between the groups. More than half patients of both TAP (74%) and CONT (72%) group had ASA grade I.

Conclusion:This study was carried out to adding transversus abdominis plane block as a part of multimodal analgesia in patients undergoing caesarean section prolonged pain- free duration, decreased VAS pain scores, reduced the number of patients who required rescue analgesicamount of rescue analgesia required was much less in amount and prolonged the time to first request for analgesia.

Key words*:* Caesarean Section, Transversus Abdominis Plane Block, Analgesia

INTRODUCTION

Cesarean section is one of the commonly performed surgical procedures in the field of obstetrics. It accounts formore than one-fourth of all births worldwide.[1] The mostcommon undesirable outcome following cesarean section ispostoperative pain. Failure to treat the pain not only causesdistress to the mother but also affects mother-baby bonding, which, in turn, affects care and breastfeeding of the newborn.[2]

Post-operative analgesia is important after surgeryto avoid various complications such as venousthromboembolism, respiratory complications andprolonged hospital stay. Substantial pain and discomfortare anticipated after caesarean delivery; hence, analgesicregimen should ensure effective and safe analgesia.[3]The transversus abdominis plane (TAP) is the fascialplane between the internal oblique and transversusabdominis muscle containing the thoracolumbarnerves T10 to L1. The introduction of local anaestheticin this plane blocks these nerves (T10 to L1). Wehypothesised that ultrasonography (USG)-guided TAPblock reduces requirement of opioids and provideseffective and adequate analgesia.[4,5]

There are several methods to offer postoperative analgesiafor abdominal surgery, oral analgesics, patient-controlledintravenous analgesia (PCIA), patient-controlled epiduralanalgesia (PCEA), and regional nerve block.[5-7]

Conventional analgesic regimens use opioids administered through systemic and/or neuraxial routes. Neuraxial methods are effective and safe, but need to be performed by an experienced person and require very close monitoring.[8]

Opioids can also be delivered using intravenous or epidural patient-controlled analgesia (PCA). Patient controlled analgesia allows patients to have control over their pain management and hence improves their satisfaction with the therapy. However, unwanted effects like sedation, nausea and vomiting, pruritus and occasionally respiratory depression remain the major drawbacks of opioids. Secretion into breast milk is the additional concern in this population. Non-steroidal anti- inflammatory drugs (NSAIDs) and paracetamol can only supplement other modes of analgesia and are not sufficient on their own.[9,10]

Given these issues, peripheral nerve block techniques like transversus abdominis plane (TAP) block were introduced as an effective component of multimodal analgesia after caesarean delivery. These techniques not only reduced pain quite successfully but also eliminated some of the problems associated with the use of systemic opioids or central neuraxial blocks. Ultrasound guided transversusabdominis plane (TAP) block is one such effective method of providing post- operative analgesia for lower abdominal surgeries.[10-14]

The current study had the main aim to compare the effectiveness of post caesarean section pain relief between transversus abdominis plane block and conventional parenteral opioid analgesia by comparing visual analogue pain scores.

MATERIAL AND METHODS

The current study is a prospective randomized interventional study observational study. The study was conducted over the period of DNB training for a period of three years. After the approval of the Institutional Ethical Committee and written informed consent, 100 patients of American Society of Anesthesiologists (ASA) Grade I and II aged 18 - 45 years scheduled to undergo lower segment caesarean section under spinal anesthesia were included in this study. The main objective of the study was to compare the effectiveness of post caesarean section pain relief between transversus abdominis plane block and conventional parenteral opioid analgesia. To calculate the number of participants needed for this clinical study, the significance level was set at 95% ($\alpha = 0.05$) one sided, and the power of the test was set at 80% with a type II error (β) of 0.20.

PRE-ANAESTHETIC ASSESSMENT

A thorough preoperative evaluation of each patient was done.

A detailed history was taken including history of any major illness or disease in the past, details of pregnancy, past obstetric history, pregnancy outcome, post pregnancy and a general physical examination and systemic examination of each patient was performed to check the general wellbeing of each patient, and to exclude any major medical disorder, including any history of relevant drug allergy to local anesthetic, patients on anticoagulant therapy with INR>1.5, any history of abdominal flank infection. All routine biochemical, hematological and radiological investigations were done.

At the time of this checkup they were acquainted with the visual analogue scale (VAS) for pain scoring. A 10-cm visual analogue scale (VAS) has end points labeled 'no pain' and 'worst possible pain'. During this visit procedure was also explained to the patients and their doubts were also cleared.

ANAESTHESIA TECHNIQUE

PREPARATION AND PREMEDICATION

Routine pre-operative preparation consisted of fasting for 6-8 hrs. prior to surgery.

MONITORING

On arrival in the operation room standard monitoring equipment's were attached and their vitals were monitored using Agilent multi parameter monitor, which included:Continuous ECG lead 2., Heart Rate, Oxygen saturation by Pulse Oximeter, and Noninvasive blood pressure (Systolic BP, Diastolic BP and Mean BP).Base line readings of these parameters were noted just prior to induction of anaesthesia, after incision, completion of surgery, time of transversus abdominis plane block.

ANAESTHESIA TECHNIQUE

Patients were divided randomly into two groups by using blind sealed envelope technique method with 50 patients in each group: CONT group and TAP group.TAP group received transversus abdominis plane block after caesarean section.CONT group received no transversus abdominis plane block after caesarean section.

The CONT group acted as control and was given spinal anaesthesia with 0.5% bupivacaine heavy 3.0 ml in L3-L4 subarachnoid space with a 25G Quincke point spinal needle in sitting position but transversus abdominis plane block was not given in this group

Patients in TAP group received the same spinal anaesthesia, but after completion of surgery and before applying dressing on the wound, they were given transversus abdominis plane block by using high frequency linear probe of ultrasound that was kept horizontally on the flank at the level of umbilicus in anterior axillary line. Ultrasound probe in lateral approach of transversus abdominis plane block All the three layers of abdominal muscles were identified and a 23G 100mm needle attached with local anaesthetic mixture with a 50 mm extension line was introduced by in plane technique. When the tip of the needle reached the fascia between internal oblique and transversus abdominis, after careful aspiration to rule out intravascular placement, a test injection was made of 0.5ml, opening up of transversus abdominis plane was looked for and needle was adjusted if required accordingly and test injection was repeated, when the transversus abdominis plane was seen opening up,the whole amount of drug was injected. the same procedure was repeated on the other side. Needle entering transversus abdominis plane, the drug used was 0.25% bupivacaine 30 ml along with dexamethasone 4 mg in each side. since transversus abdominis plane block was mainly a pure sensory block and was giving it as a single shot, we wanted it to have the maximum duration.

as adding dexamethasone to local anaesthetic prolongs the duration of the block, hence we chosen to add it to the local anaesthetic mixture.[17]

STATISTICAL ANALYSIS

Detailed data of all subjects of case and control group were collected. After complete evaluation all findings were expressed in terms of Mean ± SD. Comparison between case group and control group was done using paired "t" test. All statistical analysis was done using SPSS software version 20.

RESULTS

The present study was conducted in the Department of Anaesthesia, Sarvodaya Hospital and Research Centre, Faridabad with the objective to compare the effectiveness of post caesarean section pain relief between ultrasound guided transversus abdominis plane block and conventional parenteral opioid analgesia by comparing visual analogue pain scores and total opioid consumption in 24 hours. A total of 100 patients, 50 in each group were included.Table-1 & Graph 1 shows the distribution of patients according to age between the groups. The mean age of patients of TAP and CONT groups was 25.62±2.19 and 25.64±2.31 years respectively. There was no significant ($p>0.05$) difference in age between the groups showing comparability of the groups in terms of age.Table-2 & Graph 2 shows the distribution of patients according to ASA grade between the groups. More than half patients of both TAP (74%) and CONT (72%) group had ASA grade I. There was no significant ($p>0.05$) difference in ASA grade between the groups showing comparability of the groups in terms of ASA grade.Table-3 & Graph 3 shows the comparison of heart rate between the groups across the time periods. There was no significant ($p>0.05$) difference in heart rate between the groups at 0 hour to 3 hours. Heart Rate was observed to be significantly ($p<0.05$) lower in TAP group than CONT group at 4 hours to 24 hours.Table-4 & Graph 4 shows the comparison of mean blood pressure postoperatively between the groups across the time periods. There was no significant ($p>0.05$) difference in mean blood pressure postoperatively between the groups at 0 hour to 3 hours. Postoperatively mean blood pressure was observed to be significantly ($p<0.05$) lower in TAP group than CONT group at 4 hours to 24 hours.

OBSERVATION TABLES

Table 1: Distribution of patients according to age between the groups

Groups	Age in years (Mean±SD)
TAP	25.62±2.19
CONT	25.64±2.31
p-value[1]	0.96

Table 2: Distribution of patients according to ASA grade between the groups

ASA grade	TAP (n=50)		CONT (n=50)		p-value[1]
	No.	%	No.	%	
Grade I	37	74.0	36	72.0	0.82
Grade II	13	26.0	14	28.0	

Table 3: Comparison of Heart Rate between the groups across the time periods

Time periods	TAP (n=50)	CONT (n=50)	p-value[1]
0 hour	76.62±5.00	76.60±5.77	0.98
1 hour	77.32±4.57	78.26±5.36	0.34
2 hours	77.50±5.54	77.12±6.58	0.75

3 hours	77.44±5.41	78.46±6.13	0.38
4 hours	74.62±7.45	79.22±6.46	0.001*
6 hours	78.08±8.04	81.14±5.47	0.02*
8 hours	76.12±6.28	81.32±6.34	0.001*
12 hours	76.94±7.74	86.18±3.86	0.001*
18 hours	75.26±4.74	86.36±4.23	0.001*
24 hours	73.24±4.08	82.04±6.55	0.001*

Table 4: Comparison of Postoperative mean blood pressure between the groups across the time periods

Time periods	TAP (n=50)	CONT (n=50)	p-value[1]
0 hour	98.02±2.69	98.02±3.42	1.00
1 hour	98.44±2.40	99.40±2.91	0.07
2 hours	98.36±3.18	99.34±2.88	0.11
3 hours	98.70±3.10	99.20±5.46	0.57
4 hours	97.54±5.06	99.48±4.62	0.04*
6 hours	98.04±2.61	101.90±2.80	0.001*
8 hours	98.60±2.37	101.04±2.16	0.001*
12 hours	98.26±2.57	101.36±2.29	0.001*
18 hours	97.26±1.92	100.62±2.40	0.001*
24 hours	96.86±2.45	100.06±2.18	0.001*

DISCUSSION

Cesarean section is a very common surgical procedure around the world. Cesarean sections represent globally about 15% of deliveries and reached 21.1% of deliveries in developed countries.[18]But the pain associated with it is the main hurdle that prevents the mother to cherish those golden moments of her life with her child and it also hampers care of newborn and mother child bonding.

Post cesarean pain has mainly two main parts, somatic and visceral pain. The somatic pain initiating from nociceptors in the abdominal section arises from deep and cutaneous structures, which are conducted through the anterior division of spinal segmental nerves of T10 to L1. These nerves run in anterior abdominal wall laterally in between the internal oblique and transversus abdominis muscle layers, and this is the type of pain that is usually more troublesome and that needs to be tackled more effectively to make patient comfortable in the postoperative period and adding transversus abdominis plane block to multimodal analgesia regime targets somatic pain and greatly helps patient in postoperative period in being comfortable and alert. The stimuli of the visceral uterine nociceptors arrive through afferent nerve fibers that ascend via the inferior hypogastric plexus and enter the spinal cord through the vertebrae T10- L1 spinal nerves and visceral pain is usually dull and aching in character which can be easily dealt with NSAIDS.[19,20]

Multimodal analgesia technique is best suited in this scenario as aim of this approach is to improve analgesia and to decrease the amount of opioids that is needed to achieve pain relief, thus decreasing the incidence of opioid-related side effects.[21]

The addition of the transversus abdominis plane (TAP) block as a part of multimodal analgesic technique for postoperative pain relief after caesarean section, decreased significantly the dosage of opioids as studied by Naveen et al 2017[22] and we had observed the same by adding transversus abdominis plane block to our analgesic regime.

After the initial description of the technique by Rafi (2001)[23], over the past few years, many investigations had thrown light on the advantages of the transversus abdominis plane (TAP)

block in decreasing the dosages of opioids and relieving of pain in patients of abdominal surgeries in the postoperative period.

Our study was conducted in the Department of Anesthesia, Sarvodaya Hospital and Research Centre, Faridabad with the objective to compare the effectiveness of post caesarean section pain relief between transversus abdominis plane block and conventional parenteral opioid analgesia by comparing visual analogue pain scores and total consumption of opioids in 24 hours A total of 100 patients were included. In TAP group 50 patients received transversus abdominis plane along with parenteral opioid analgesics but CONT group 50 patients received only parenteral opioid analgesics and no TAP block.

In our study, the mean age of patients of TAP and CONT groups was 25.62±2.19 and 25.64±2.31 years respectively. There was no significant ($p>0.05$) difference in age between the groups showing comparability of the groups in terms of age.

In the present study, more than half patients of both TAP (74%) and CONT (72%) group had ASA grade I. There was no significant ($p>0.05$) difference in ASA grade between the groups both groups were comparable in terms of ASA grade.

Our study found that there was no significant ($p>0.05$) difference in heart rate and postoperative mean blood pressure between the groups in the first three hours post-operatively. Heart rate and postoperative mean blood pressure were observed to be significantly ($p<0.05$) lower in TAP group than CONT group beyond 3 hours till the end of study period. This observation might be the result of the fact that the effect of spinal anaesthesia must not have worn off till 3 hours so there was no significant difference in heart rate and mean blood pressure between two groups.

Our study showed that there was no significant ($p>0.05$) difference in visual analogue scale between the groups during first three hours as effect of spinal anesthesia had not worn off till that time in both groups. VAS was observed to be significantly ($p<0.05$) lower in TAP group than CONT group at 4 hours to 24 hours. Owen et al (2011)[24] studied the impact of transversus abdominis plane block on 16 patients who were also given conventional analgesics and 18 women given only conventional analgesics, they reported that surgical transversus abdominis plane block was better in relieving the pain postoperative period than group treated with only conventional analgesics ($p< 0.01$), respectively, in addition to lowering in the consumed morphine in the control group. A meta-analysis done by Champaneria et al (2016)[25] in 2016 showed that the transversus abdominis plane block reduced the postoperative pain score after caesarean section.

Our study revealed that the time to first rescue analgesia was significantly ($p=0.0001$) higher among patients of TAP (19.82±6.28 hours) group compared to CONT (4.52±1.31 hours) group. during our study, time of rescue analgesia could have been much higher as beyond 24 hours we took that time as 24 hours in data sheet and this was done for mathematical reasons, had we taken the time of rescue analgesia as 0 for those who didn't need analgesia at all it would have artificially and drastically reduced the time to rescue analgesia and we cannot calculate with a value of infinity so we took that value as 24 hours which was the end of our study time but this still had the effect of reducing the average time of rescue analgesia but that was the best that could be done but as we were forced to give a time of 24 hours as time of rescue analgesia in those who did not need any rescue analgesia at all . In the study by Qian et al (2020) [26] showed that the time to first request for analgesia was prolonged (control: 7.10±1.21 vs. TAP; 11.60±2.11 h; $p<0.05$). Kakade and Wagh (2019) [27]also observed that the duration of postoperative analgesia in hours was significantly longer in the TAP block group compared with the control group (5.14±1.63 vs 2.61±0.89, $p< 0.001$). Salunke et al (2017)[28] showed that in patients receiving transversus abdominis plane block with 0.25% Ropivacaine (Group A), the requirement for analgesic significantly reduced as compared to those who did not receive the block (Group B).

Although as compared to other studies using transversus abdominis plane block ,our time to first rescue is much longer, this was due to reasons like firstly we added dexamethasone to TAP block which prolonged its action of analgesia, secondly we used 30 ml of 0.25% bupivacaine and this volume was more than other studies, then thirdly patients who didn't require rescue analgesia at all for 24 hours and beyond, we took that time as 24 hours in data sheet and this was done for mathematical reasons as explained above,fourth reason was as we had given preemptive analgesia in the form of TAP block that is as we had already given analgesia before the onset of painful stimulus with the goal of preventing central neural sensitization , overall pain scores were low as compared to situation in which we had not intervened. And difference of VAS scores from CONT group would have been higher had we not intervened with intravenous tramadol whenever VAS crossed 4.

Ultrasound guidance can confirm the position of the needle and thus improve the certainty and safety of the block that was the reason that we used ultrasound guided transversus abdominis plane block in our study for accuracy of location of needle placement and that increased the precision of block and decreased failure rate as compared to blind technique that was used earlier.[29]

Our study demonstrated that adding transversus abdominis plane block as a part of multimodal analgesia in patients undergoing caesarean section prolonged pain-free duration, decreased VAS pain scores, reduced the number of patients who required rescue analgesic and many patients didn't require rescue analgesia at all and amount of rescue analgesia required was much less in amount and prolonged the time to first request for analgesia.

CONCLUSIONS

We conclude that the present study that adding transversus abdominis plane block as a part of multimodal analgesia in patients undergoing caesarean section prolonged pain- free duration, decreased VAS pain scores, reduced the number of patients who required rescue analgesic, amount of rescue analgesia required was much less in amount and prolonged the time to first request for analgesia.

DISCLOSURE STATEMENT

This study is investigator initiated. The authors declare that they have no competing/conflict of interests in relation to this article.

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No financial support from an external agency was used for this study.

CONSENT FOR PUBLICATION

Not applicable.

Ethics approval and consent to participate

The study protocol was approved by the medical ethics committee of the S.P. Medical College, Bikaner, Rajasthan (State), India.

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