Research Paper

Efficacy of Trans Abdominis Plane (TAP) Block for Post-caesarean Delivery Analgesia: A Prospective Randomized Controlled Study

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Abstract

Background: Caesarean delivery is a major surgical procedure after which substantial post-operative pain and discomfort can be anticipated. A substantial component of pain experienced by patients is derived from abdominal wall incision. Currently multimodal analgesia technique involving abdominal field block with parenteral analgesia are becoming popular for these patients. Transversus abdominal plane (TAP) blockcan relieve pain associated with abdominal incision. We carried out this study to evaluate the efficacy of TAP block in providing post operative pain relief and the cumulative requirement of analgesic over first 48 hour in patients who underwent LSCS under spinal anaesthesia.

Methods: This prospective randomized controlled study was carried out with 60 patients posted for elective caesarean section, two groups with 30 patients each. Both groups were compared to see the effectiveness of Trans Abdominis Plane (TAP) Block as a method for post-operative multimodal analgesia technique using VAS score. Total number of rescue analgesia required upto 48hrs and total dose of rescue analgesia given in both the groups was also compared.

Results: The mean VAS score at rest andon movement was decreased significantly after Trans Abdominis Plane (TAP) Block. The total dose and number of rescue analgesia was also decreased significantly.

Conclusions: TAP block as a component of multimodal analgesia after caesarean section was effective in providing analgesia with delayed time for 1st rescue analgesia and reduction in total analgesic requirement in 1st 48 hr.

Keywords: Caesarean section, post-operative analgesia, Trans Abdominis Plane (TAP) Block.

Introduction

Caesarean delivery is a major surgical procedure after which substantial post-operative pain and discomfort can be anticipated and failure to treat it adequately may affect maternal-infant bonding, breast-feeding, as well as may expose the mother to risk of thromboembolism because of immobility. The provision of effective post-operative analgesia is of

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key importance to facilitate early ambulation, infant care, and prevention of post-operative morbidity.

A substantial component of pain experienced by patients is derived from abdominal wall incision. Nonsteroidal anti-inflammatory drug alone may be insufficient to treat post caesarean pain. Systemic or neuraxial opioid are effective for treating post-operative pain, but associated with number of side effects like nausea, vomiting, pruritus, constipation, and respiratory depression. Currently multimodal analgesia technique involving abdominal field block with parenteral analgesia are becoming popular for these patients.

The abdomen wall consists of three muscle layers, the external oblique, the internal oblique, and the transversus abdominis and their associated fascial sheath. This muscular wall is innervated by afferents that course through the transversus-abdominisneuro-fascial plane.

Transversus abdominal plane (TAP) block is a regional block that blocks abdominal wall neural afferent between T6 and L1 and thus can relieve pain associated with abdominal incision. TAP is a neurovascular plane located between internal oblique and transverse abdominis muscle and nerve supplying abdominal wall pass through this plan before supplying anterior abdominal wall. Therefore, if the local anaesthetic is deposited in this space, myocutaneous sensory blockade results.

Rafi A.N. first described the TAP blockin 2001 using the anatomical landmarks by first identifying the lumbar triangle of petit.[1]In 2007, McDonnell J.G. presented preliminary work on TAP block in cadaver and healthy voluntary.[2]TAP block has subsequently been used as a component of multi modal analgesia for post operative pain relief of various surgical procedure such as large bowel resection, open appendicectomy, nephrectomy, hernia repair, laparoscopic cholecystectomy, and caesarean section.

TAP block is given by two techniques. First is Landmark technique described by Rafi through triangle of Petit and second is Ultrasound guided technique by this technique visualization of all anatomical structure, needle and spread of local anaesthetic in transverses abdominis plane are possible.[3]We have used Landmark technique that is loss of double resistance (double pop) in our study.

We carried out this study to evaluate the efficacy of TAP block in providing post operative pain relief and the cumulative requirement of analgesic over first 48 hour in patients who underwent LSCS under spinal anaesthesia. Also, to note VAS score upto 48-hour post operatively, time when first analgesic required (VAS score>4), hemodynamic parameter, and complications (nausea, vomiting, hypotension).

Material and Methods

The present study was carried out in the department of anaesthesiology, Shri M.P. Shah Govt. Medical College, Jamnagar, during the period of July 2019 to July 2020, after approval from the hospital ethical committee. This prospective randomized controlled study was carried out with 60 patients selected from total of 1570 patients who underwent elective caesarean section during study period, two groups with 30 patients each were randomly assigned, in Group B: TAP block was given while in Group C: TAP block was not given (no intervention). Double blinding was done.

Inclusion criteria: Full term pregnancy, Age-20-35 years, Weight 50-70 kg, ASA gradeI/II/III, Elective LSCS under spinal anaesthesia, Informed consent.

Exclusion Criteria: Age <20 or >35 years, Weight <50 or >70 kg, ASA grade IV/V, contraindication to spinal anaesthesia, patients' refusal and not able to understand study protocol, sensitivity to local anaesthetics, patients with compromised renal and liver function, uncontrolled diabetes, severe cardiovascular and respiratory disease, infection, trauma, scar or sinuses at site of block, patients under general anaesthesia.

All patients were thoroughly assessed, by taking history, and examined in detail. All subjects fulfilling the inclusion criteria were explained about the purpose, procedure, and side effects of procedure, objective of the study, methodology, advantage, and likely complications. Patient selected after pre-anaesthetic checkup, and investigations. Informed written consent was taken from those willing to participate in the study. Patients were kept adequately nil by mouth, on the day of surgery, all the basic necessities like anaesthesia machine and resuscitation drugs, airway equipments and suction

apparatus were checked. A good venous access was secured with 20G IV cannula and pre-loading done with 10ml/kg of Ringer's lactate solution prior to induction. Patients were positioned on the operating table in the supine position with left lateral tilt and multipara monitor was attached. All baseline parameters were observed and recorded which consist of non-invasive blood pressure (NIBP), Electrocardiography (ECG), Spo2 before induction and local anaesthetic sensitivity testing was done. All patients were given premedication with Inj. Ondansetron0.08mg/kg I.V. before induction and Inj. Pantoprazole40 mg I.V. slowly, no sedative premedication was given. Under all aseptic and antiseptic precaution all patients were given spinal anaesthesia with 2 ml of 0.5% Bupivacaine heavy in left lateral position.

At the end of surgery, TAP block was performed by senior anaesthetist, in supine position, under all aseptic and antiseptic precautions, using 18 G I.V. set needle with wedge kept between area of costal margin and iliac crest. Landmark technique, described by McDonnel et al[2,4,5] was used. This technique accesses the transverse abdominisplane via the lumbar triangle of petit. LOR technique combined with double "pop" was used. After aspiration, a 20 ml of 0.25% of Bupivacaine hydrochloride was injected on both sides in Group B, while TAP block was not performed in Group C. After completion of procedure, all patients were shifted to post anaesthesia care unit (PACU).In PACU, all patients received standard analgesia according to obstetric department protocol Inj. Tramadol 1mg/kg I.V. 8 hourly.

The post-operative pain relief was assessed by using visual analogue scale (VAS). Rescue analgesia was given in the form of Inj. Diclofenac sodium 1.5 mg/kg I.M. when VAS score is >4. Total dose and time of standard analgesia required in first 48 hour post-operatively was noted. Post block vital parametermonitoring was started from the end of the procedure in both groups up to 48 hours. Post operative monitoring, VAS and complications were assessed by junior resident blinded about the type of procedure done on patients.

Results:

After completion of study observation and results were analyzed statistically using software SPSS. Students' T test was applied for comparing the inter group results and the p value calculated. Nonparametric data was analyzed using the chi square test. Statistical significance was assumed at p<0.05.

The number of patients in either group was 30. The mean age of patients was 27.6±4.61 in group B and 26.03±3.72 years in group C. The mean weight of patients was 55.33±6.01 Kg in group B and 56.53±6.73 Kg in group C. The mean height of patients was 153.43±3.82 cmin group B and 155.63±2.45 cm in group C. No statistically significant difference was found in both groups. (p>0.05) [Table 1]

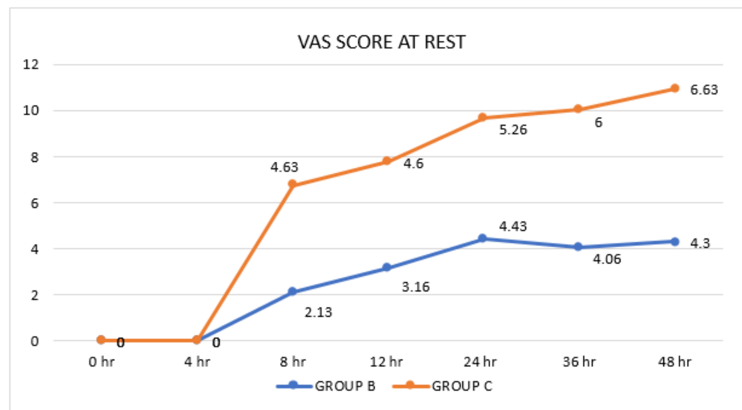
Table 1: DEMOGRAPHIC CHARACTERISTICS

Parameter	Group B	Group C	p value
Number of patients	30	30	>0.05
Age (years)	27.6±4.61	26.03±3.72	>0.05
Weight (Kg)	55.33±6.01	56.53±6.73	>0.05
Height(cm)	153.43±3.82	155.63±2.45	>0.05

The mean VAS score at rest in both groups was 0 at 0 and 4 hours.In group B, VAS score at rest was < 4 at 8 hours. In group C, VAS score at rest was> 4 after8 hours. Moreover, at all-time intervals after 4-hour, VAS score at rest was significantly higher in group C as compared to group B. There was statistically significant difference in both groups. (p<0.001) [Table 2]

Table 2: VAS SCORE AT REST

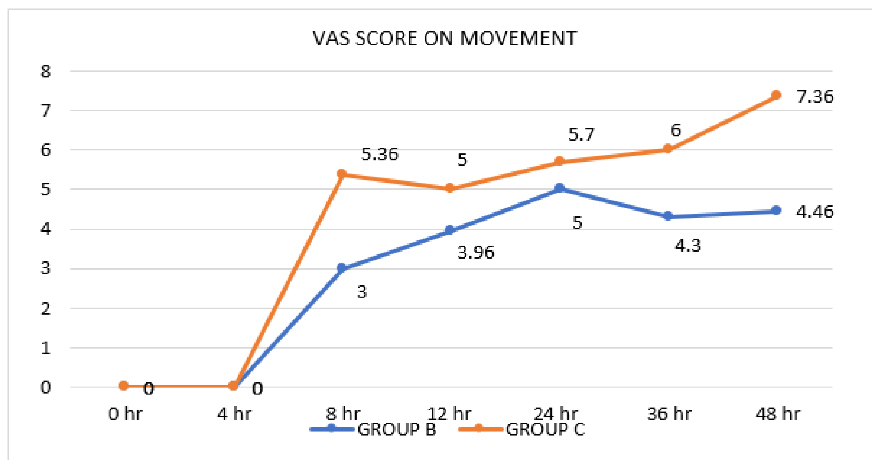
TIME	GROUP B	GROUP C	p value
0hr	0	0	>0.05
4hr	0	0	>0.05
8hr	2.13±0.34	4.63±0.55	<0.001
12hr	3.16±1.31	4.6±0.93	<0.001
24hr	4.43±1.22	5.26±1.14	<0.001
36hr	4.06±0.52	6.0±1.38	<0.001
48hr	4.3±0.65	6.63±1.24	<0.001



The mean VAS score on movement in both groups was 0 at 0 and 4 hours. In group B, VAS score on movement was < 4 at 8 hours. In group C, VAS score on movement was > 4 after 8 hours. Moreover, at all-time intervals after 4-hour, VAS score on movement was significantly higher in group C as compared to group B. There was statistically significant difference in both groups. ($p<0.001$) [Table 3]

Table 3: VAS SCORES ON MOVEMENT

TIME	GROUP B	GROUP C	p value
0hr	0	0	>0.05
4hr	0	0	>0.05
8hr	3±0.58	5.36±1.06	<0.001
12hr	3.96±1.03	5±1.36	<0.001
24hr	5±0.98	5.7±1.41	<0.001
36hr	4.3±0.70	6.36±1.56	<0.001
48hr	4.46±0.97	7.36±1.27	<0.001



Time for first rescue analgesic dose was significantly prolonged in group B than group C. It was 22.8±7.94hr in group B and 9.33±1.91hr in group C. There was statistically significant difference in both groups. ($p< 0.001$) [Table 4]

Table 4 – First rescue analgesia time (in hour)

Group B	Group C	p- value
22.8±7.94	**9.33±1.91**	<0.001

In Group B, 24 patients required 1 dose of analgesic, 6 patients required 2 doses of analgesic in 48 hours. In Group C, 1 patient required 2 dose of analgesic and 17 patients required 3 doses of analgesic and 12 patients required 4 doses of analgesic in 48 hours. ($p<0.001$) [Table5]

Table 5: Number of doses of rescue analgesia in 48 hours

No. of doses	Group B	Group C	p value
1	24pts	0 pts	<0.001
2	6 pts	1pts	<0.001
3	0 pts	17pts	<0.001
4	0 pts	12pts	<0.001

The mean cumulative Inj.Diclofenac sodium requirement was significantly higher in group C as compared to group B. The total dose of Inj. Diclofenac sodium required by patients ingroup B in 48 hrs was 90 ± 30.51 mg, while in group C it was 252.5± 41.70mg. (p< 0.001) [Table 6]

Table 6: Cumulative Inj. Diclofenac sodium Requirement after 48 hours (in mg)

Group B	Group C	p value
90± 30.51	252.5± 41.70	<0.001

On intergroup comparison, there were no statistically significant difference in the mean pulse rate between two groups. (p>0.05)Oncomparison of systolic and diastolic blood pressure, there were no statistically significant difference as compared to baseline till 48 hours after TAP block. (p>0.05)In both the groups, Spo2 was comparable at all times. None of the patient in Group B as well as Group C experienced any complications like nausea, vomiting, bradycardia, hypotension, tachycardia, local anaesthetic toxicity,transient femoral palsy, accidental intra peritoneal or intra vascular injection or bowel perforation.

Table 7: Pulse rate (per minute)

Time	Group B	Group C	p value
Pre-induction	75.23±10.18	74.63±10.86	>0.05
Baseline	83.6±8.63	84.66±7.82	>0.05
0 hour	75.93±8.79	79.66±8.97	>0.05
4 hours	72.73±6.85	71.33±7.95	>0.05
8 hours	74.93±6.36	74.06±5.66	>0.05
12 hours	74.23±4.50	73.9±3.64	>0.05
24 hours	75.33±7.03	78.26±8.11	>0.05
36 hours	72.13±7.00	72.26±8.11	>0.05
48 hours	73.5±7.37	72.6±7.84	>0.05

Table 8: Systolic blood pressure (mm Hg)

Time	Group B	Group C	p value
Pre-induction	120.06±9.77	121.93±8.93	>0.05
Baseline	108.04±7.49	107.85±4.86	>0.05
0 hour	108.86±5.50	111.26±5.44	>0.05
4 hours	114.4±4.65	114.73±4.21	>0.05
8 hours	118.33±5.14	119.13±5.27	>0.05
12 hours	119.73±5.93	120.66±6.13	>0.05
24 hours	117.4±7.96	117.8±7.98	>0.05
36 hours	119.2±7.43	118.6±7.86	>0.05
48 hours	119.33±7.86	118.4±7.79	>0.05

Table 9: Diastolic blood pressure (mm Hg)

Time	Group B	Group C	p value
Pre-induction	72.33±4.90	72.66±4.93	>0.05
Baseline	69.06±7.69	66.8±6.02	>0.05
0 hour	69.8±4.04	68.33±3.15	>0.05
4 hours	66.26±5.72	67.33±5.61	>0.05
8 hours	72.86±6.02	71.86±6.55	>0.05
12 hours	70.04±4.65	69.6±4.93	>0.05
24 hours	70.26±6.40	69.66±5.53	>0.05
36 hours	71.2±6.16	70.86±5.08	>0.05
48 hours	71.26±5.86	71.4±5.20	>0.05

Table 10: Changes in oxygen saturation

Time	Group B	Group C	p value
Pre-induction	98.73±0.52	98.8±0.55	>0.05
Baseline	98.93±0.25	99.00±0	>0.05
0 hour	98.93±0.25	99.00±0	>0.05
4 hours	98.63±0.49	98.83±0.37	>0.05
8 hours	98.8±0.40	98.96±0.18	>0.05
12 hours	98.73±0.44	98.96±0.18	<0.05
24 hours	98.8±0.40	98.96±0.18	>0.05
36 hours	98.8±0.40	98.96±0.18	>0.05
48 hours	98.8±0.40	99.00±0	>0.05

Discussion

The aim of good post-operative analgesia is to produce a long lasting, continuous effective analgesia with minimum side effects. The benefits of adequate postoperative analgesia are reduction in postoperative stress, morbidity and improved surgical outcome. Effective pain control also facilitates rehabilitation and accelerates recovery from surgery. [6,7,8]

A multimodal analgesic regimen is most likely to achieve these goals. However, the optimal components of this regimen continue to evolve. Although single-shot neuraxial analgesic techniques using long- acting opioids, or patient-controlled epidural opioid administration produce effective analgesia, they are associated with a frequent incidence of side effects. IV patient-controlled analgesia (PCA) morphine facilitates a greater degree of patient control, and thereby results in high patient satisfaction levels but the analgesia produced is often incomplete, and opioid-mediated side effects remain common.

TAP block is a technique that provides analgesia to the parietal peritoneum as well as the skin and muscle of the anterolateral abdominal wall by blocking neural afferents.[9]Epidural analgesia is a good alternative for postoperative pain relief. But the gravid uterus increases the chances of dural and vascular puncture, also making it difficult to identify the space. Furthermore, it may not be preferred in case of emergency caesarean section. Infiltration of local anaesthetic is also used to provide pain relief, but it is not effective for prolonged analgesia. Currently multimodal analgesia technique involving abdominal field block with parenteral analgesia are becoming popular.

FBonnettet al[10] hasdescribed many advantages of TAP block asit is simple and effective, appropriate for surgical procedure where parietal pain is significant, can be performed when neuraxial blocks are contraindicated as it provides an alternative analgesic solution. Potential drawbacks include, bilateral block is required, duration of block is limited, for some surgeries that induce both parietal and visceral pain, other techniques could be more appropriate and using the anatomical landmark method, inadvertent needle position can result in severe complication like bowel puncture, nerve injury, etc.

Different studies have used different drug, in different doses and also in the different concentration. Local anaesthetic such as 0.375% levobupivacaine, 0.375- 0.75% ropivacaine or 0.25- 0.5% bupivacaine have been used in the amounts 15-20 ml bilaterally.

A N Rafi et al[1]described the use of 20 ml of local anaesthetic agent for each side for analgesia.SParmar et al[11] used 15 ml (0.25%) of bupivacaine on each side in open cholecystectomy under general anaesthesia. They found TAP block reduced VAS pain score on emergence and at all postoperative times up to 12 hours.S Bhattacharjee et al[12] used 0.25% bupivacaine 0.5 ml/kg on each side in patients undergoing total abdominal hysterectomy under general anaesthesia. McDonnell JG et al[4] used Ropivacaine 0.75% with dose of 1.5 ml/kg (max. dose 150 mg per side) in TAP block after caesarean delivery under spinal anaesthesia adjuvant to patient-controlled morphine analgesia and regular diclofenac sodium and acetaminophen. P L Petersen et al[13] used ultrasound guided posterior bilateral TAP block with 20 ml of 0.5% Ropivacaine on each side after laparoscopic cholecystectomy under general anaesthesia adjuvant to oral acetaminophen, ibuprofen, and I.V.Morphine. R Kawahara et al[14] performed USG guided bilateral TAP block with 20 ml of 0.375% Ropivacaine with midaxillary approach after gynecological laparoscopic surgery under general anaesthesia adjuvant to patient-controlled analgesia(PCA) with tramadol. They concluded that postoperative pain, nausea and PCA consumption were significantly lower in patients with TAP block in early postoperativestage.

Above studies show that local anaesthetic agent, volume, concentration, and delivery method differ between studies, these regimens have not yet been compared against each other. TAP block requires large volume of local anaesthetics and to achieve pain relief without local anaesthetic toxicity, in our study we used Inj. Bupivacaine hydrochloride plain 0.25% as at this concentration sensory effects are seen predominantly, has a long duration of action and low tissue toxicity. The volume used in our study was 20 ml on each side.

SParmar et a1[11] in their study observed that TAP reduced VAS score for pain on emergence and at all postoperative time points up to 12 hours. The incidence of post-operative nausea and vomiting, and demand of rescue opioid in the first 12 postoperative hours were also reduced.This shows that TAP block provides better post operative analgesia, which is comparable with our study.P L Petersen et al[13] observed VAS score while coughing was significantly reduced in TAP group compared to placebo unto 12hours but VAS score at rest showed no significant difference between two groups. They concluded thatTAPblock after laparoscopic cholecystectomy may have some beneficial effect in reducing pain while coughing and on opioidrequirements.USrivastava et al[15]showed that at all-time intervals after 4-hour, VAS score at rest and at movement was significantly lower in TAP block.They alsoobserved that time of 1st analgesia was 12hr after TAP block within group B and 6.5 hr after no TAP block. Our results are similar to this study. In our study total consumption of Inj. Diclofenac sodium was 90$\pm$ 30.51 mg in group B whereas it was 252.5 $\pm$ 41.76mg in group C which is highly significant. Our results are in consonance with other studies.

We did not find any perioperative complication like bradycardia, hypotension, tachycardia, local anaesthetic toxicity,transient femoral palsy, accidental intra peritoneal and intra vascular injection or bowel perforation.

Limitations of our study:

First, the TAP block produces sensory analgesia of abdominal wall. Testing would have demonstrated successful block, but we avoided for fear of loss of blinding.Second, we employed the landmark technique for performing block. Ultrasound can improve the certainty and safety of block by confirming the position of needle.Third, although, we did not encounter block related complication in any patient,our sample size was not enough to assess the safety.

Conclusion

TAP block as a component of multimodal analgesia after caesarean section was effective in providing analgesia with delayed time for 1st rescue analgesia and reduction in total analgesic requirement in 1st 48 hr.

Conflict of interest: NIL

Source of funding: Self

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