

**ASSESSING THE ANALGESIC EFFICACY OF TRANSVERSUS  
ABDOMINIS PLANE BLOCK AFTER CESAREAN SECTION  
DELIVERY UNDER SPINAL ANESTHESIA AS PART OF  
MULTIMODAL ANALGESIA**



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## ***Abstract***

**Background:** Transversus abdominals plane block was a kind of nerve block performed on the triangle of Petit to block a number of abdominal nerves.

**Objectives:** To assess analgesic efficacy of transversus abdominis plane block after cesarean section delivery under spinal anesthesia at Zewditu Memorial Hospital from February to March 2016.

**Methods:** A prospective cohort study design was conducted. 42 patients undergoing caesarean section under spinal anesthesia were followed postoperatively. Those who undergo TAP block with bupivacaine ( $n = 21$ ) versus non-TAP ( $n = 21$ ) with standard analgesia with intravenous agents were followed. Each patient was assessed post-operatively by a blinded investigator for visual analogue score (VAS) at 2, 4, 6 and 12 hours, time to 1<sup>st</sup> analgesic request and total analgesic consumption within the 1<sup>st</sup> 12 postoperative hours. SPSS window version 20.0 software was used for analysis.

**Results:** Postoperative VAS outcomes based on (mean  $\pm$ SD) for TAP group and non-TAP group include at 2 hr ( $5.23 \pm 3.34$ ) vs ( $15.28 \pm 6.51$ ), at 4 hr ( $7.09 \pm 3.11$ ) vs ( $17.52 \pm 3.9$ ), at 6 hr ( $8.9 \pm 4.63$ ) vs ( $21.04 \pm 5.06$ ) and at 12 hr ( $11.33 \pm 4.98$ ) vs ( $25.2 \pm 5.9$ ). There was also decreased postoperative analgesic consumption and increased time to 1<sup>st</sup> analgesia in TAP group.

**Conclusion and Recommendation:** It is concluded that bilateral single injection of TAP block prolonged the time to 1<sup>st</sup> analgesic request, reduced total postoperative analgesic consumption and had lower postoperative severity of pain when compared with non-TAP groups in patients after cesarean section under spinal anesthesia when it is used as part of multimodal analgesia. I recommend TAP block as part of multimodal analgesia after cesarean delivery. I also recommend further study to find out the effect of TAP block after 12 hr.

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***List of acronyms***

TAP – Transversusabdominis plane block

C/S-cesarean section

IO-Internal oblique

EO-External oblique

LA-Local anesthetics

# CHAPTER ONE

## ***1. Introduction***

### ***1.1 Background Information***

TAP block was simple to perform, and effective peripheral abdominal field block that blocks the lower intercostals (T7–T11), ilioinguinal, and iliohypogastric nerves. It was a modified technique in which the local anesthetic was injected in the neurovascular plane between the transversus abdominis muscle and internal oblique muscle of the anterior of the abdominal wall via the lumbar triangle of Petit. It was bounded posteriorly by the latissimusdorsi muscle and anteriorly by the external oblique and iliac crest forming the base of the triangle (1,2).

Acute post operative pain was a commonly encountered problem in every day practice which needs multimodal approaches of pain management (3). Multimodal approaches to the provision of postoperative analgesia often incorporate blockade of the abdominal wall(4). TransversusAbdominis Plane block technique involves injection of local anesthetic solution into a plane between internal oblique (IO) and transversusabdominis (TA) muscles. This plane contains the thoracolumbar nerves originating from T<sub>7</sub> to L<sub>1</sub> spinal roots which supply sensation to the anterolateral abdominal wall. These multiple mixed segmental nerves branch and communicate as they run through the lateral abdominal wall between IO and TA muscles, within the TA fascial plane (5).

Blind TAP block was performed by appreciation of double pop sounds. It was first described in 2001 by Rafi as a blind land mark technique using the lumbar triangle of Petit (6). There were studies which showed that the injection of drugs via the triangle of Petit using the "double pop" technique resulted in reliable deposition into the transversusabdominis plane (1). At the midaxillary line, all the nerves distributed within the transversusabdominis plane. TAP block

performed at the level of the Petit triangle near the midaxillary line (7). TAP block techniques gained wide acceptance due to lower risk of complications and better outcome. TAP block had decreased opioid consumption(8).

The abdominal wall had three muscle layers: external and internal oblique, and transverses abdominis muscles. Those muscular wall contains the intercostal nerves, the ilioinguinal and iliohypogastric nerves and the lateral cutaneous branches of the dorsal rami of L<sub>1</sub>-L<sub>3</sub>. The above nerves run in a neurovascular plane between the internal oblique and transverses abdominis muscles and stand for the area of local anesthetic deposition (9). Blocking those sensory nerve supply to the anterior abdominal wall had been reported to provide effective postoperative analgesia after lower abdominal surgeries(10).

The duration of analgesia was primarily determined by spread of the agent into paravertebral space. High volume of local anesthetic was needed in order to had good spread over the anterior abdominal wall nerves. Local anesthetics, such as 0.5% bupivacaine, had been used in the amounts of 15-20 ml bilaterally in order to had adequate spread over those abdominal nerves (7,11).

## ***1.2 Statement of the problem***

Pain was inevitable during surgery and pain management was the main issue in anesthesia and surgery. So an ideal analgesic technique, offering pain-free treatment, free of side effects and cost-effective agent was needed to achieve good pain management (12). Transversus abdominis plane (TAP) block provided good postoperative analgesia, when used in patients requiring abdominal wall incisions for lower abdominal surgical procedures like lower segment caesarean section, prostatectomy, appendectomy, and laparoscopic surgeries(13,14,15,16).

Mostly postoperative pain relief was done by multimodal analgesia by using non-steroidal anti-inflammatory drugs (NSAIDs), Opioids and peripheral nerve blocks. Opioids were one of analgesic agents used for surgery in the perioperative period and were the only options before the development of peripheral nerve blocks(17,18). But opioids were full of side effects like nausea, vomiting, constipation, urinary retention, respiratory depression and sedation. So other medications devoid of those side effects were needed for good pain relief without adverse effects (19,20). Due to these non-opioid analgesic techniques were good for better pain management which avoided side effects associated with opioids (19). Local anesthetic agents, regional anesthesia and patient controlled analgesia were other alternatives of analgesia which made pain management very easy(21).

Sometimes TAP block may not have adequate analgesia if not injected in the correct plane that means in the transversus abdominis plane which was found between internal oblique muscle and transversus abdominis muscle. TAP block did not used to block visceral pain, it only blocked parietal pain(22). Even if most of pain was arising from anterior abdominal wall. Local anesthetic could cause femoral nerve palsy during placement of the block using a "blind" technique (23).

Unsuccessful TAP block could result in failure to control postoperative pain. This might be due to imprecise injection of the local anesthetic (LA) solution relative to the transversus abdominis plane. The inaccurate LA deposition can be a consequence of both landmark-guided and



ultrasound guided blocks (24). If there is failure to control postoperative pain, unnecessary physiological and psychosocial consequences could happen like dissatisfaction, myocardial problems, prolonged hospital stay and it might progression to chronic pain(25).

In the study done by Mark J et.al. Absolute contraindications to TAP blocks include patient refusal, soft tissue infection of the abdominal wall and skin, or abnormality at the needle insertion site. Coagulation status is an area of uncertainty with the TAP block and will require further investigation(26).

This study is aimed at assessing the analgesic efficacy of TAP block as part of multimodal analgesia in terms of VAS, time to 1<sup>st</sup> analgesic request and total post operative analgesic in milligrams.

### ***1.3 Significance of the study***

Transverses abdominals plane block is a relatively new technique used in a multimodal approach to provide postoperative analgesia following cesarean delivery. It is a technically simple block to perform, with a high margin of safety. TAP block reduces the need for postoperative opioid use, increase the time to first request for further analgesia, and provide more effective pain relief, while decreasing opioid related side effects such as sedation and postoperative nausea and vomiting. Therefore conducting research on analgesic efficacy of TAP block will help to improve pain management with decreased side effects.

The result of the study is also helpful for program planners and policy makers to devise strategies which in turn help to improve patient's safety. There are limited researches in this topic . So it could be used as a baseline data.

## CHAPTER TWO

### ***2. Literature Review***

In the study done in Canada TAP block reduced visual analogue scale pain scores (10 cm line where 0 cm, no pain, and 10 cm, worst pain) by 8 mm, and decreased the incidence of opioid-related side-effects(27).

In a Randomized control trial undertaken in India on 60 patients, Patients who received TAP block with bupivacaine had significantly less mean total pain scores ( $48.07 \pm 6.77$ ) when compared to the control group ( $62.63 \pm 6.66$ ) in the first 24 hours, with a *P* value of 0.0001(28).

In the study done by Nanze Y et.al TAP block was shown to reduce the need for postoperative opioid use, increase the time to first request for further analgesia, and provide more effective pain relief, while decreasing opioid related side effects such as sedation and postoperative nausea and vomiting(29). The conventional postoperative analgesic regimen following lower abdominal surgery utilized systemic opioids, which can cause sedation, headache, nausea, vomiting, respiratory compromise, pruritus and bladder and bowel dysfunction(30).

Two-hourly pain scores were less in the TAP block group up to 18 hours when compared to the control group. Both the groups showed a statistically significant difference in the mean total tramadol consumption in the first 24 hours postoperatively, which was  $439 \pm 68.59$  mg in the control group and  $281.33 \pm 69.66$  mg in the TAP block group, with a *P* value of 0.0001(28).

First dose of rescue analgesia required in group with TAP block was at  $547.133 \pm 266.9$  min and in non TAP groups was at  $49.17 \pm 24.95$  min, which was statistically significant. Total dose of tramadol consumption in TAP groups was  $103.83 \pm 32.18$  mg and in non TAP groups was  $235.83 \pm 47$  mg, which showed that tramadol consumption was significantly decreased in groups with TAP block(31).

TAP block was effective in reducing severity of pain, delayed the demand of first postoperative analgesic request and reduced the need of patient controlled analgesia of tramadol during first 48 hours after surgery in patients undergoing cesarean section under spinal anesthesia. The TAP

block also had lower post operative nausea and vomiting (PONV) and lowers drowsiness and it had more satisfactory effect with pain management compared to those who did not receive TAP block. TAP block had better analgesic benefit in patients who had cesarean delivery (32,33).

Several studies have documented that the TAP block provided effective analgesia during the first 24 h after surgery in a series of lower abdominal or pelvic surgical procedures(34). TAP block reduces respiratory problem associated with post operative pain(35). The total post-operative tramadol requirement was reduced in those with TAP block compared to those who did not take TAP(36). Patients who received TAP block with bupivacaine had significantly less mean total pain scores when compared to the control group in the first 24 hours(37).

In Indian's study Mean tramadol use was significantly less 8, 12, and 24 h after surgery in TAP group in relation to non TAP group. The cumulative tramadol usage during first 24 h after surgery was significantly reduced in study TAP group in comparison to non TAP group ( $75 \pm 22$  vs.  $168 \pm 45$  mg in TAP group and non TAP group, respectively,  $P < 0.0001$ ). Overall tramadol consumption was reduced approximately by 50% in TAP group compared to non TAP group in first 48 h ( $127 \pm 24$  vs.  $253 \pm 52$  mg in TAP group and non TAP group, respectively,  $P < 0.0001$ ) (38).

In another study done in India The time of the first demand for analgesia was shorter in the control group than in study group. The median time to first demand for analgesia was 6.5 h (inter-quartile range [IQR]: 2-8 h) in group with non TAP and 12 h (IQR 8-17 h) in group with TAP block( $P < 0.001$ ) (39).

TAP block with bupivacaine and ropivacainewere equivalent for post-operative analgesia and 24 h cumulative rescue analgesic requirement median (interquartile range) ( $75.00 [75.00-75.00]$  in Group I vs.  $75.00 (75.00-93.75)$  in Group II,  $P = 0.366$ )(40).

A study conducted in patients undergoing caesarean section using ropivacaine, 0.375%, 40 ml for TAP block for post-operative analgesia showed that the pain scores and opioid consumption were similar between the two groups. The groups consisted of one that received TAP block with ropivacaine ( $n = 50$ ) and the other, placebo ( $n = 50$ ). The mean (standard deviation) VAS on

movement at 24 h in the ropivacaine and placebo groups was 3.4 (2.4) and 3.2 (2.2) cm, respectively,  $P = 0.47$ (41).

In Indian's study VAS was noted at 2, 4, 6, 8, 12, 18 and 24 h. VAS was reduced after TAP block for the first 8–10 h post-operatively as compared to patients who did not receive TAP block(42).

The study done in Debretabore showed that time to 1<sup>st</sup> analgesic request with (mean  $\pm$ SD ) was (286.0  $\pm$ 166.31) vs (76.25  $\pm$ 22.05), in TAP and non TAP groups respectively(43).

## **CHAPTER THREE**

### ***3.Objectives***

#### ***3.1. General Objective***

- To assess analgesic efficacy of transversus abdominals plane block after cesarean section delivery under spinal anesthesia at Zewditu Memorial Hospital from February to march, 2016.

#### ***3.2 Specific Objectives***

- ❖ To compare pain score difference in patients who received TAP block Vs those who did not within 12 hours post c/s.
- ❖ To determine if there is a statistical difference in analgesic consumption in patients who received TAP block and those who didn't
- ❖ To identify time to 1<sup>st</sup> post operative analgesic request.

## **CHAPTER FOUR**

### ***4. Methods***

#### **4.1 Study area and period**

The study was conducted at Zewditu Memorial Hospital which is located in capital city of Ethiopia, Addis Ababa. It was one of the thirteen government hospitals found in Addis Ababa, which was under the control of Addis Ababa Health Bureau. The hospital primarily gave Cesarean delivery services and TAP block as pain management for patients. The study was conducted from February to march 2016.

**4.2 Study Design-** a prospective cohort study design was used.

#### **4.3 Population**

**4.3.1 Source population** -all patients who undergone cesarean section delivery under spinal anesthesia at Zewditu Memorial Hospital.

**4.3.2 Study population**–TAP and non-TAP patients who undergone cesarean section delivery under spinal anesthesia at zewditu memorial hospital from February to march 2016.

#### **4.4 Inclusion and Exclusion Criteria**

**4.4.1 Exclusion criteria-** patients with decreased level of consciousness.

#### **4.5 Variables of the Study**

**4.5.1 Dependant variables**– Post operative Pain (VAS pain score, Total analgesic consumption, Time to 1<sup>st</sup> analgesic consumption)

#### **4.5.2 Independent variables**

**4.5.2.1 Socio-demographic variables** –age, weight, height, BMI andASA status.

**4.5.2.2 Anesthesia and surgery related** -duration of surgery, incision size

#### **4.6 Sample size and sampling procedure**

The sample size (n) was determined on the basis of mean (VAS) scores of the cases and non TAP groups as calculated from the previous study with mean  $\pm$  SD (1.7 $\pm$  1.7 ) VS (3.5 $\pm$ 1.5) by using open Epi. The number of TAP block groups and non TAP groups were 21 each.

#### **4.7 Data collection procedure**

Structured questionnaires and check lists were prepared by the investigator for all patients who took spinal anesthesia for cesarean section delivery. A total of 3 Anesthetists were participated in data collection interview. Visual analogue scale, time to 1<sup>st</sup> postoperative analgesic request and total postoperative analgesic consumption were used to assess effectiveness of analgesia in the postoperative 12 hours.

#### **4.8 Data analysis and interpretation**

Epi Info software was used for data entry. SPSS window version 20 was used for data analysis. Two sample t-test was done for comparison of mean between the TA and non-TAP groups. Tables and graphs were used for presentation of descriptive purpose.

#### **4.9 Operational definition**

**Transverse abdominis plane (TAP) block**-is a peripheral nerve block designed to anesthetize the nerves supplying the anterior abdominal wall (T<sub>7</sub> – L<sub>1</sub>)(1,2).

**Triangle of petit**- The area on the lateral abdominal wall bounded by the iliac crest, the posterior margin of the external oblique muscle, and the lateral margin of the latissimusdorsi muscle.

#### **Visual analogue scale (VAS) score**

Instruct the patient to point to the position on the line between the faces to indicate how much pain they are currently feeling. The far left end indicates 'No pain' and the far right end indicates 'Worst pain ever'.



#### **4.10 Ethical consideration**

Ethical clearance was obtained from ethical review board of college of health science, Addis Ababa University department of Anesthesia. Official permission letter was obtained from Zewditu Memorial Hospital. Informed verbal consent was secured from each study participant. Confidentiality was ensured by avoiding personal identifications, keeping questionnaires and checklists blocked.

#### **4.11 Limitation of the study**

Patients were followed only in the postoperative 12 hrs.

## CHAPTER FIFE

### 5. Results

#### 5.1 Socio-demographic characteristics of the patients

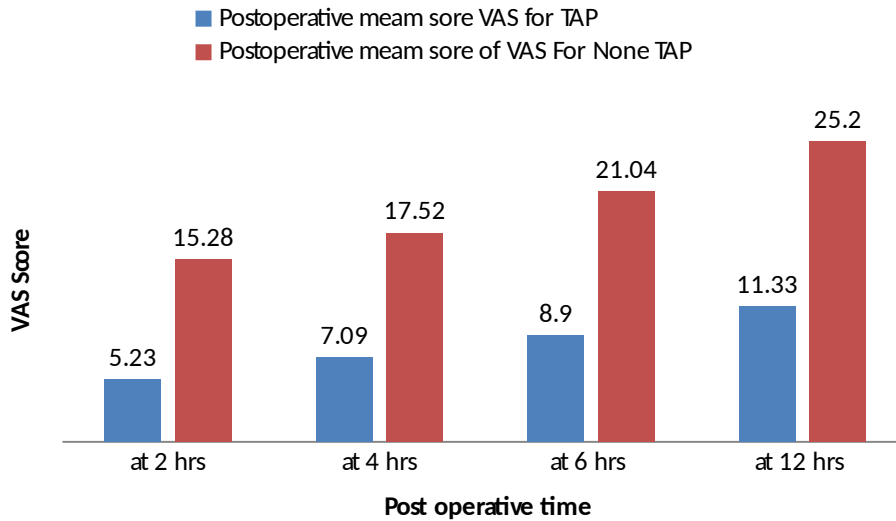
Forty two patients operated for cesarean section under spinal anesthesia were included in the study. 21 of them were given bilateral TAP block with 20 ml of 0.25 % bupivacaine and 21 were managed by other systemic postoperative analgesic agents without TAP block . They had comparable demographic characteristics.

*Table1.*Demographic characteristics of patients who underwent cesarean section under spinal anesthesia from February to march 2016.

	Cases(TAP)	controls	P value
Age	27.33 ±3.3	31±5.1	0.62
Weight	61.33±5.54	63.1±7.2	0.59
Height	165.76±6.04	169.2±8.4	0.57
BMI	22.21±1.79	21.9±1.9	0.15
ASA status I	16	14	
II	5	7	0.12

#### 5.2 Postoperative pain on VAS scores

Postoperative VAS outcomes based on( mean ±SD) for TAP group and non- TAP group include at 2 hr (5.23±3.34) vs (15.28±6.51) (p=0.000), at 4 hr (7.09±3.11) vs (17.52 ± 3.9) (p=0.000) , at 6 hr (8.9±4.63) vs 21.04±5.06) (p=0.000) and at 12 hr (11.33 ± 4.98) vs (25.2 ± 5.9) (p=0.000) by using two sampled t-test.



**Figure 1.** mean postoperative visual analogue scale (VAS) scores at rest in each group over the 1<sup>st</sup> 12 hours at Zewditu Memorial Hospital from February to March,2016, Addis Ababa.

### 5.3 Postoperative analgesic consumption

Total Tramadol consumption within the 1<sup>st</sup> 12 postoperative hours was 800 mg in TAP groups and 2350 mg in non TAP groups.

### 5.4 Postoperative time for the first analgesic request

Postoperatively the time from the end of surgery to the 1<sup>st</sup> analgesic request was significantly different between TAP and non TAP groups. The TAP block group showed longer duration of time to 1<sup>st</sup> analgesic request than nonTAP group(mean  $\pm$  SD)( 571.42  $\pm$ 177.6 )minutes vs (142.85  $\pm$  48.28) minutes respectively.

## CHAPTER SIX

### 6. Discussion

The results of this study showed that TAP block when used as part of multimodal analgesia after caesarean delivery under spinal anesthesia showed 65 % reduction in tramadol consumption during the 1<sup>st</sup> 12 postoperative hours. This was one indicator of analgesic efficacy of TAP block(9). The study done in India showed 50 % reduction in tramadol consumption within the 1<sup>st</sup> 24 postoperative hours. The possible explanations for this variation in tramadol consumption in this study and the study done in India might be due to different pain threshold, skill difference, or it might be due to different duration of postoperative follow-up. In India they were followed for 24 hours but here they were followed for 12 hours(38).

TAP block provided effective analgesia during the first 12 hr after surgery in a series of lower abdominal or pelvic surgical procedures(30). The mean Postoperative time to first analgesia of this study in TAP and non TAP groups with (mean  $\pm$ SD) was (571.42  $\pm$ 177.6 ) vs (142.85  $\pm$  48.28) minutes, respectively. The study done in Indian was supportive to this result which showed that there is time variation between those who took TAP and those who did not take TAP block. This might be due to similar volume of the agent or similar site of injection(39).

This study showed that the total tramadol use within the 1<sup>st</sup> 12 postoperative hours in TAP and non TAP groups was 800 mg and 2350 mg ,respectively. The total post-operative tramadol requirement was reduced in those with TAP block compared to those who did not take TAP(32). This reduction by 65 % in TAP group compared to non TAP groups indicated TAP block could avoid increased opioid consumption and allowed early ambulation . So it was a cost effective method which encouraged use of TAP block as part of multimodal analgesia (14,18,19). The study done in Debretabor also showed significant reduction in tramadol consumption(43). This might be due to similar setup or use of similar technique.

TAP block resulted in decreased VAS score, delayed time for rescue analgesia and reduced requirement of opioid analgesic. Use of peripheral nerve blocks as part of multimodal analgesia made pain management effective and easy. TAP block had high success rate in pain management (21). There was high reduction of VAS score in TAP group compared to non TAP groups in this study. In the study done in Canada TAP block showed reduced visual analogue scale pain scores and decreased the incidence of opioid-related side-effects. It showed that TAP block reduced visual analogue scale pain scores (10 cm line where 0 cm, no pain, and 10 cm, worst pain) by 8 mm. The outcome of this study was supportive (27). This might be due to similar volume and type of local anesthetic agent.

## **CHAPTER SEVEN**

### **7.1 Conclusion**

Bilateral single injection of 20 ml of 0.25 % bupivacaine as multimodal analgesia resulted in decreased VAS scores, lower postoperative severity of pain, and decreased postoperative analgesic consumption. TAP block prolonged the time to 1<sup>st</sup> analgesic request , reduced total postoperative analgesic consumption and had lower postoperative severity of pain when compared with non TAP groups in patients after cesarean section under spinal anesthesia when it is used as part of multimodal analgesia.

## ***7.2 Recommendation***

We recommend TAP block to be used as part of multimodal analgesia after cesarean delivery.

We also recommend further study to find out the effect of TAP block after 12 hr.

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