
Efficacy and Safety of Transversus Abdominis Plane Block and Patient-Controlled Analgesia for Pain Relief after Cesarean Delivery

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Running Title

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Abstract

Objectives: The target of this research is to assess the efficiency of intravenous patient-controlled analgesia in comparison to ultrasound-guided TAP block in the first twenty-four hours after cesarean surgery in pregnant women who have had cesarean section.

Background: However, women's happiness continues to be an issue, despite the fact that pain treatment after cesarean section birth is highly crucial. It is helpful to identify the most appropriate analgesic method, medications, & dosage, as well as to provide effective therapy for postoperative pain, when the pain intensity of post-cesarean delivery is appropriately assessed.

Methods: A cross-sectional research has been conducted on 84 women at Faculty of Medicine, Menoufia university hospitals and Berket El-Saba General Hospital, who were admitted for delivery by elective cesarean section.

Individuals were separated into two groups: "group I" (n = 42) consisted of women who were given TAP block, & "group II" (n = 42) consisted of women who were given PCA.

Results: Following the operation, the patient's heart rate, respiration rate , pain score, intestinal motility, nausea ,& vomiting were evaluated at 2, 4, 6, 12, & 24 hours after the procedure. The "patient-controlled analgesia group" had a considerably lower level of pain compared to the "TAP group" (p value of 0.009 at 2 hours postoperative & 0.031 at 4 hours; respectively). In addition, women who were in the "patient-controlled analgesia group" had substantially greater levels of nausea & vomiting compared to those who were in the "TAP group" (p value = 0.007). It was more noticeable in the "TAP group" than in the "PCA

category" when it came to the motility of the digestive tract.

Regarding duration of analgesia, time of first analgesia, and time of first ambulation were significantly lower in TAP block collection compared to PCA collection.

Conclusions: transversus abdominis plane block was favored because it prevented the systemic impact of opioids that were utilized in Patient Controlled Analgesia. Patient Controlled Analgesia was better than TAP block since it covered visceral discomfort. In addition, Patient Controlled Analgesia may be administered without much difficulty, while transversus abdominis plane block requires further training as well as an intraoperative ultrasound equipment. When modifying the dosages, there were very few complications & adverse effects associated with any of the two.

Keywords: Transversus abdominis plane block, CS, PCA, Ultrasound guided analgesia, Pain score.

Introduction

There has been a significant increase in the number of cesarean deliveries all across the globe, involving in Egypt, according to most recent research. [1]

Throughout the first forty-eight hours after surgery, a cesarean section that is not complex may, in most cases, cause moderate to severe pain. [2]

As a result, pain management is essential since it has an impact on the mother as well as the care that she provides for the infant. Women having cesarean birth have extra strong reasons to obtain appropriate pain treatment as early mobilization constitutes a crucial component that minimizes the risk of thrombo-embolic illness which is known to be elevated during puerperium & pregnancy. [3]

Controlling postoperative pain may be accomplished via a wide variety of approaches. On the other hand, the hunt

for the most effective approach is still underway. Several different procedures have been implemented. In spite of this, the most effective method of administering opioids is still the use of several routes. [4]

During a cesarean delivery, the TAP block is a viable main analgesic that may be utilized for women who are not getting neuraxial morphine for whatever reason. This is a possibility. One kind of thoracolumbar nerve field block is known as the TAP block. This type of block is carried out in the fascial plane, which means that it is carried out across the transversus abdominis muscles & the internal oblique muscular group. Around the midaxillary line, the anterior major rami divides into the lateral and anterior dermal nerves. It has a path that runs amongst the transversus abdominis muscles & the internal oblique. They are the nerves that are in charge of the surface of the skin. [5]

IV patient-controlled analgesia, often known as PCA, is now being used extensively in the field of post-cesarean pain management. The objective of utilising patient-controlled analgesia is to successfully manage pain at a dosage & schedule that is desired. Providing individuals with the ability to deliver a predefined bolus amount of medicine on demand is one way to accomplish this goal. It was possible to deliver each bolus, either on its own or in conjunction with another drug. Opioids & local anesthetics are probably the two types of analgesics that are used the most often, however there are additional options available. [6]

We wanted to determine whether or not an ultrasound-assisted TAP block or an intravenous PCA was more effective in providing pain relief in the first twenty-four hours after a cesarean section in patient women. Postoperative pain at 2, 4, 8, 12, & 24 hours was the major outcome examined in this study. Intestinal mobility, nausea, early mobilization, heart rate, vomiting, & respiration rate were those that were considered secondary results.

Methods

A cross-sectional research has been conducted on 84 women at Faculty of Medicine, Menoufia university hospitals and Berket El-Saba General Hospital, who were admitted for delivery by elective cesarean section.

An approval was obtained from Ethics Committee in Menoufia University Hospital and Berket El-Saba Hospital.

Randomization was used to divide individuals into 2 categories. according to a sequence generated computerized software program with a ratio 1 : 1. This sequence was distributed consequently in numbered envelopes

Group I (TAP-block): included 42 patient utilising ultrasound guided transversus abdominis plane (USG-TAP) block procedure. **Group II (PCA):** involved 42 individuals utilising patient-controlled analgesia procedure.

Inclusion criteria: Singleton pregnant women aged from twenty to thirty five years, Pregnant at thirty seven to fourty two weeks, with body mass index 25–35 kg/m² and hemoglobin level above 10 g/dl undergoing elective cesarean section.

Exclusion criteria: Uncooperative patients with multiple gestation, BMI more than 35 kg/m², or having chorioamnionitis, or hypersensitivity or contraindications to opioids, or high risk pregnancy, or infection at site of injection.

Under the guidelines of the research protocol, each and every participant was asked to provide their written informed consent about the procedure.

Both groups were subjected to:

An antibiotic prophylaxis 60 minutes at least before skin incision in the form of single-dose intravenous injection of 1gm Cefazoline.

Standard methods were used to monitor them, including pulse oximeter, heart rate,

non-invasive arterial blood pressure, & the duration of cesarean section.

All operations were performed under regional spinal anesthesia.

The transversus abdominis plane block was guided by ultrasonography & performed after the incision had been closed in the collection that received the transversus abdominis plane block. since of this, the injection is completely painless, & the patient would not be able to perceive it since they are still under the influence of spinal anesthetic. In order to accomplish the TAP block, 0.25% bupivacaine was used (25 ml on each side being administered).

Utilizing a sono-sensitive short bevel needle with a gauge of 22 gauge, the approach involves inserting the needle in a sagittal plane around three to four centimeters medial to the ultrasound probe. In order to get a picture of the skin puncture & the superficial course, the probe is moved slightly anteriorly. After that, it is moved progressively posteriorly, following the needle until it reaches the right place in the transverse abdominis plane. By directing the needle point into the plane that is below the internal oblique & above the transversus abdominis muscle, the needle is precisely positioned. A modest amount of local anesthetic, one milliliter, of bupivacaine 0.25% is injected to open the plane among the two muscles. This may be followed by the insertion of the entire dosage of local anesthetic. It is necessary to reposition the needle if the 1 milliliter dosage seems to be somewhere inside the muscle rather than in between the muscles.

In PCA group: The PCA system (100 ml disposable infusion pump) was carefully explained to individual before cesarean section & its filled by 40 ml nalbuphine, 30 ml ketorolac, 3 mg granytryl, 2 ampules of ranitidine and completed by normal saline via IV patient-controlled analgesia device. The patient-controlled analgesia pump was programmed to have a basal infusion rate

of 2 milliliters per hour, a loading dose of 2 milliliters, a bolus of 2 milliliters, & a lockout interval of ten minutes.

After surgery: Visual analogue scale from 1 to ten was recorded by a blinded investigator at 2, 4, 8, 12, 24 hours during rest and during mobilization.

All women were received 1gm of paracetamol orally every 8 hours.

The rescue pain analgesia was given postoperatively in the form of Nalufin 4mg bolus IV (if VAS pain score is 4 or more) given upon patient request.

Statistical analysis

A table of the collated data was created using Microsoft Excel®. The SPSS (Statistical Package for the Social Sciences) version 28 (IBM Inc., Chicago, IL, USA) was utilized to conduct the statistical analysis. The Shapiro-Wilk test was employed to examine the variables' distribution pattern.

I- Descriptive

1. The mean value & standard deviation ($X \pm SD$) are used to analyze quantitative data that follows a normal distribution.
2. For quantitative data that is not regularly distributed, the median & the interquartile range (median (interquartile 25 – 75)) are used.
3. Frequency & percentage for qualitative data.

II- Analytic: which include the following tests:

- Chi-square test of independence (χ^2): Used to evaluate whether there is a substantial variance amongst qualitative data.
- Independent t-test: Used to evaluate whether there is a substantial variance amongst normally distributed quantitative data.

- Mann-Whitney U test: Used to assess whether there is a significant difference between non-normally distributed quantitative data.
- P value: P-value set at 0.05 where P value < 0.05 was considered statistically substantial.

Results

Age, BMI, GA, and parity were not significantly different across the groups that were investigated.

The length of time that each of the groups under study underwent surgery did not vary significantly from one another, but duration of analgesia, time of first analgesia, and time of first ambulation were significantly lower in TAP block group compared to PCA group with P value less than 0.05. [Table1]

The Visual analogue scale score was significantly higher in TAP block group at 2 and 4 hours after operation compared to PCA group. The P value was 0.009 at 2h and 0.031 at 4h which was significant, but was observed no substantial variance amongst the groups at 8, 12, and 24 hours after the operation.

Was observed no substantial variance in the number of patients with local anesthesia complications between the studied groups. The number of patients who suffered from nausea & vomiting was significantly higher in PCA group compared to TAP block group.

Discussion

With the goal of reducing the likelihood of death & disability, surgical procedures & anesthesia are considered to be essential components of medical treatment. In addition, the use of anaesthetics helps to lessen the instances of acute pain that occur during & soon after surgical procedures. [7]

When compared to systemic opioids, the

peripheral regional analgesic approach may give improved analgesia & avoid unwanted side effects. The method can be administered as a single or continuous infusion.

After receiving a comprehensive description of the procedures, as well as the benefits & drawbacks of each methodology, the ladies who participated in our research agreed with both applications. One of the pain scales that is utilized in medicine the most often is the VAS. As the best response scale, it is strongly recommended for use in evaluating pain in people who do not have cognitive impairment. [8]

Even though the VAS (which is used for assessing pain) revealed a reduction in the degree of pain feeling in both groups within the first twenty-four hours after surgery, the VAS values were much lower in the patient-controlled analgesia group than they were in the transversus abdominis plane block group. This was shown by the aforementioned research.

The TAP block was reviewed & compared to normal or control practice for the purpose of providing immediate pain relief after CS in a meta-analysis that was carried out by Champaneria (2016). The research came to the conclusion that TAP block was more effective than patient-controlled analgesia. This means that TAP block considerably reduces pain at rest when compared with placebo or with no transversus abdominis plane block at all. [9]

According to the findings of a meta-analysis conducted by Mishriky, post-cesarean TAP block is related with decreased pain levels both at rest (six & twelve hours) & with movement (six & twelve hours). [16] According to the information that is now available, the transversus abdominis plane block seems to be useful for postoperative analgesia. The investigations came to the conclusion that transversus abdominis plane block eliminates the need for opioids & has the potential to decrease pain ratings during

the first twelve hours after cesarean section . [10]

In 2018, Ng conducted a meta-analysis to compare the effectiveness of a high dosage of TAP block to that of a modest dose that was administered. As a consequence of their meta-analysis, the researchers found that both collections (low-dose & high-dose categories) had comparable effects in terms of postoperative analgesia & opioid-sparing (opioid intake, time-to-first request, & 24-hour pain levels). As a consequence of this, it was eventually determined that there would be no further benefit associated with the use of local anesthetics over a certain dose threshold. In addition, low-dose techniques for post-cesarean transversus abdominis plane block have the potential to lessen the likelihood of local anesthetic toxicity while yet preserving the effectiveness of the analgesic agents. [11] According to the findings that we obtained, this is consistent.

According to the findings of our research, nalbuphine was selected as an alternative to morphine in order to mitigate the well-known adverse effects of morphine, which include respiratory depression, itching, & postoperative nausea & vomiting. On the contrary, nalbuphine, which is both a μ antagonist and a k agonist, exhibits a ceiling effect in its respiratory depression. As a result, it is regarded as a safer alternative to morphine. When compared to morphine, the occurrence of side effects such as pruritis & PONV during treatment with nalbuphine is much reduced. [12] During the postoperative phase, Yeh studied individuals who had undergone open gynecological procedures & utilized various combinations of morphine & nalbuphine. He discovered that there was no variation in the amount of PCA that was required. [13]

It is possible that the systemic impact of the combined medicines of PCA, which influence visceral pain, is the reason why PCA is better than TAP block in terms of pain relief after CS & patient satisfaction. This is in contrast

to transversus abdominis plane block, which only operates on somatic pain in the anterior abdominal wall during the procedure.

On the other hand, Erbabacan came to the conclusion that, in instances when lower abdominal procedures are being performed, 30 milliliters of transversus abdominis plane block is just as effective as intravenous patient-controlled analgesia in terms of pain relief. In addition, when intravenous patient-controlled analgesia was compared to TAP block, it was found that TAP block was considered to be a more superior method. This was due to the fact that it was able to avoid the systemic effects of morphine, which was utilized for PCA, & because its analgesic impact began sooner. [14] It is However, this research was conducted on lower abdominal procedures rather than cesarean sections, which do not take into account the discomfort that is associated with post-operative uterine contractions.

In contrast to the findings that we obtained, a research that was carried out by Erbabacan revealed that the values of heart rate were discovered to be considerably lower in the transversus abdominis plane block group compared to the patient-controlled analgesia collection. According to the findings of our research, there was no discernible variation in heart rate amongst the groups that were evaluated at the beginning of the investigation, five, ten, thirty, & forty minutes after the operation.

The results of our investigation showed that there were no variances between the effects of transversus abdominis plane block & IV patient-controlled analgesia on respiratory rate. This might be attributed to the fact that both groups reported experiencing modest levels of discomfort. In terms of nausea & vomiting, it was discovered that the women who were in the "PCA group" experienced much more of them than those who were in the "TAP block group" (Table 2). Reductions in postoperative nausea & vomiting, as well as antiemetic needs, have been reported.

This difference may be due to the dosage of nalbuphine that was administered to the PCA group.

While Siddiqui performed a meta-analysis to analyze the therapeutic efficacy of transversus abdominis plane block on nausea alone, he discovered that there was no significant decrease in nausea score. This finding contradicts the findings that we obtained at the time. Nevertheless, this might be because of the various dosages that were administered. [15]

Similarly, Mäkelä conducted an investigation on 205 individuals & analyzed oxycodone, which has an emetic effect. The researchers came to the conclusion that individuals who received intravenous PCA reported higher nausea after 4 hours & more vomiting at 8 hours ($p = 0.001$ and $p = 0.01$, respectively) [16]

However, we are able to explain this discrepancy through utilizing different dosages than we used in our research. Those investigations did not concur with our findings. Auscultation with a stethoscope was performed at intervals of 2, 6, & 24 hours in order to assess the motility of the digestive tract. In the "TAP block group," it was heard sooner than in the "PCA group," according to the observations. PCA medications have a systemic impact, which might be the cause of this phenomenon. The authors of the Cochrane study, Charoenkwan and Matovinovic, came to the conclusion that early postoperative eating is safe & facilitates speedier recovery of bowel function, a shorter hospital stay, & greater levels of satisfaction following major gynecological surgery. [17]

In terms of the early mobilization of women in the groups that were tested, PCA had a role in delaying patient mobilization owing to its sedative impact. This was in comparison to patients who received TAP block. According to the findings of Mäkelä, the average amount of time required for mobilization was seventeen hours, which was far higher than the six-hour guideline [16]

As a result of the main mechanism of the treatment and the pharmaceuticals that are used, it has been stated that the PCA technique is associated with a number of difficulties and typical adverse effects. Among the most prevalent difficulties associated with PCA pumps are the failure to employ anti-reflux valves, pumps that "run away," patient-controlled analgesia via proxy, poor syringe positioning, & machine manipulation. [18]

TAP block in cesarean birth is effective as a main means of analgesia in women who are not receiving neuraxial morphine for any reason. However, as a result of anatomical changes that occur after cesarean delivery, it may be difficult to execute the TAP block after the delivery. Nevertheless, the ultrasonographic anatomy is indicated as the optimal solution to this difficulty in order to conduct the block. This is true even after the cesarean birth. Visceral analgesia was not provided by the TAP block, which was the primary disadvantage of this technique. As a consequence of this, it is possible that this is the reason why several studies were unable to convincingly establish that TAP block is superior to alternative options.

During our review of the relevant literature, we came to the realization that the bulk of the studies that were conducted on both methodologies had been conducted on surgical procedures other than cesarean sections. We have high hopes that our study will open the way for more research on this subject, especially in light of the significant increase in the number of women who have cesarean sections & the increasing need for procedures that are painless.

Conclusion

Because of its usefulness in alleviating pain after surgery, TAP block and IV PCA were both subjected to research. On the other hand, intravenous PCA was preferable than transversus abdominis plane block because it covered visceral pain, but

transversus abdominis plane block was favored since it avoided the systemic impact of opioids that were employed in patient-controlled analgesia. Additionally, patient-controlled analgesia could be done without much difficulty, while TAP block required additional training as well as an intraoperative ultrasound equipment. When changing the amounts of the medications that were utilized in both procedures, there were very few complications and adverse effects of either sort.

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Table 1

	TAP block group (n =42)	PCA group (n =42)	Statistical test	P value
Duration of surgery (mins) Mean \pm SD Range	45.5 \pm 7.9 35 - 60	45.5 \pm 7.9 35 - 60	t =2.61	0.011*
Duration of analgesia (mins) Mean \pm SD Range	843 \pm 317 400 - 1440	1172 \pm 208 480 - 1440	t =5.6	<0.001*
Need for rescue analgesia Yes No	17 (40.5%) 25 (59.5%)	8 (19.0%) 34 (81.0%)	χ^2 =4.56	0.033*
Time of first analgesia (hours) Mean \pm SD Range	10.4 \pm 2.4 7 - 15	15.2 \pm 3.1 8 - 18	t =4.3	<0.001*
Time of first ambulation (hours) Mean \pm SD Range	5.4 \pm 1.2 4 - 8.5	6 \pm 1.3 4 - 8.5	t =-2.12	0.037*

Table 2

	TAP block group (n =42)	PCA group (n =42)	Statistical test	P value
VAS at 2h Median (IQR) Range	1 (0 - 1) 0 - 2	0 (0 - 1) 0 - 1	U =626	0.009*
VAS at 4h Median (IQR) Range	2 (1 - 3) 1 - 5	1 (0 - 2) 0 - 4	U =649	0.031*
VAS at 8h Median (IQR) Range	2 (2 - 3) 1 - 5	2 (1 - 3) 0 - 4	U =704	0.1
VAS at 12h Median (IQR) Range	1 (0 - 2) 0 - 3	0 (0 - 2) 0 - 4	U =813	0.507
VAS at 24h Median (IQR) Range	1 (0 - 1) 0 - 2	0 (0 - 1) 0 - 2	U =739	0.160