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Transversus Abdominis Plane block under general anesthesia versus intrathecal morphine for pain management after elective cesarean delivery

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Abstract:

Background: For women having cesarean deliveries, neuraxial anesthesia combined with neuraxial opioids is still a common and useful method of administering anesthesia and analgesia. Nevertheless, in certain circumstances, general anesthesia is necessary, which makes it impossible to employ neuroaxial drugs for postoperative analgesia; this has increased the usage of other pain management techniques in addition to the incidence of opioid-related side effects. Transversus abdominis plane (TAP) block has been suggested as a useful component of the multimodal regimen for managing post-delivery pain, so the study was designed to describe the postoperative analgesic efficacy of TAP blocks (without ITM) in comparison to ITM for cesarean section.

Methods: An interventional study on a total of 100 American Society of Anesthesiologists physical status I and II who were divided into two groups: 50 patients in Group I received intrathecal morphine as a postoperative analgesic after spinal anesthesia (ITM Group) and 50 other patients in Group II (TAP Group) received ultrasound-guided TAP block following surgery performed under general anesthesia. This research compares the pain management outcomes of two therapy groups (ITM and TAP) based on a statistical analysis of data collected using Statistical Package for Social Sciences(SPSS) version 20, which was examined, cleaned, and coded.

Results: the study shows that the ITM group had significantly lower postoperative pain intensity than the TAP group at all time points except for 6 and 8 hours after surgery, when the difference did not reach a significant value. Seven cases in (group I) need rescue nefopam versus eleven cases in (group II); none of the patients required tramadol during the first 24 hours postoperatively in both groups. In the ITM group, twenty-one cases (42%) develop postoperative side effects compared to twenty-nine cases (58%) in whom no side effects had been reported, whereas only one case (2%) in the TAP group complains from nausea. Maternal satisfaction with pain relief was similar in both groups.

Conclusions: 1. Intrathecal morphine is effective in the management of post-cesarean pain and provides a superior analgesic effect, although associated with undesirable side effects, in comparison with ultrasound-guided TAP block.2.Transversus abdominis plane block has a considerable potential

to provide effective pain relief after cesarean section with no significant side effects. 3. Although the analgesic effect of TAP block covers only somatic pain, visceral pain at its worst did not appear to be prominent and was relieved by paracetamol and nefopam.4.TAP block can be considered as a valuable analgesic option for patients who cannot tolerate intrathecal morphine for analgesia after cesarean delivery or those having a high risk of nausea and vomiting.

Key words:
TAP block, postoperative, somatic pain, ITM, bupivacaine, and nefopam.

Introduction

The most terrifying scenario for patients having surgery is postoperative pain and discomfort, which is widely known to be related with cesarean sections (1). The biggest obstacle facing anesthesiologists today is providing elective postoperative analgesia since it is crucial for promoting early ambulation, fostering mother-child relationships, and preventing postopertive morbidity (2).

A multimodal regimen is the foundation of many analgesic methods. Still, the best elements of this routine are always changing (3). For women having cesarean deliveries, neuraxial anesthesia combined with neuraxial opioids is still a common and useful method of administering anesthesia and analgesia (4). There are several adjuvants to intrathecal local anesthetics that can be used to enhance the quality and duration of spinal blocking and extend postoperative analgesia when arranging spinal anesthesia for a cesarean operation (5). The American Society of Anesthesia (ASA) recommendations for obstetric anesthesia suggest that neuroaxial opioids be used in lieu of intermittent parenteral boluses. Among neuroaxial opioids, intrathecal morphine is regarded as the "gold standard." (6), But the predominant side effects of opioids continue to be their undesired side effects, which include drowsiness, nausea, vomiting, pruritus, urine retention, and respiratory depression (7).

Low intrathecal morphine dosages, between 0.1 and 0.25 mg, have been utilized recently to lessen problems and side effects (8). Nevertheless, in certain circumstances, general anesthesia is necessary, which makes it impossible to employ neuroaxial drugs for postoperative analgesia; this has increased the usage of other pain management techniques in addition to the incidence of opioid-related side effects (9). Recently, the transversus abdominis plane (TAP) block has been suggested as a useful component of the multimodal regimen for managing post-delivery pain, particularly when carried out under ultrasonography guidance. Given these issues, in addition to the thought that the advantage of adding a TAP block could be even more obvious after a cesarean section performed under general anesthesia, the study was designed, which is, to our knowledge, the first study of patients undergoing cesarean section under general anesthesia while has described the postoperative analgesic efficacy of TAP blocks (without ITM) in comparison to patients receiving ITM for cesarean section (without TAP block) in the first 24 hours postoperative period (10).

Patients and Method:

Type of study: An interventional study.

Study setting and sampling: A total of 100 American Society of Anesthesiologists physical status I and II, aged between 18 and 45 years, with pregnancy weight of more than 50 kilograms and more than 35 weeks gestation, were scheduled for an elective cesarean section via a (Pfannenstiel) incision under spinal or general anesthesia after receiving ethical approval by the Hospital Ethics Committee and informed consent from the patient. Over the course of six months (December 2022–June 2023), 100 parturients were randomly assigned to receive either transversus abdominis plane block or spinal morphine. The patients were divided into two groups: 50 patients in Group I received

intrathecal morphine as a postoperative analgesic after spinal anesthesia (ITM Group), and 50 other patients in Group II (TAP Group) received ultrasound-guided TAP block using 20 milliliters of 0.25% plain bupivacaine and five milliliters of 0.2% lidocaine per side following surgery performed under general anesthesia.

Patients who were less than 50 kg during pregnancy, those who couldn't undergo regional anesthesia due to bleeding diathesis or infection at the block site, those with severe medical conditions like pre-eclampsia or eclampsia, those with chronic pain disorders, those who were discharged from the hospital during follow-up, and parturients receiving any other analgesics other than those specified in the study protocol were all excluded from the study.

Tools of the study: Data was collected through patients' files of admission to the operating room by a data sheet designed by the researcher.

Reliability and validity: The data sheet was reviewed by anesthesiologists, gynecologists, and obstetrician consultants; it was piloted on a small sample of inpatients to test the clarity and applicability of study tools, identify difficulties that may be faced and the time needed for filling.

Definitions:

TAP block (11): is a regional anesthetic technique that blocks the abdominal wall neural afferents between T6 and L1 segmental nerves, which provides good analgesia for abdominal wall incision by introducing local anesthetics into the neuro-fascia plane between the internal oblique and transversus abdominis muscle, it has been proposed to relieve the somatic pain components (12).

Morphine (13): it's the basic reference of opioids to which all analgesics of its kind are compared. It is a phenanthrene derivative, the prototypical agonist opiate at mu and kappa opioid receptors, and its chemical formula is C17H19NO3. It can be administered by mouth, intravenously, intramuscular, subcutaneously, rectally, intranasal, and through the neuro axial route. It has a significant amount of first-pass liver metabolism, and about 40%-50% of the absorbed morphine reaches the central nervous system. Most morphine is eliminated by the kidney. Its poor lipid solubility- a physical characteristic that favors its behavior when injected into the intrathecal space- producing slow analgesic onset with long duration and rostral migration that explain some of its side effects,

Somatic pain (14): is a pain evoked by nociceptive information that arising from any tissues of the body, including bones, muscles, joints, ligaments, and tendons of the spine, the trunk, and the limbs.

Visceral pain (14) refers to pain that arises from the internal organs of the body.

Pain Assessment Scale (15):

0	no pain
1-3	Mild
4-6	Moderate
7-9	Severe
10	worst pain possible

Procedure: Heart rate, blood pressure, and peripheral oxygen saturation were monitored in the operating room prior to induction of anesthesia. In both groups, two intravenous cannulas were inserted, intravenous infusion of crystalloid solution was given as preloading, ephedrine was administered as needed (in Group I) to treat hypotension, and 10 mg metoclopramide was given intravenously as premedication before surgery in Group I but offered to patients who complained of nausea or vomiting in Group II.

Each patient in Group I received spinal anesthesia with 12.5-12.75 mg of 0.5% hyperbaric bupivacaine supplemented with 160 Mcg of free preservative morphine at L3-L4 or L4-L5 interspace in a sitting position using 25-gauge pencil point spinal anesthesia needle with 20G guide needle. In the TAP group, anesthesia was induced with 2mg\kg Propofol; tracheal intubation was facilitated by the administration of atracurium 0.5 mg\kg, and anesthesia was maintained with 0.6% Isoflurane. After delivery of the infant and clamping of the umbilical cord, 5 IU oxytocin was administered slowly; analgesia was provided with 100 Mcg fentanyl, and 1mg midazolam was given. TAP block was performed bilaterally at the end of operation when the patient was still under general anesthesia using either SonoScape, or Voluson E6\GE HealthCare ultrasonography machines with a linear array transducer probe (10.0-11.5 MHZ), after preparing the skin with antiseptic solution, the probe was placed transversely on the anterolateral abdominal wall between the iliac crest and costal margin, under USG, the three layers of muscles (External Oblique, Internal Oblique and Transversus Abdominis) were identified, A 22 gauge 90 mm length needle attached to a syringe filled with the injected solution was used to perform the block, the needle was then introduced through the skin in the plane of the US beam and advanced into the fascia plane between the internal oblique and transversus abdominis muscles, once the tip of the needle was in the TAP, aspiration done to exclude inadvertent vascular puncture and a test dose of 1ml of the already prepared study solution was injected to verify needle placement seen as the formation of hypo-echoic lens-shaped image. After an adverse test dose, 25 ml of the study solution was injected slowly (20 ml of 0.25% plain bupivacaine and 5 ml of 0.2% lidocaine in two separated syringes per side) after the end of surgery performed under general anesthesia. TAP block was performed in a similar fashion on the opposite side. At the end of the surgery, 2.5 mg neostigmine and 1mg atropine were administered to antagonize any residual neuromuscular blockade, and the patient was extubated awake and taken to the postoperative recovery room. Postoperative analgesic regimen consists of 1gm intravenous paracetamol eight hourlies; the first dose was given at the end of the surgery, supplemental analgesia 20 mg nefopam (Acupan) infusion was administered if the pain score was beyond 3 points or if the mother demand for it, intravenous tramadol 100 mg was given if pain score still remains more than three.

In the postoperative care unit, all observations were made by an independent observer who was unaware of group allocation. Collected data included age, weight, height, parity, gestational age, and past medical and surgical history. Patients were evaluated for pain immediately after surgery and at 2,4,6,8,12,18,24 hours postoperatively, with 0 representing no pain and 10 representing the worst pain possible.

The occurrence of pruritus, postoperative nausea and vomiting, and respiratory depression associated with morphine consumption were assessed; patients whose pruritus was severe and troublesome received intravenous 25 mg diphenhydramine, the total number of supplemental doses of nefopam and tramadol consumed in 24 hours was also recorded. Concomitant administration of adjuvant analgesics in the setting of multimodal analgesia was restricted to the routine use of paracetamol and rescue nefopam infusion or tramadol only for better evaluation of the true analgesic efficacy of ITM and TAP block for the sake of comparison and to spare the postoperative side effects related to the use of opioids or non-steroidal anti-inflammatory drugs as part of postoperative multimodal analgesia. Twenty-four hours after the injection, both sites of the TAP block injections were inspected to detect complications such as hematomas or infection; the patients were also interviewed after 24 hours of surgery regarding satisfaction with their pain management, which was rated on a three-point scale (1 score =highly satisfied, two score=satisfied, 3scores=unsatisfied).

Statistical analysis: Each data sheet was assigned a serial identification number, the data were reviewed, cleaned with double check entry into the computer using Statistical Package for

Social Science (SPSS) version 20, and then it was coded by the researcher. Data were presented as frequency, percentage, tables, pie, and bar charts were used also. Appropriate tests were performed to assess the statistical relation between different variables. A P-value of 0.05 level or less was considered statistically significant.

Results:

One hundred patients were enrolled in the present study: 50 patients in the ITM group and 50 in the TAP group, and data from them were analyzed. Socio-demographic data were expressed as mean and standard deviation, and there was no significant difference between the two groups, as shown in Table 1:

Table 1. Main characteristics of patients in both groups:

Parameter	ITM (N=50)	TAP (N=50)	P-value
Age (yrs.)	6.238±28.06	5.397±28.12	0.402
Weight (kg)	70.82±13.986	12.794±75.94	0.886
Height (cm)	4.699±160.28	5.573±161.08	0.108
Parity	0.490±1.62	0.485±1.64	0.683
GA (wks.)	1.325±37.60	1.233±37.70	0.842
PMH	0.328±1.88	0.328±1.88	1.000
PAS	0.505±1.50	0.495±1.40	0.156
Duration of surgery (min)	12.452±39.80	8.034±37.50	0.172

Pain assessment scale scores were used to measure postoperative pain intensity at different time points between the two groups. The results are shown in Table 2 as mean difference and standard deviation, which indicates that the ITM group had significantly lower postoperative pain intensity than the TAP group at all time points except for 6 and 8 hours after surgery when the difference did not reach a significant value as indicated by the p-value.

Table 2. Post-operative pain scores in both groups at different time points:

Pain assessment score at time point	ITM (N=50)	TAP (N=50)	P-value
H0	0.141±1.02	0.485±1.36	0.001
H2	0.351±1.14	0.495±1.40	0.001
H4	0.3570±1.16	0.503±1.46	0.001
H6	0.497±1.28	0.530±1.62	0.073
H8	0.443±1.26	0.535±1.80	0.576
H12	0.544±1.48	0.314±1.94	0.001
H18	0.593±1.66	0.470±2.06	0.001
H24	0.468±1.84	0.247±1.98	0.001

Table 3. The number of cases that need rescue analgesic 24 hours postoperatively:

Postop. analgesic drug	ITM (N=50)	TAP (N=50)	P-value
Nefopam	**7 (14%)**	**11 (22%)**	**0.001**

As seen in Table 3, seven cases in (group I) need rescue nefopam versus eleven cases in (group II); this difference in analgesic requirements is significant (p-value less than 0.05), none of the patients required tramadol during the first 24 hours postoperatively in both groups.

It should be mentioned that, in our study, two cases in the TAP group had been recorded to receive nefopam at two different time points as they develop moderate pain (pain score = 4). In the first 12 hours after the operation, breakthrough pain (moderate pain) occured in two cases in the ITM group versus five cases in the TAP group and was handled by nefopam infusion. In the second 12 hours, five rescue doses of nefopam were needed in the ITM group versus eight doses in the TAP group, as illustrated in Figure (1):

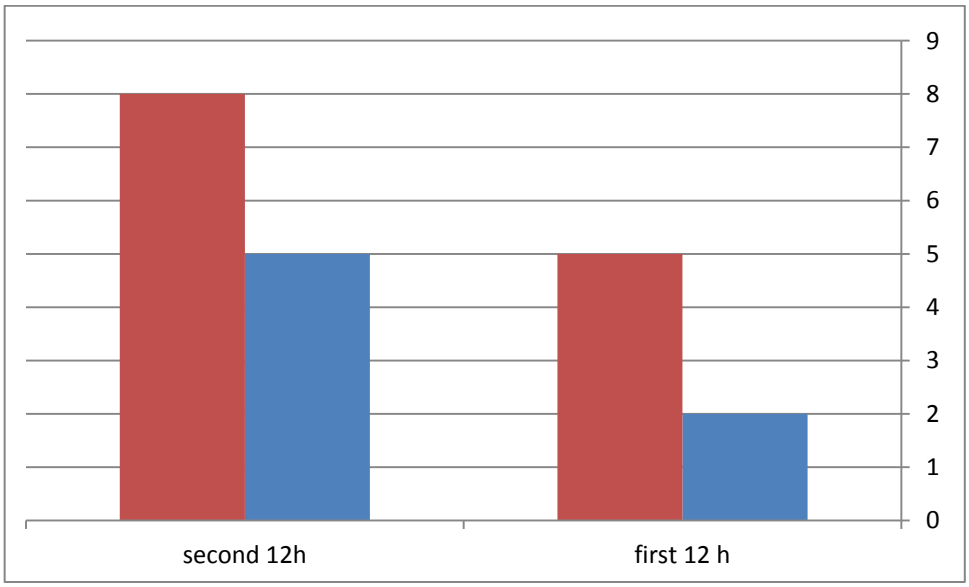

Figure (1) No. Of cumulative nefopam doses during the first and second 12 hours postoperatively

In the ITM group, twenty-one cases (42%) develop postoperative side effects compared to twenty-nine cases (58%) in whom no side effects had been reported, whereas only one case (2%) in the TAP group complains from nausea, as seen in Figure (2).

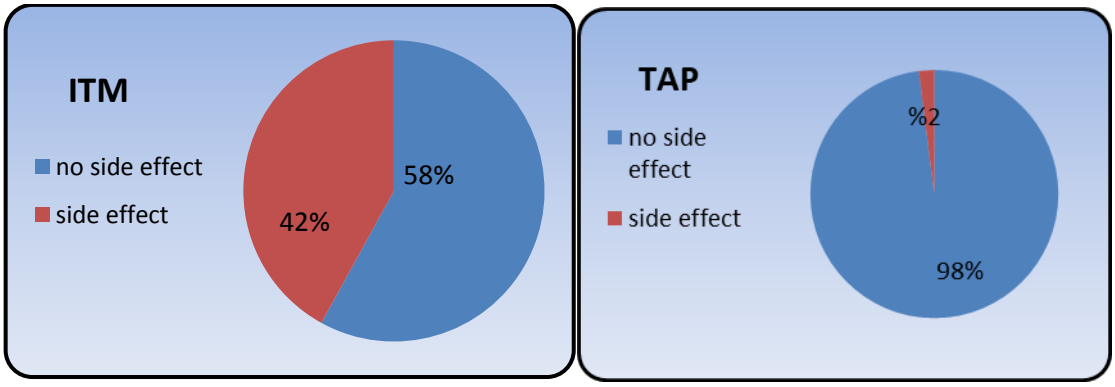

Figure (2) proportion of postoperative side effects in both groups

Table 4. Post-operative side effects:

Side effect	ITM (N=50)	TAP (N=50)	P-value
Nausea	2 (4%)	1 (2%)	0.0

			01
Vomiting	11 (22%)	0 (0%)	0.002
Pruritus	8 (16%)	0 (0%)	0.002
respiratory depression	0 (0%)	0 (0%)	0.000

In Table (4), the incidence of side effects in the ITM group was significantly higher than that in the TAP group (P value ≤ 0.05).

N.B. None of the patients in either group develop complications.

Table 5. assessment results according to Patient Satisfaction

Satisfaction score	ITM (N=50)	TAP (N=50)
highly satisfied	24 (48%)	26 (52%)
Satisfied	26 (52%)	24 (48%)
Unsatisfied	0 (0%)	0 (0%)

Maternal satisfaction with pain relief was similar in both groups, as seen in Table 6. It should be mentioned that in either group of the present study, no case had been recorded to have a pain score of more than 4 of 10 maximum scores.

Discussion:

Spinal opioids and abdominal field block have been investigated as effective analgesia for postoperative pain and reduce the need for systemic medications (16) (17) (18). This has presented the opportunity to design this study to compare the analgesic efficacy and side effects of spinal morphine co-administered in neuroaxial anesthesia to ultrasound-guided TAP block after elective C-section performed under general anesthesia during the first 24 hours in the postoperative period. In the present study, socio-demographic data were all similar in both groups as in Kanazi et al. (19) and other studies comparing between ITM and TAP groups (20), Bedru et al. found in his study that except for height and gestational age, no significant variations were found between groups when demographic characteristics were compared (21).

The results showed that pain scores were significantly lower in the ITM group at all-time points apart from H6 and H8, which show statistically no significant difference, and this may be related to the fact that the TAP analgesic effect covers only somatic pain derived from the abdominal wall incision while intrathecal morphine is effective in the treatment of both somatic and visceral pain, and this was noticed at these two-time points as patients are encouraged for early movement so experienced more postoperative visceral pain. Similarly, Bedro et al. (21) found that the addition of morphine for cesarean delivery under spinal anesthesia provides superior analgesia and exhibits significantly lower postoperative pain scores compared to that of the TAP block, while Kanazi et al. (19) reported in his study improved early postoperative pain scores (during the first 4 hours). McMorrow et al. (20) found that ITM – but not TAP block- improved analgesia and reduced early pain after cesarean section. Kwikiriza A. et al. (22) and Loane H et al. (23) studies did not find a significant difference regarding the pain scores between the groups.

The study showed that ITM improved pain intensity during the first 24 hours after cesarean deliveries compared to TAP. The average cumulative doses of 24 hours postoperative nefopam

rescue analgesia were lower in the ITM group, and the number of patients requiring analgesia for breakthrough pain in the first and second 12 hours was significantly lower in the ITM group compared to the TAP group. The results were similar with the search of Bedru (21), who concluded that ITM provided better analgesic efficacy and less postoperative analgesic consumption compared to that of the TAP group; Ben Marzouk et al. (24) found that ITM and TAP block have similar efficacy for pain relief after cesarean section and the total doses of rescue analgesia were comparable in both groups. Kanazi et al. (19) showed in his study that patients receiving ITM 0.2 mg for postoperative pain management reported a longer duration of analgesia, improved early pain scores, and less use of tramadol during the first 24 hours, but at the cost of increased incidence of nausea, vomiting, and pruritus in comparison with the ultrasound-guided TAP block. Regarding postoperative side effects, vomiting, and pruritus are the opioid-related side effects recorded in 22% and 16% of patients in the ITM group, respectively, as compared to the TAP block group, which displayed no side effects apart from nausea reported in a single case. None of the patients in the study population had respiratory depression. Similar finding was observed with the research of Kanazi et al (19). In a meta-analysis conducted by Tao-ran Yang (25), although the incidence of postoperative pruritus in the ITM and TAP block groups was comparable, the incidence of PONV was reported to be higher in the ITM group. Our study, as well as Kanazi's study (19), found that ITM and TAP block provided equivalent maternal satisfaction. The presence of side effects associated with ITM has not been shown to have a negative impact on patient satisfaction. Every patient in both groups was either satisfied or highly satisfied with the post-cesarean section pain management strategy provided for her, whether ITM or TAP block services.

Conclusions:

1) Intrathecal morphine is effective in the management of post-cesarean pain and provides a superior analgesic effect, although associated with undesirable side effects, in comparison with ultrasound-guided TAP block.
2) Transversus abdominis plane block has a considerable potential to provide effective pain relief after cesarean section with no significant side effects.
3) Although the analgesic effect of TAP block covers only somatic pain, visceral pain at its worst did not appear to be prominent and was relieved by paracetamol and nefopam.
4) TAP block can be considered as a valuable analgesic option for patients who cannot tolerate intrathecal morphine for analgesia after cesarean delivery or those having a high risk of nausea and vomiting.

Recommendation:

Adjuvant analgesics should be administered concurrently with TAP block as a post-C-section delivery analgesic method to enhance quality and improve outcomes. This should be done in the context of multimodal analgesia to reduce the visceral pain component originating from the uterus.

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