EFFICACY OF ULTRASOUND-GUIDED TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK FOR POST-CESAREAN SECTION DELIVERY ANALGESIA

- A Double-Blind, Placebo-Controlled, Randomized Study -

JUMANA M BAAJ*, RAED A ALSATLI**, HAYAN A MAJAJ***, ZAINAB A BABAY**** AND AHMED K THALLAJ*****

Abstract

Background: Ultrasound-guided transversus abdominis plane (TAP) block has been used for intra-operative and postoperative analgesia. Here we evaluate the efficacy of TAP block for postoperative cesarean delivery analgesia.

Method: A randomized, double-blind, placebo-controlled trial was performed at King Khalid University Hospital on 40 patients undergoing cesarean delivery under spinal anesthesia with bupivacaine and fentanyl. At the end of surgery they received bilateral ultrasound-guided TAP block either with bupivacaine 0.25% (B group) 20 patients, or saline (S group, or placebo group) 20 patients, followed by patient controlled analgesia with IV morphine only. Each patient was assessed 24 hours after delivery for pain, morphine consumption, nausea, vomiting, sedation, patient's satisfaction, and also pain relief during mobilization (24 hours post-cesarean section).

*Results***:** All 40 participants completed the study. Total morphine consumption was reduced more than 60% in the bupivacaine group; the bupivacaine group also reported improved satisfaction with their pain relief over 24 hours after surgery, reduced morphine consumption, less nausea, vomiting, and better patient's satisfaction.

Conclusion: Ultrasound-guided TAP block improved postoperative analgesia, reduced morphine consumption and improved patient's satisfaction regarding analgesia after cesarean delivery.

Key words: Ultrasound guided (USG), transversus abdominis plane (TAP), (U S) ultrasound. external oblique muscle (EOM), internal oblique muscle (IOM), transversus abdominis muscle (TAM), visual analogue scale (VAS), cesarean section C/S.

From the Departments of Anaesthesia, Cardiac Science Obstetrics & Gynaecology, College of Medicine and King Khalid University Hospital, King Saud University, Riyadh, Saudi Arabia.

* MD, Arab Board. Consultant Anesthesiologist, Department of Anaesthesia.

** MD, Facharzt, Assistant Professor and Consultant Cardiac Anaesthetist, Department of Cardiac Science, Cardiac Anaesthesia.

*** MD, Arab Board, Senior Registrar, Department of Anaesthesia.

**** MBBS, ABOG, Professor and Consultant, Obstetrician, Gynecologist and Perinatologist, Department of Obstetrics & Gynaecology.

***** MD, Arab Board, Assistant Professor and Consultant Anaesthesiologist, Department of Anaesthesia.

Address Correspondence to: Dr. Jumana BM Baaj, Consultant Anaesthetist, Department of Anaesthesia, College of Medicine, P.O Box: 2925, Riyadh 11461, Kingdom of Saudi Arabia. Tel: (+9661) 4692019/4692194, Fax: (+9661) 4692366, E-mail: bjumana@yahoo.com

Introduction

Post-cesarian section pain and discomfort may be anticipated due to skin incision, uterine incision and uterine contraction. The aim of this study is to evaluate the analgesic efficacy of ultrasound-guided TAP block for postoperative period.

We hypothesized that the TAP block, as an analgesic regimen, would result in improved analgesia, decreased opioid consumption in the first 24 hours after cesarean delivery compared with placebo, facilitated early mobilization, and improved postoperative patient's satisfaction.

Method

The study was performed in the period May 2009 to April 2010, in King Khalid University Hospital. It was approved by our institution's Ethics Committee and a written informed consent was obtained from each patient. We studied 40 ASA I-II women having cesarean delivery at term in a randomized, double-blind, placebo-controlled trial. A control group of 20 patients received saline for TAP block (S group), while other 20 patients received bupivacaine (B group). All participants were above 18 years old.

Exclusion Criteria: Patients who were (ASA) classification III-IV, patients with contraindications to spinal anesthesia or history of allergy to bupivacaine, patients who received analgesics in the past 24 hours, and obese patients with a BMI >40 were not included in the study.

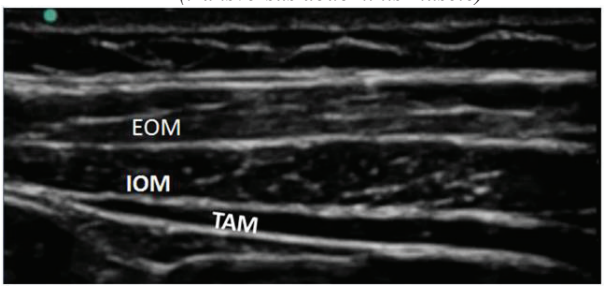
All participants received spinal anesthesia using hyperbaric 0.5%, bupivacaine 10 mg, and fentanyl 20 µg. Antiemetics were not routinely administered but if required, metoclopromide 10 mg i.v. was given.

An ultrasound-guided TAP block was performed at the end of surgery, skin was prepared with 2% chlorhexidine solution and a high-frequency (13-6 MHz) ultrasound probe (SonoSite M-Turbo Sonosite Inc., Bothel) was used.

The injectate syringes were prepared under aseptic technique; syringes contained either normal saline 40 ml (placebo group) or bupivacaine 0.25% 40 ml. Investigators were blinded to the injected solution. Ultrasound probe was positioned in mid-axillary line half way between costal margin and iliac crest.

The satisfactory image was aimed to visualize the subcutaneous fat, external oblique muscle, internal oblique muscle, transversus abdominis muscle, peritoneum, and intraperitoneal cavity (Fig. 1).

Fig. 1
Transversus abdominis plane, EOM (external oblique muscle), IOM (internal oblique muscle), TAM (transversus abdominis muscle)



A 100 mm long 20G short bevel needle (Stimuplex A B/BRAUN Melsungen AG, Germany) was inserted in plane to the probe of the ultrasound anteriorly to lie between internal oblique muscle and transversus abdominis muscle, a total of 20 ml study solution was injected in each side (left and right). Successful injection was obtained when an echoluescent lens-shape appeared between the two muscles (Fig. 2a and 2b).

Fig. 2a
Transverse ultrasound view of the EOM, IOM, and TAM at the beginning of local anesthetic injection, between the inner two muscles IOM and TAM

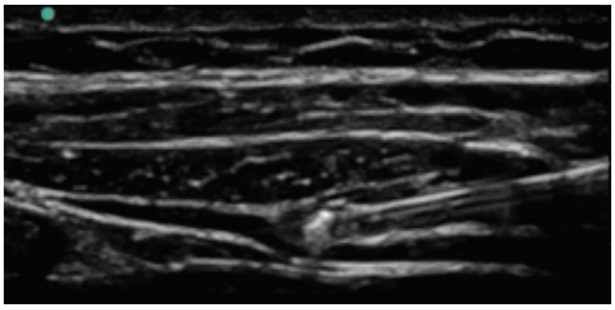
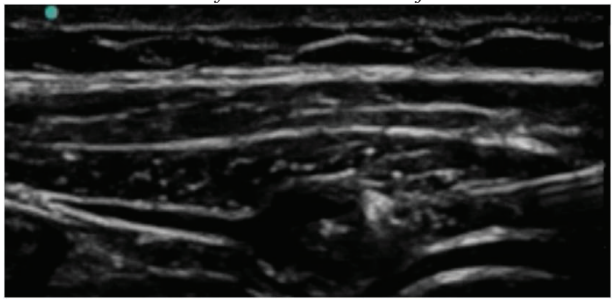


Fig. 2b
Transverse ultrasound view of the EOAM, IOAM, and TAM at the end of local anaesthetic injection



All patients received morphine patient-controlled analgesia with dose of 1mg bolus, and 10 minutes lock-out time for 24 hours postoperatively. The primary outcome was the total morphine consumption over 24 hours after surgery. Data were obtained from PCA pump. Accumulative morphine doses at 6, 10, 12, 18, 24 hours post-surgery were recorded, participants were asked about their pain experience on 10mm visual analogue scale (VAS) during the 24 hours postoperatively and during mobilization 24 hours after surgery. Satisfaction with pain relief was reported over 24 hours. Participants were asked for severity of nausea, vomiting, and sedation.

The calculation assumed the use of Fisher's exact test. Chi-square test was used to compare between patients in bupivacaine group and placebo group for nominal variables, i.e. sedation, satisfaction, post-operative nausea and vomiting, previous cesarean and previous surgical operations.

Student's t-test was used for independent groups to compare between both groups for measurable variables, i.e. age, BMI, weight, height, morphine consumptions and visual analogue score.

We assumed there was a statistically significant difference when P-value is less than 0.05

Results

Forty patients were included in the study, all participants had elective cesarean deliveries, the baseline characteristics of the two groups were not significantly different (Table 1); ultrasound views were satisfactory in all participants, no blood aspiration occurred in all TAP block cases, no side effects were observed during and after 24 hours of surgery. Regarding previous cesarean sections there was no statistical difference between both groups (Table 2).

Table 1
Baseline characteristic of the study participants; no statistically significant differences between the groups for all baseline characteristics

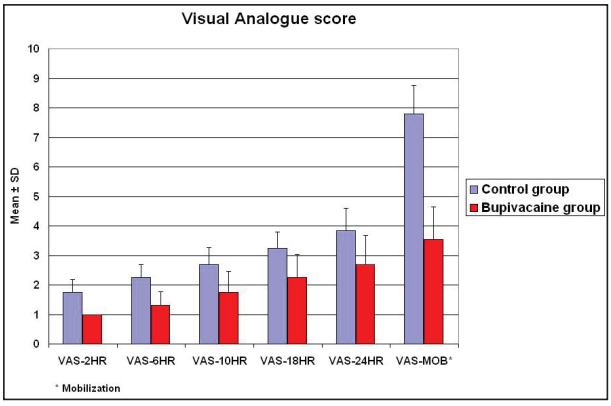
Parameter	Bupivacaine group	Control group
Age (yrs) {mean range}	29	30.75
Height (cm) {mean (SD)}	156.53 ± 4.12	155.25 ± 5.09
BWT(kg) {mean (SD)}	78.27 ± 9.33	75.7 ± 7.56
BM I {mean (SD)}	32.0 ± 2.91	31.35 ± 3.23

Table 2
Previous caesarean section (C/S) showing no significant difference between both groups of patients

Parameter	Bupivacaine group No. (%)	Control group No. (%)	P value
No C/S	12 (63.2%)	9 (45%)	0.415
Previous C/S	7 (36.8%)	11 (55%)	

The TAP block with bupivacaine 0.25% compared with placebo reduced postoperative pain (Fig. 3).

Fig. 3
The TAP block with bupivacaine reduced postoperative visual analog scale by 25% (± SD) compared with control group

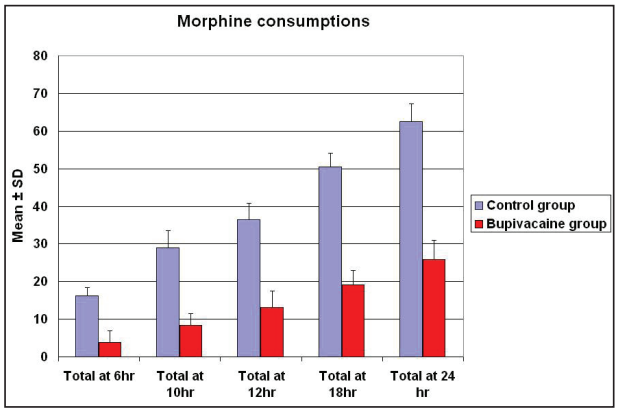


Total morphine requirements in the first postoperative 24 hours were also reduced in the bupivacaine group compared with the placebo group (25.89 ± 5.13 mg versus 62 ± 4.78, p <0.05) (Table 3, Fig. 4).

Table 3
Postoperative morphine consumption in 24 hours period post surgery is reduced in Bupivacaine group compared to control group. Data are presented as mean ± (SD)

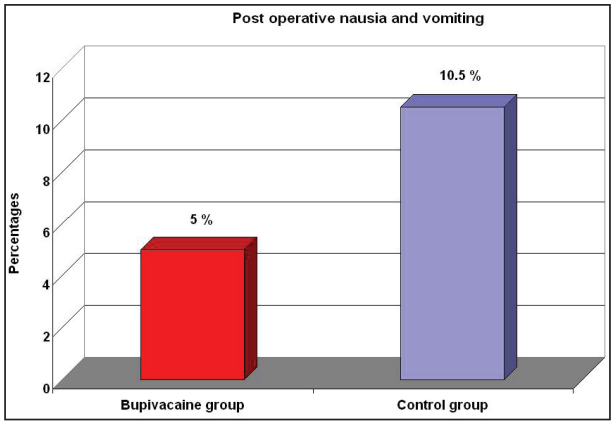
Cumulative morphine dose at:	Bupivacaine group	Control group
6hr(mg) {mean(sd)}	3.89 ± 2.97	16.25 ± 2.99
10hr	8.3 ± 3.14	28.95 ± 4.5
12hr	13.11 ± 4.3	36.5 ±.28
18hr	19.05 ± 3.97	50.4 ± 3.73
24hr	25. 79 ± 5.14	62.55 ± 4.72

Fig. 4
Postoperative morphine consumption in 24 hours period post-surgery. Data are presented as mean (SD)



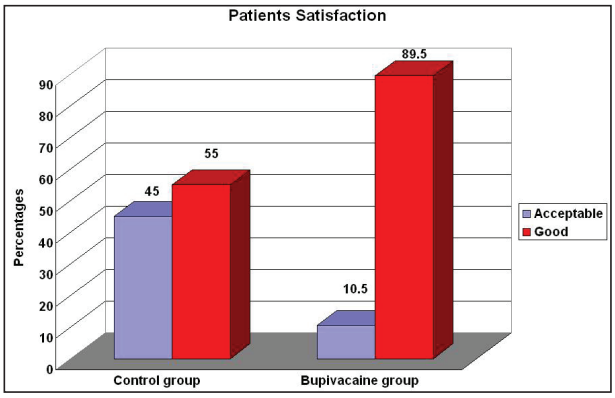
There was less nausea and vomiting in bupivacaine group than placebo group; two patients from placebo group received antiemetic during 24 hours period, but only one patient from bupivacaine group received an antiemetic drug in the same period (Fig. 5).

Fig. 5
Postoperative nausea and vomiting was less in the Bupivacaine group compared to control group.



Patient's satisfaction with pain relief was significantly higher in bupivacaine group (Fig. 6).

Fig. 6
Patient's satisfaction with pain relief was significantly higher in Bupivacaine group.



Discussion

TAP block is relatively a new regional anesthesia-analgesia technique[1]; it was initiated by Raffi as a landmark-based technique within the iliolumbar triangle of Petit. The triangle of Petit was bounded inferiorly by iliac crest, posteriorly by latissimus dorsi muscle and anteriorly by external oblique muscle.

TAP block provides motoric and sensory block to anterior and lateral abdominal wall, it has been used for intra-operative and postoperative analgesia, either by anatomical landmarks or ultrasound-guided. It has been performed for the following procedures: caesarean delivery[2], hysterectomy[3], retropubic prostatectomy[4], appendectomy[5], laparoscopic cholecystectomy[6], and laparoscopic hernia repair with mesh.

The efficacy of TAP block was also studied by Belavy et al[7] using Ropivacaine 0.5% as one tool of multimodal analgesia in addition to PCA morphine, paracetamol and NSAIDs regularly, but in this study, morphine is the single analgesic given to the patient if postoperative analgesia was required. Efficacy of block was evaluated by assessing pain level with VAS, and the postoperative morphine consumption.

Though ultrasonographic guidance enable exact placement of local anesthetics between internal oblique and transversus abdominis muscle, the safety of TAP block has been discussed by Zorica et al[8]. There are reports of visceral damage when the needle went too far like liver injury[9], colon rupture[10-11], and another reported complication is transient femoral nerve palsy[12]. Accidental intravascular injection of local anesthetic, infection, and catheter breakage should also be considered as potential complications of TAP block[13].

There are several suggestions to minimize such complications: (i) by using a fine-gauge, blunt-tipped, short-bevel needle to minimize risk of visceral

damage, and (ii) directing the needle obliquely instead of perpendicularly to increase the resistance of each aponeurosis, and using smaller volume of local anesthetic to decrease the incidence of femoral nerve block.

Conclusion

This study demonstrates the analgesic efficacy of ultrasound-guided TAP block after cesarean delivery. The block reduced the postoperative pain, total morphine consumption, antiemetic drugs, and improved patient's satisfaction and quality of pain relief.

We recommend this block for all women undergoing cesarean delivery who are not given long-acting neuroaxial opioids.

Further research is essential to determine the ideal injected dose, volume of local anesthetics, duration of the block according to local anesthetic serum level, and the use of TAP block as intraoperative anesthetic technique for other procedures.

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