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ORIGINAL RESEARCH OPEN ACCESS

Effect of dexamethasone as an adjuvant to levobupivacaine in transversus abdominis plane (TAP) block for postoperative analgesia in subjects undergoing lower segment cesarean section

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Abstract

Background: Inadequate pain relief after caesarean section is a common problem in every part of the world. Transversus abdominis plane (TAP) block provides adequate post-operative pain relief following abdominal surgeries. TAP block duration is limited to effect of administered local anesthetics. Hence, adjuvant medications are added to local anaesthetic (LA) to prolong the effect of TAP block. The primay objective of this study was to analyse the analgesic effect of dexamethasone added to levobupivacaine in comparison with analgesic effect of levobupivacaine alone in TAP block. The secondary objectives are to analyse the number of supplemental analgesic requirements in the first 24 hrs after surgery and to analyse the duration of postoperative analgesia which is time to first analgesic request from the time of TAP block.

Methods: 116 women scheduled for lower segment cesarean section (LSCS), belonging to ASA physical status 2 or 3, aged between 18 and 35 years, under SAB were recruited. Ultrasonogram (USG) guided TAP block was performed on each side after the completion of the surgery. Subjects in group L (n = 58) received TAP block on each side with 20 ml of 0.375% levobupivacaine and group LD (n = 58) with 19 ml of 0.375% levobupivacaine + 1ml (4mg) of dexamethasone. They were evaluated for pain at 10min, 30min, 45min, 1hour, 2hrs, 4hrs, 8hrs, 12hrs and 24hrs after the block using visual analog scale (VAS) score. Duration of postoperative analgesia and requirement of rescue analgesia were also analysed.

Results: The post-operative visual analogue scale (VAS) scores were lower in group LD at 8, 12 and 24 hrs ($p < 0.05$). Mean duration of analgesia was significantly prolonged in group LD with lesser requirement of rescue analgesics ($p < 0.05$) up to 24 hrs.

Conclusion: Dexamethasone (4 mg) as an adjuvant to levobupivacaine in USG guided TAP block reduces post-operative pain scores prolongs the duration of analgesia and decreases demands for rescue analgesics.

Keywords: levobupivacaine; dexamethasone; ultrasound guided block; transversus abdominis plane block; Lower segment caesarean section; visual analogue scale

Introduction

Caesarean section has been associated with moderate to severe pain. One third of subjects having Pfannenstiel incision experience chronic pain at incision site [1]. It should be adequately controlled otherwise it leads to untoward adverse events ranging from patient discomfort, prolonged immobilization to thromboembolic phenomenon and pulmonary complications [2].

The pain during postoperative period arises from incision site, pain from viscera and dynamic pain

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during coughing or mobilizing, majority contributed by abdominal wall incision [3].

Multimodal approach for analgesia after hysterectomy includes systemic analgesics and regional techniques. Most commonly used is the systemic analgesic drug like NSAIDS and opioids. Regional techniques include central neuraxial block and peripheral nerve blocks. All analgesic modalities have their own advantages and disadvantages [4].

Transversus abdominis plane (TAP) block is a novel type of peripheral nerve block that involves innervations of the anterolateral abdominal wall derived from T6-L1. It provides adequate post-operative pain relief following various abdominal surgeries [2].

TAP block inhibits abdominal neural afferents by introducing local anaesthetic (LA) drugs into the neuro fascial plane between the internal oblique and transversus abdominis muscles. With the widespread availability of ultrasound guidance for more accurate localisation of TAP (than the 'blind' technique), the TAP block is an established technique for reduction of post-operative pain following abdominal surgery [5]. Levobupivacaine is a long acting local anaesthetic with clinical profile similar to that of bupivacaine with lesser neuro and cardiac toxicity [6].

TAP block duration is limited to effect of administered local anesthetics. The use of continuous infusion catheter to administer LA is an option to prolong the block duration. Recently adjuvant medications were added to LA to prolong the effect of TAP block like dexamethasone, magnesium sulphate, fentanyl and clonidine [7, 3].

The primay objective of this study is to analyse the analgesic effect of dexamethasone added to levobupivacaine in comparison with analgesic effect of levobupivacaine alone in TAP block. The secondary objectives are to analyse the number of supplemental analgesic requirements in the first 24 hrs after surgery and to analyse the duration of postoperative analgesia which is time to first analgesic request from the time of TAP block.

Methods

This is a prospective, randomized, double blind study, conducted at Hassan Institute of Medical Sciences, Hassan, a tertiary health care center; from October 2022 to January 2023. After obtaining permission from the institutional ethical committee, informed and written consent is taken from the subjects.

Inclusion criteria: 116 women scheduled for lower segment cesarean section (LSCS), belonging to ASA physical status 2 or 3, aged between 18 and 35 years, under SAB were recruited.

Exclusion criteria: Women belonging to ASA 4 and 5; less than 18 years and more than 35 years; women not willing to participate in the study were excluded.

All subjects underwent thorough preoperative evaluation. Subjects were kept nil per oral for 6 hrs. The subjects were randomly allocated into two groups using sealed envelope technique which was opened just before shifting the patient inside the operation room by anesthetist who was not involved in the study to prepare the solution. Under aseptic precautions all subjects were given subarachnoid block, in sitting position, using 25 G Quincke needle at L_3-L_4 intervertebral space and 2.2ml of hyperbaric bupivacaine was injected into subarachnoid space after confirmation of free flow of CSF. In both the groups, USG guided TAP block was given at the end of the surgery. After the surgery, under aseptic precautions, USG guided TAP block was performed using linear probe of 5-12 MHz.

Ultrasound probe was placed in the midaxillary line between iliac crest and costal margin. After visualization of external oblique, internal oblique, tranversus abdominis and their fascia; 23G, 10 cm needle was advanced by in-plane technique. On confirmation of needle tip position, 20 ml of study solution was injected on each side. The subjects in group L received 20 ml of 0.375% of levobupivacaine on each side where as subjects in group LD received 19 ml of 0.375% levobupivacaine + 1ml (4mg) of dexamethasone on each side. Postoperatively, subjects were evaluated for pain using visual analog scale score (VAS score) in post anaesthesia care unit and ward at 10min, 30min, 45 min, 1hr, 2hrs, 4hrs, 8hrs, 12hrs and 24hrs post TAP block. Subjects were asked to rate average pain they experienced postoperatively on a 0-10 VAS score. No pain = 0 to very severe pain = 10. The primary outcome measure in this study is the postoperative VAS score. The secondary outcome measures included the number of supplemental analgesic requirements for 24 hrs after the surgery and the duration of postoperative analgesia which is time to first analgesic request from the time of TAP block.

Statistical analysis

Based on pilot study with 15 subjects in each limb, sample size was calculated with α of 5% and power of the study 80%, we required 58 subjects in each group. Considering dropout rate as zero, we included 116 patients in each group. The data were entered into the

SPSS 15 Software. Statistics were represented in terms of mean ± standard deviation (SD) for normal distribution and median with interquartile range for skewed data. P value < 0.05 was considered statistically significant.

Results

Our study involved 116 subjects who were randomly assigned to one of two groups, with 58 in each group. TAP block was performed on group L subjects with 20 ml of 0.375% levobupivacaine and on group LD with 19ml of 0.375% levobupivacaine + 1ml (4mg) dexamethasone.

No patient experienced pain in the first four hrs after the block in both the groups. Mean VAS score in group L at the end of 8 hrs was 1.05, at the end of 12hrs was 3.93 and at the end of 24hrs was 4.39. No patient experienced pain at the end of 8 hrs in group LD. Mean VAS score in group LD at the end of 12hrs was 0.91 and at the end of 24hrs was 3.67. VAS score ratings had same analgesic effects in the first 4hrs of block in both the study groups. Lesser VAS scores were seen in group LD compared to group L at 8th, 12th and 24th hrs of block which was statistically significant (p value <0.05) (Table 1).

Table 1: Comparison of L group and LD group with VAS scores at different treatment times by independent t test.

VAS at	*L group*		*LD group*		*t value*	*p value*
	Mean	*Std.Dev.*	*Mean*	*Std. Dev.*		
10 min	0.00	0.00	0.00	0.00	0.0000	1.0000
30 min	0.00	0.00	0.00	0.00	0.0000	1.0000
45 min	0.00	0.00	0.00	0.00	0.0000	1.0000
1 hour	0.00	0.00	0.00	0.00	0.0000	1.0000
2 hour	0.00	0.00	0.00	0.00	0.0000	1.0000
4 hour	0.00	0.00	0.00	0.00	0.0000	1.0000
8 hour	1.05	1.71	0.00	0.00	4.6902	0.0001*
12 hour	3.93	1.08	0.91	1.58	12.0714	0.0001*
24 hour	4.39	0.77	3.67	0.60	5.6200	0.0001*

*p<0.05

As defined in our study, duration of analgesia is time between TAP block to administration of the first rescue analgesic. Mean duration of analgesia in group L was 11.25 hrs and mean duration of analgesia in group LD was 20.90 hrs which is statistically significant with p value <0.05 (Table 2).

Table 2: Comparison of L group and LD group for duration of analgesia scores by independent t test.

Groups	*Mean (hrs)*	*SD (hrs)*	*SE (hrs)*	*t value*	*p value*
L group	11.25	3.01	0.39	-12.1209	0.0001*
LD group	20.90	5.30	0.70		

*P<0.05

Mean consumption of rescue analgesics over 24hrs in group L was 1.98 and in group LD was 1.26, indicating analgesic consumption was more with group L than with group LD which is statistically significant with p value <0.05 (Table 3).

Discussion

TAP block was introduced in 2001 by Rafi, from then it is being widely used for pain relief following lower abdominal surgeries. The increase in success rate and refinement in technique is seen with the ultrasound guidance.

Table 3: Comparison of L group and LD group with rescue analgesic consumption by independent t test.

Groups	*Mean*	*SD*	*SE*	*t value*	*p value*
L group	1.98	0.23	0.03	11.1873	0.0001*
LD group	1.26	0.44	0.06		

*P<0.05

Shibata et al performed transversus abdominis plane block under ultrasound guidance in patients undergoing gynecological abdominal surgeries [8]. They found that transversus abdominis neuro fascial plane can be easily visualized on the midaxillary line and the local anaesthetic spread can be confirmed. They quoted that lower abdominal surgery should be an indication for the TAP block.

Sharma et al conducted randomised single blinded study to evaluate efficacy of TAP block after abdominal surgeries [9]. They concluded that patients who received TAP block had significant reduced tramadol

requirements in 24 hour and 48 hour postoperative period and a longer time to the first tramadol request (178.5 ± 45.6 minutes) as compared to the control group (23.5 ± 3.8 minutes).

Carney et al evaluated the analgesic efficacy of the TAP block in 50 patients undergoing total abdominal hysterectomy via a transverse lower abdominal wall incision [10]. The TAP block, as a component of a multimodal analgesic regimen, provided superior analgesia when compared to placebo block up to 48hrs in the postoperative period. There were no complications attributable to the TAP block.

McDonnell et al evaluated analgesic efficacy of TAP block over the first 48hrs of postoperative period after caesarean delivery performed through a Pfannensteil incision [11]. Fifty women undergoing elective caesarean delivery were randomized to undergo TAP block with ropivacaine (n = 25) versus placebo (n = 25). The TAP block with ropivacaine compared with placebo reduced postoperative visual analog scores. Mean total morphine requirements in the first 48 postoperative hours were also reduced. The transversus abdominis plane block, when used as part of a multimodal analgesic regimen, resulted in better analgesia and decreased supplemental opioid consumption after caesarean delivery.

Belavy et al evaulated the efficacy of ultrasound guided TAP block using ropivacaine 0.5% in women undergoing caesarean section [12]. They found out that USG guided TAP Block with 0.5% ropivacaine reduces 24hr morphine consumption with no local complication with one patient had allergy to ropivacaine.

Rani et al [13] studied the efficacy of 0.5% ropivacaine and 0.25%levobupivacaine when used in transversus abdominus plane block for postoperative analgesia in lower abdominal surgeries and concluded that 0.25% levobupivacaine and 0.5% ropivacaine have similar analgesic effect after lower abdominal surgery in transversus abdominus plane block.

Kaki et al [2] evaluated effect of addition of dexmedetomidine to bupivacaine in transversus-abdominis plane block in abdominal hysterectomy patients and concluded that addition of dexmedetomidine to bupivacaine in TAP block achieves better anaesthesia and provides better pain control postoperatively without any major side-effects.

Fuladi et al [14] compared bupivacaine 0.25% and ropivacaine 0.5% in TAP block for postoperative analgesia in lower abdominal surgeries in 75 adult patients. In this study 25 patients received normal saline, 25 patients received ropivacaine and 25 received bupivacaine and mean duration of analgesia in bupivacaine group was 420.6 minutes and 2187 minutes in ropivacaine group. Hence ropivacaine provided longer duration of analgesia.

Varshney et al [15] evaluated transversus abdominis plane block with levobupivacaine versus levobupivacaine with dexmedetomidine for postoperative analgesia following caesarean delivery concluded that bilateral TAP block with 0.25% levobupivacaine provides good quality analgesia for early postoperative period and adding dexmedetomidine further improves pain control and gives higher patient satisfaction without any added side effects.

Parameswari et al [16] concluded that the addition of dexmedetomidine to bupivacaine in TAP block prolonged the duration of time at which first dose of rescue analgesia was sought and also reduced the total dose of opioid requirement in the first 24hrs post-caesarean section.

In a study by Rana et al [3], 65 subjects undergoing total abdominal hysterectomy under sub arachnoid block, Ultrasound guided TAP block was performed at the end of surgery. Subjects in group B received 18 ml of 0.25% of bupivacaine + 2 ml of Normal saline and subjects in group BM received 18ml of 0.25% bupivacaine + 1.5ml of MgSO4 + 0.5ml normal saline. They concluded that addition of $MgSO_4$ to Bupivacaine in a dose of 150mg lead to lower pain score (Visual analogue score) at 4, 6 and 12hrs after the block. In our study, addition of dexamethasone to 0.75% levobupivacaine lead to significant lower pain score (VAS) at 4, 8, 12 and 24hrs after the block.

In a study by Kartalav et al [7], 90 subjects of inguinal hernia surgery were included and group 1 subjects received only general anesthesia, in group 2 subjects received GA and unilateral TAP block (25 ml of 0.5% ropivacaine), in group 3 subjects received GA + unilateral TAP block (25 ml of 0.5% ropivacaine) + dexamethasone (4 mg). There was significant difference in the VAS scores between group 1, group 2 and group 3 at 2, 4, 6, 12 and 24hrs post procedure. The VAS scores in group 3 were significantly lower than group 1 and 2. In our study, significant lower pain scores (VAS) were observed at 4, 8, 12 and 24hrs after the block with dexamethasone additive group compared to plain levobupivacaine group.

In a study by Rana et al [3], 968 +/- 161.06 minutes of analgesia was observed in $MgSO_4$ additive group and 397.67 +/- 92.84 minutes in plain bupivacaine group,

concluding significant prolong duration of analgesia is produced by $MgSO_4$ additive. In our study, 1254 +/- 318 minutes of analgesia was observed in dexamethasone additive group and 675 +/- 180.6 minutes of analgesia was observed in plain levobupivacaine group, concluding significant prolong duration of analgesia is produced by addition of dexamethasone.

In a study by Rana et al [3], plain bupivacaine group received rescue analgesics from 4 – 12 hrs and $MgSO_4$ additive group received rescue analgesics after post op 12hrs, indicating short pain free period and more requirement of analgesia in bupivacaine group. $MgSO_4$ group had beneficial effect in reducing the number of systemic analgesic requirement. In a study by Kartalav et al [7], the cumulative post op 24hrs morphine consumption was significantly lower in group 3 than group 2 and group 1. In our study, mean consumption of rescue analgesia in plain levobupivacaine group was 1.98 and in dexamethasone additive group was 1.26 (p value < 0.05), indicating statistically significant lesser rescue analgesic consumption in dexamethasone additive group.

Limitations: In our study, the data was collected in a tertiary care center with limited subjects and it is a single center study, so large data and multicenter studies are needed to confirm the results.

Conclusion

Dexamethasone (4 mg) as an adjuvant to levobupivacaine in USG guided TAP block reduces post-operative pain scores prolongs the duration of analgesia and decreases demands for rescue analgesics compared to plain Levobupivacaine. We recommend the use of dexamethasone as an adjuvant for TAP blocks.

Conflicts of interest

Authors declare no conflicts of interest.

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