

The Efficacy of Fentanyl as Adjuvant in Ultrasound Guided Oblique Subcostal Transversus Abdominis Plane Block

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Abstract

Background: Ultrasound guided oblique subcostal transversus abdominis plane block is associated with a wider area of spread (T7-L1). The aim of this study was to assess the efficacy of adding fentanyl to 0.25% bupivacaine in bilateral oblique subcostal transversus abdominis plane block preemptively in patients undergoing laproscopic cystectomy.

Method: 100 patients posted for laproscopic ovarian cystectomy were randomly allocated in two equal groups. Group BF received preoperatively 20 ml of 0.25% bupivacaine and 1 mcg fentanyl (1ml) on each side oblique subcostal block and group B received 20 ml bupivacaine with 1ml normal saline. We assessed opioid requirement, the time of first demand of rescue analgesia and twenty four hour morphine requirement.

Results: There is a statistically significant difference in the intraoperative fentanyl requirement between the two groups. Group BF required 16.4016.26mcg of intraoperative fentanyl while Group B required 59.8019.05mcg fentanyl ($p < 0.001$). There is a significant difference in the mean VAS score in the two groups. The time of first demand of rescue analgesia was earlier in Group B; 5.961.09hrs compared to

11.182.28 hrs in Group BF ($p < 0.001$). The total 24 hour morphine requirement in Group BF was significantly lower 0.581.01mg compared to Group B i.e. 4.621.63mg ($p < 0.001$).

Conclusion: 1mcg/kg fentanyl used as a supplement in bilateral TAP block reduced the need for systemic opioid intra and post operatively and prolonged analgesia in laproscopic ovarian cystectomy patients.

Keywords: Fentanyl; Bupivacaine; Ultrasound Guided Transversus Abdominis Plane Block; Laproscopic Surgeries.

Introduction

Laproscopic surgeries are preferred to open surgeries due to minimal invasiveness, less tissue handling, less patient discomfort, early patient recovery and discharge. Laproscopic ovarian cystectomy is associated with moderate pain in the immediate postoperative period. Systemic opioids are the conventional post operative pain management modality but have side effects of nausea, vomiting, sedation and pruritus. These days ultrasound guided regional blocks have helped to block the pain afferents more superiorly and so reduced the use of narcotics. In laproscopic surgeries, the major component of pain originates from the abdominal

wall incision [1]. Transversus abdominis plane (TAP) block is a regional analgesic technique that blocks neural afferents of antero lateral abdominal wall. Rafi [2] and McDonnell [3] were the first to describe this block. Hebbard et al [4] described its ultrasound approach. Three approaches described are - the subcostal, midaxillary, and lumbar triangle of Petit [5]. The oblique subcostal approach was associated with a larger area of spread T7-T11, where as it was only T10-L1 with the other two approaches [6].

Local anaesthetics used alone give analgesia for few hours only, however adjuncts have been combined with local anaesthetics to improve the duration and quality of peripheral nerve block. Fentanyl is an opioid that has been successfully used as adjuvant to local anaesthetics to prolong the analgesia [7]. Very few studies are done on the use of fentanyl in oblique subcostal TAP block given preemptively in laproscopic gynaecologic surgeries. In this study, we have assessed the

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Received on 22.12.2016

Accepted on 28.12.2016

efficacy of fentanyl as adjuvant to bupivacaine in oblique subcostal TAP block in laproscopic cystectomy patients given preoperatively.

Materials and Methods

This double blind study was done on 100 ASA 1 and 2 patients posted for laproscopic ovarian cystectomy after obtaining approval from faculty ethical committee. Patient refusal, coagulation disorders, local infection at the site of block, allergy to local anaesthetics, chronic use of pain medications were the exclusion criteria done.

A detailed pre anaesthetic check up was done. The preoperative investigations included were haemoglobin, blood sugar levels, serum electrolytes, urea, creatinine, liver function tests, coagulation profile, chest X-ray and pulmonary function tests. We explained them visual analogue pain scale for pain assessment 0-10, 0 meaning no pain and 10 meaning worst pain imaginable.

The patients were randomized using a computer generated program and allocated to 2 groups- Group BF and Group B. Group BF received on each side 20 ml 0.25% bupivacaine and 1mcg/kg (1ml) of fentanyl while Group B received 20 ml 0.25% bupivacaine and 1ml normal saline before the incision. All patients were premedicated with Injection glycopyrrolate and Injection midazolam 0.03 mg/kg. Monitoring included noninvasive blood pressure, heart rate, pulse oximetry and end tidal CO₂ (Et CO₂).

Induction was with injection fentanyl 2mcg/kg, propofol 1-2 mg/kg and vecuronium 0.1mg/kg intravenously. Tracheal intubation was done with endotracheal tube no.7 mm ID. Maintenance of anaesthesia was with N₂O, O₂(FiO₂ 0.35) and sevoflurane(1-1.2 MAC). After intubation, oblique subcostal TAP block was performed. We placed the linear probe below the xiphisternum and moved it laterally along the subcostal margin. The rectus abdominis and transversus abdominis muscles were identified. A 22 gauge 150 mm stimuplex needle was inserted in plane through the rectus abdominis muscle 2-3 cm medial to the probe. Once the tip was visualised between the rectus muscle and transversus

abdominis muscle and negative aspiration confirmed the drug was injected and hydrodissection demonstrated. The drug injectant was loaded by another Anaesthetist and handed to the investigator. The block was repeated on the other side as well. Ventilatory settings were adjusted to maintain ET CO₂ between 35-40 mmHg and SpO₂-95-100%. A PEEP of 5 cm H₂O was used in all patients. All patients were placed in dorsal lithotomy position. Umbilical incision was made and CO₂ was insufflated through the port. Intra abdominal pressure was not to exceed 20 cm Hg. Two secondary ports were placed 5 cm superior and lateral to the pubic symphysis. Any 20% rise of heart rate or blood pressure necessitated repeating intravenous fentanyl at 25mcg increments and this was recorded.

The cases were all done by the same surgical team and was completed in 60-75 minutes. At the end of procedure, patients were reversed with Neostigmine 50 mcg/kg and atropine 0.01mg/kg. All patients were extubated uneventfully and kept in PACU for 24 hours. Postoperatively pain scores were assessed for 24 hours and whenever VAS \geq 3, intravenous Morphine 2mg was administered. Hemodynamic monitoring and any adverse effects were looked for. The time for the first requirement of morphine and the cumulative dose of morphine for 24 hours were noted.

Statistical Methods

The statistical analysis was performed by STATA 11.2 (College Station TX USA). Shapiro wilk test has been used to check normality, Mann Whitney test were used to find the significance difference between the pain score with treatment groups, Students t-test were performed to find the significance difference between the age, height, weight, intra operative fentanyl used, time of first dose of morphine, total 24 hours morphine required with the treatment groups and those expressed as mean and standard deviation. P<0.05 considered as statistically significance.

Results

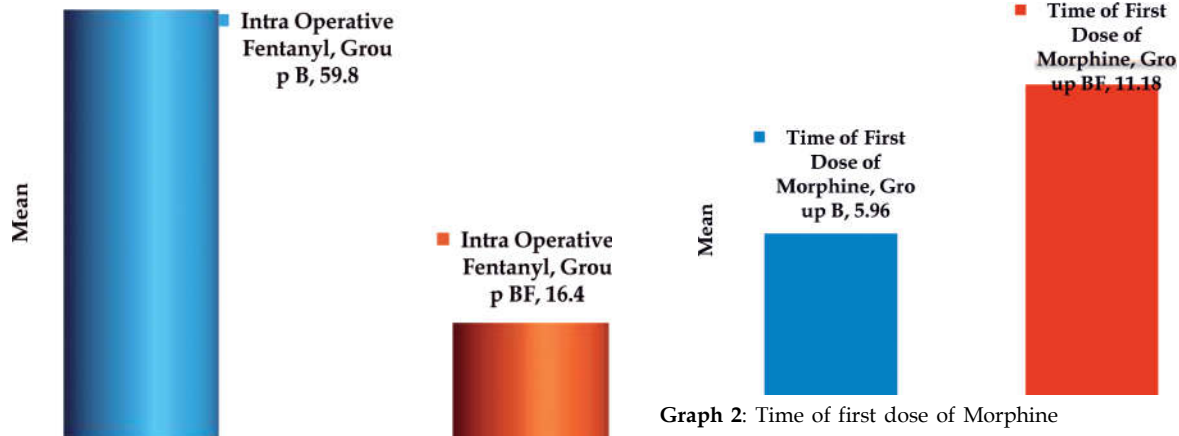
One hundred patients took part in this study and were randomly assigned to the two groups. All

Table1: Patient demography

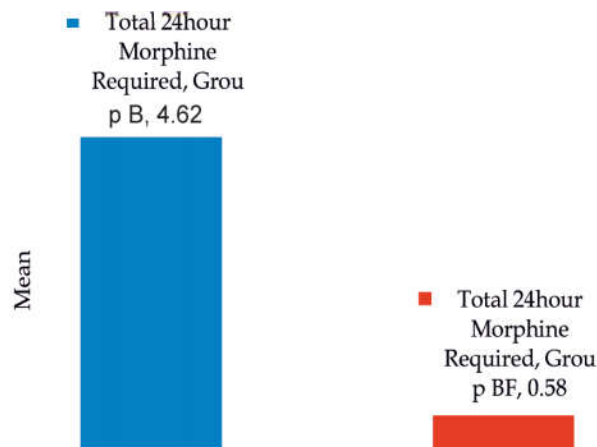
Height	155.92 \pm 9.04	157.88 \pm 6.26	0.211
Weight	57.32 \pm 6.95	58.06 \pm 4.68	0.534
	Group B Mean \pm SD	Group BF Mean \pm SD	P-Value
Age	42.76 \pm 8.63	41.80 \pm 8.42	0.575

Table 2: Intraoperative and postoperative Opioid requirement

	Group B Mean ± SD	Group BF Mean ± SD	P-Value
Intraoperative fentanyl	59.80 ± 19.05	16.40 ± 16.26	<0.001
Time of 1st dose of morphine	5.96 ± 1.09	11.18 ± 2.28	<0.001
Total 24 hour morphine required	4.62 ± 1.63	0.58 ± 1.01	<0.001



Graph 1: Intraoperative Fentanyl



Graph 3: Total 24 hour Morphine required

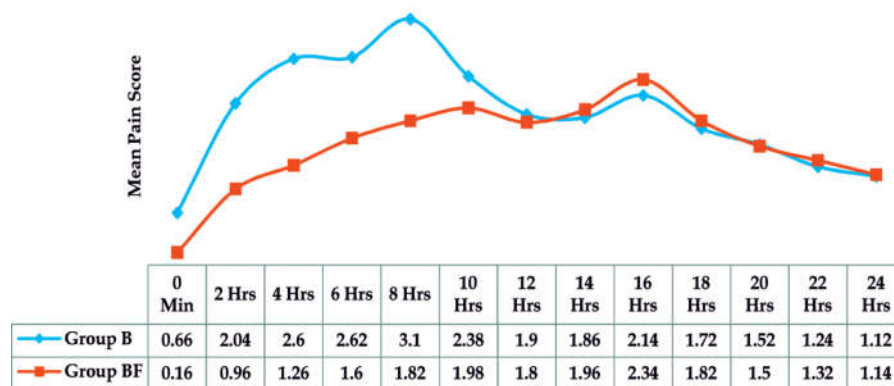
ultrasound guided oblique subcostal TAP block were performed as described without any complications. Patient characteristics and perioperative data are shown in Table 1. There were no differences in patient demography.

There is a statistically significant difference in the intraoperative fentanyl requirement between the two groups. Group BF required 16.40±16.26 mcg of intraoperative fentanyl while Group B required 59.80±19.05 mcg fentanyl (p<0.001).

Also there is a significant difference in the mean VAS score in the two groups. P<0.001 for 8 hours.

Table 3: Mean Pain Score

Time	Group B Mean ± SD	Group BF Mean ± SD	P-Value
0 minutes	0.66 ± 0.74	0.16 ± 0.36	<0.001
2 hours	2.04 ± 1.47	0.96 ± 0.49	<0.001
4 hours	2.60 ± 1.19	1.26 ± 0.49	<0.001
6 hours	2.62 ± 1.01	1.60 ± 0.50	<0.001
8 hours	3.10 ± 1.03	1.82 ± 0.44	<0.001
10 hours	2.38 ± 1.14	1.98 ± 0.51	0.007
12 hours	1.90 ± 0.84	1.80 ± 0.40	0.803
14 hours	1.86 ± 1.03	1.96 ± 0.78	0.365
16 hours	2.14 ± 0.93	2.34 ± 0.96	0.284
18 hours	1.72 ± 0.81	1.82 ± 0.99	1.000
20 hours	1.52 ± 0.76	1.50 ± 0.81	0.739
22 hours	1.24 ± 0.62	1.32 ± 0.51	0.234
24 hours	1.12 ± 0.48	1.14 ± 0.35	0.446



Graph 4: Mean pain score

The time of first demand of rescue analgesia i.e. morphine was earlier in Group B; 5.96 ± 1.09 hours compared to 11.18 ± 2.28 hours in Group B ($p < 0.001$). The total 24 hour morphine requirement in Group BF was significantly lower, 0.58 ± 1.01 mg compared to Group B i.e. 4.62 ± 1.63 mg ($p < 0.001$).

Discussion

This study shows that fentanyl supplemented with 0.25% bupivacaine in bilateral oblique subcostal TAP block given pre emptively in patients undergoing laproscopic ovarian cystectomy prolonged analgesia and decreased requirement of systemic opioid both intraoperatively and postoperatively.

TAP blockade has been rapidly evolving and recently has been modified to the oblique subcostal approach which provide wider sensory blockade and is suitable for surgeries both superior and inferior to umbilicus [8]. The efficacy of TAP block in providing analgesia in various abdominal surgeries is very encouraging [9-13]. Ultrasound guided TAP block has advantages of being performed accurately and safely in a short time as the procedure is implemented by watching real time image. Also the target site has no vital anatomical structure like large vessels and spinal cord [14].

Our study has revealed that pre emptive oblique subcostal TAP block with fentanyl performed has reduced intraoperative systemic opioid requirement. The wider and more extensive spread of the drug via oblique subcostal approach has resulted in a better sensory coverage.

Opiates have anti-nociceptive effect at the central and / or spinal cord level [15]. In animals peripheral opioid receptors have been reported [16-18]. Fentanyl has been shown to extend the dose of analgesia when

added to local anaesthetics in brachial plexus block [19] and axillary block [20]. But Fletcher et al [21] found no increase in duration of analgesia when fentanyl was added to lidocaine for axillary block. These differences may be due to variations in technique or opioid used. Li Zhong Wang et al concluded that 50 mcg of fentanyl added to 0.375% ropivacaine in ultrasound guided TAP block did not improve analgesia following caesarean delivery. This may be due to a lower dose of fentanyl used and also due to the limitation of TAP block to somatic pain only.

Fentanyl acts directly on peripheral nervous system [18]. Activation of peripheral opioid receptors results in opioid antinociception. Primary afferent tissues (here, intercostal T7-T11, subcostal T12, iliohypogastric and ilioinguinal nerves L1) contain opioid binding sites. Fentanyl may diffuse through the nerve sheath and potentiate the action of local anaesthetics. Fentanyl is reported to have a local anaesthetic action as well [23]. These are the ways to explain the mechanism of fentanyl to intensify the peripheral block with local anaesthetics. None of the patients had any adverse effects.

Further research is required to study any changes occurring to the pH of local anaesthetic agent upon the addition of fentanyl causing any delayed onset. The block has to be performed in awake patients and in surgeries involving motor innervation and onset of motor and sensory block is to be assessed. Also a comparison between all additives including buprenorphine, dexamethasone, dexmedetomidine has to be studied.

Thus we conclude that 1mcg/kg fentanyl used as a supplement in TAP block performed preemptively on each side of abdomen reduced the need for systemic opioid intra and post operatively and prolonged analgesia in laproscopic ovarian cystectomy patients.

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