Section: Anaesthesia

Original Research Article

A PROSPECTIVE RANDOMIZED STUDY TO COMPARE ULTRASOUND GUIDED TRANSVERSE ABDOMINIS PLANE BLOCK WITH LOCAL ANAESTHETIC INFILTRATION FOR POSTOPERATIVE PAIN RELIEF IN PATIENTS UNDERGOING TOTAL ABDOMINAL HYSTERECTOMY WITH BILATERAL SALPINGO-OOPHORECTOMY

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Abstract

Background: Transversus abdominis plane block is a safe, simple and effective technique of providing analgesia for lower abdominal surgeries with easily identifiable landmarks. Aims: To compare the analgesic efficacy of transversus abdominis plane block with that of direct infiltration of local anaesthetic into surgical incision in lower abdominal procedures. **Settings and Design:** Prospective randomized controlled trial in lower abdominal surgeries done under general anaesthesia. **Materials and Methods:** 54 ASA I-II patients undergoing Abdominal Hysterectomy with Bilateral Salpingo-oophorectomy under general anaesthesia were divided randomly into two groups each after written informed consent. A USG Guided bilateral TAP block was performed on Group T with 0.25% bupivacaine 0.6 ml/kg with half the volume on either side intra-operatively after skin closure before extubation using a short bevelled needle, whereas Group I received local infiltration intra-operatively after skin closure with the same amount of drug. The time taken for the first rescue analgesic and visual analogue score (VAS) was noted, following which, the patient was administered intravenous morphine 0.1 mg/kg and connected to an intravenous patient controlled analgesia system with morphine for 24 hrs from the time of block administration. 24 h morphine requirement was noted. VAS and sedation scores were noted at 2, 4, 6 and 24 h postoperatively. Statistical **Analysis Used:** The results were analyzed with SPSS 16. A P value < 0.05 was considered significant. Duration of analgesia and 24 h morphine requirement was analysed by Student's t-test. VAS scores, with paired comparisons at each time interval, were performed using the t-test or Mann-Whitney U-test, as appropriate. Categorical data were analyzed using Chi square or Fisher's exact test. **Results:** In Group T, the time to rescue analgesic was significantly more and the VAS scores were lower (P = 0.001 and 0.003 respectively). The 24 hr morphine requirement and VAS at 2, 4, 6 and 24 h were less in the Group T (P = 0.001). Incidence of PONV was significant in Group I (P = 0.043), whereas Group T were less sedated at 2 and 4 h (P = 0.001 and 0.014). **Conclusions:** Transversus abdominis plane block proved to be an effective means of analgesia for lower abdominal surgeries with minimal side-effects.

INTRODUCTION

Gynaecological surgeries are often associated with severe pain requiring a well-planned analgesia regimen to ensure adequate patient-comfort, satisfaction, early mobilization, and to decrease the hospital/post-anaesthesia care unit (PACU) stay. Transversus abdominis plane (TAP) block was first described by Rafi,[1] and works by blocking the thoraco-lumbar nerves (T6–L1) which supply sensory fibres to the anterior abdominal wall. It has been used to provide analgesia for various surgical procedures.[2–9] Local anaesthetic infiltration into the

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surgical site relieves pain at the incision site and is used widely as part of multi-modal analgesia regimens. A comparison of both these methods in terms of duration and quality of analgesia is warranted as both help in alleviating the incisional pain.

We hypothesized that the TAP block would provide a longer duration and better quality of analgesia than that of direct infiltration of surgical incision with local anaesthetic.

MATERIALS AND METHODS

After approval by the Institute Ethics Committee and written informed patient consent, we studied 54 American Society of Anaesthesiologists physical statuses I-II patients scheduled for abdominal hysterectomy with bilateral Salpingo-oophorectomy under general anaesthesia, in a prospective, investigator-blinded randomized controlled clinical trial. Patients who had a history of relevant drug allergy and tolerance to opiates were excluded from this study.

Patients were randomized by means of a computer-generated random number to either undergo TAP block (Group T, n = 27) or to receive local anaesthetic infiltration into surgical incision (Group I, n = 27), intra-operatively, after skin closure, before reversal of patient from general anaesthesia.

The patients and the investigator who assessed the patient's parameters postoperatively were blinded to the group assignment. All the patients received a standardised general anaesthetic as per the institute protocols. Standard monitoring included non-invasive blood pressure monitoring, arterial oxygen saturation, electrocardiogram and end-tidal carbon-dioxide monitoring. Anaesthesia was induced with Propofol 2 mg/kg, fentanyl 2 mcg/kg and atracurium 0.5 mg/kg intravenous (IV) and anaesthesia was maintained with isoflurane and 40% oxygen in nitrous oxide. All patients received hourly boluses of fentanyl 0.5 mcg/kg (IV). Prophylactic antiemetic was not administered.

A single investigator, experienced in performing the blocks, administered the TAP block as well as skin infiltration. After induction of general anaesthesia, bilateral TAP block was performed under ultrasonographic guidance with a SonoSite M-Turbo transportable ultrasound device and a linear 6–13 MHz ultrasound transducer. Once the EOAM, IOAM, and TAM were visualized at the level of the anterior axillary line between the 12th rib and the iliac crest (Fig. 1), the puncture area and the ultrasound probe were prepared in a sterile manner. Then, the block was performed with a 21G 90 mm Facette tip needle. Once the tip of the needle was placed in the space between the IOAM and TAM and negative aspiration puncture, volume of 0.6 ml/kg of 0.25% bupivacaine in two divided doses i.e. 0.3 ml/kg on either side is administered under direct Ultrasound guidance. Group I patients received infiltration of surgical incision with 0.6 ml/kg of 0.25% bupivacaine.

Postoperatively the patients were observed in PACU with standard monitoring. The time for the first request for analgesia in minutes (T-rescue), as well as visual analog scale (VAS) at that time (VAS T-rescue) was noted. Patients were administered morphine 0.1 mg/kg IV in increments on request for analgesia and then connected to intravenous patient-controlled analgesia (IVPCA) system with morphine 1 mg/ml (bolus 1 ml, 5-minute lockout interval, 0.2 mg/kg four hourly dose limit) in both the groups which was continued for 24 h from the time of block administration. Secondary outcomes were 24 h morphine requirement, VAS and sedation scores at 2, 4, 6 and 24 hrs postoperatively. Rescue antiemetic requirement was noted if any. Ondansetron 0.1 mg/kg IV was given as rescue antiemetic. Pain severity was measured using VAS score (0 = no pain and 10 = worst imaginable pain). Sedation was measured using a categorical scoring system (awake and alert = 0, quietly awake = 1, asleep but easily roused-2, deep sleep = 3).

We calculated the sample size based on a pilot study done previously in our hospital. We determined that a study with 27 patients per group would have a 75% power ($\alpha = 0.05$ and $\beta = 0.2$) for a 50% absolute reduction in the mean time for the first request for rescue analgesia. To minimize effect of any data loss, we elected to recruit 27 patients per group into the study.

Statistical analysis was performed using Statistical Package for the Social Sciences 16 (SPSS 16). Demographic data were analyzed using Student's t-test or Fisher's exact test as appropriate. Duration of analgesia and 24 h morphine requirement were analyzed by Student's t-test. VAS scores, with paired comparisons at each time interval, were performed using the t-test or Mann-Whitney U-test as appropriate. Categorical data were analysed using Chi square or Fisher's exact test. Normally distributed data are presented as mean ± SD. The level for analysis was set at $P \leq 0.05$.

RESULTS

54 subjects entered into the study. All patients who entered randomisation completed the study. Both the groups were comparable in age and weight [Table 1]. Patients who underwent TAP block took a longer time to request for the first rescue analgesic ($P = 0.001$), with reduced VAS at T-rescue ($P = 0.003$) and also reduced 24 h morphine requirement ($P = 0.001$) [Table 2].

Postoperative VAS scores in Group T were significantly reduced at 2, 4, 6 and 24 h. Sedation scores were significantly less at 2 and 4 h ($P = 0.001$ and 0.014 respectively). Post-operative nausea and vomiting (PONV) incidence was significant ($P = 0.043$) in Group I and required antiemetic administration.

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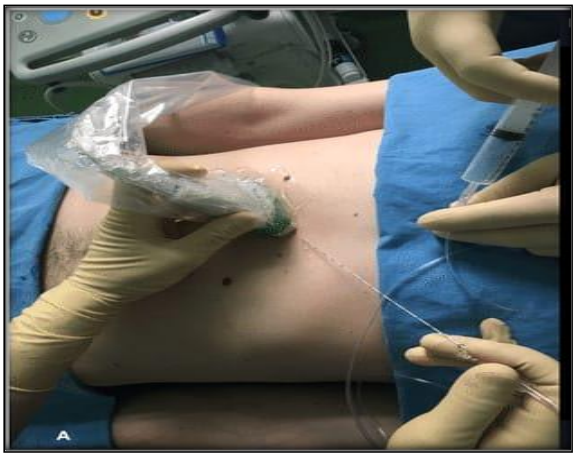

Figure 1

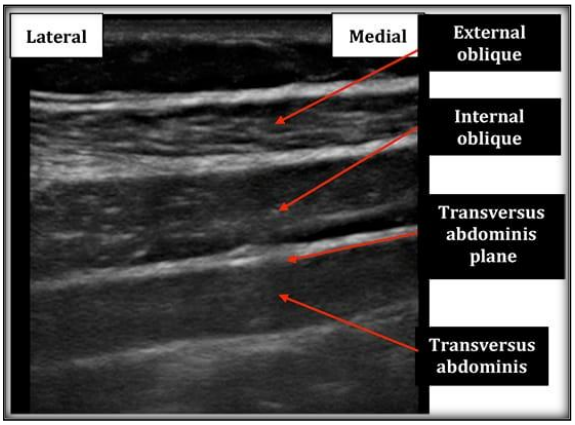

Figure 2

Table 1: Patient characteristics data comparison Group T and Group I

Group	USG Guided TAP Block (Group=T) n=27	INFILTRATION Group (Group I) n=27
Age(p=0.396)	43.16±9.33	45.52±8.04
Weight(p=0.664)	57.87±12.76	56.68±8.96

Table 2: Comparison of time to first rescue analgesic (Trescue), VAS at first request of analgesic (VAS Trescue) and 24h-morphine requirement between Group T and Group I

Group	TAP Block (Group=T)	Infiltration Group (Group I)	P value <0.05
Trescue(min)	152±47.6	86.83±39.06	0.001
VAS Trescue(mm)	5.21±1.5	6.85±1.89	0,003
24 hrs Morphine(mg)	23.16±5.13	30.51±4.39	0.001

DISCUSSION

The aims of this study were primarily to determine the duration of analgesia of TAP block, the quality of analgesia (as assessed by VAS scores and 24 h morphine requirement) and to note the incidence of side effects - sedation score and PONV which follow opioid usage.

TAP block provided a longer duration and better quality of analgesia as compared to local anaesthesia infiltration of surgical incision with lesser sedation and decreased incidence of PONV.

The benefit of TAP block in patients undergoing various procedures such as abdominal hysterectomy with bilateral Salpingo-oophorectomy has been demonstrated. Most studies compared TAP block with placebo but none compared TAP block with local anaesthesia infiltration, although both take care of the incision pain (parietal component of surgical pain).

McMorrow et al,[4] reported no analgesic benefit with TAP block (with 0.375% bupivacaine) as compared to spinal morphine (100 mcg morphine) in patients undergoing abdominal hysterectomy With bilateral Salpingo-oophorectomy which was possibly due to the analgesic effect of intradural morphine both at the visceral and parietal components of pain, whereas TAP block acts only on the nerves supplying the anterior abdominal wall and thereby subdues parietal component of pain only. No analgesic benefit from ultrasound-guided TAP block (with 0.375% ropivacaine 20 ml on each side) has also been reported in patients undergoing abdominal hysterectomy With bilateral Salpingo-oophorectomy under spinal anesthesia with morphine.[10] However when the opioid sparing effect of ultrasound-guided TAP block after abdominal hysterectomy With bilateral Salpingo-oophorectomy (with 0.5% ropivacaine 20 ml on each side) was investigated by another study, opioid consumption was found to be decreased in the first six hours, with lesser 24 h morphine requirement.[11]

We found that incidence of PONV in Group T was significantly lower. This is in contrast to the results of Carney et al,[2] who did not observe any reduction in the incidence or severity of PONV in the TAP block group as compared to placebo group in patients undergoing total abdominal hysterectomy With bilateral Salpingo-oophorectomy

Three approaches for the TAP block, subcostal, mid-axillary and lumbar triangle of Petit, were compared.[12] The subcostal approach was associated with a larger area of spread (T7-L1), whereas it was only T10-L1 was achieved with the other two approaches. We used the mid-axillary approach as the level T10-L1 would suffice the incisional pain in lower abdominal procedures reliably. Moreover, its landmarks are much clearer and the drug has a paravertebral spread when administered at this location.

We use ultrasound for performing TAP block as wider applicability and merit has been shown by

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previous studies with the landmark technique. The mid-axillary point approach, despite its ill-defined sonoanatomy, has a paravertebral spread, blocking the lateral cutaneous afferents which is not the case with the more sonoanatomically clear anterior approach of the ultrasound-guided block.[4] The local anesthetic distribution might vary with the two approaches. The transversus abdominis neuro-fascial plane, with its contents can act as a depot for prolonged duration of action as compared to a surgical incision, which is highly vascular and probably leads to faster local anaesthetic absorption followed by metabolism, which probably explains the lesser duration of action.[Fig 2] T-rescue in Group T is 152 ± 47.6 minutes as compared to Group I, which is 86.83 ± 39.06 minutes.

Rozen et al,[13] demonstrated that the nerves located between the costal margin and inguinal ligament in the anterior axillary line have segmental origin from T9-L1 (TAP plexus) and the presence of a fascial layer within the TAP demands the anaesthetic be placed between this layer and the transversus abdominis muscle layer. We had used a "double-pop" technique with a large-bore (18G) needle which should reliably deposit the drug beyond the external and internal oblique muscles into the TAP.

A review of incisional local anaesthesia for postoperative pain relief after abdominal operations concluded that except for herniotomy, it was not an effective method for postoperative analgesia (appendicectomy, major abdominal surgeries, Caesarean section, abdominal hysterectomy, open cholecystectomy).[14] A meta-analysis on the effectiveness of TAP block concluded that TAP block is comparable to morphine for postoperative analgesia, reduces the requirement of postoperative opioid use, increases time to first request for further analgesia, offers better pain relief and has lesser side effects.[15] The meta-analysis analyzed studies comparing either placebo or no placebo. We compared two standard methods of analgesia for parietal pain - TAP block and local infiltration instead of placebo.

Our study has certain limitations. We did not assess pain on movement, as our primary aim was to find the duration of action of the two techniques, and assessing pain on movement which includes both visceral and parietal components of pain would have influenced the duration of analgesia. Both the techniques studied block only the parietal component of pain originating from the anterior abdominal wall due to the surgical incision and not the visceral component of pain, which may be a major part of pain on movement. Blinding of performer of blocks is not possible due to the varying techniques of both the groups, but, the investigator who assessed the patient postoperatively is blinded to which group the patient belongs. The patient too could not be blinded as there is appreciable loss of sensation or paresthesia with the TAP block, so true blinding may not have been possible.

Further studies are warranted with other local anaesthetics, in varying concentrations, doses, with additives, with ultrasound-guided technique, in other surgeries, and also comparing pain on movement. We did not place a continuous block with a catheter, as we wanted to assess the duration of analgesia with a single injection on each side, as well as the procedural considerations of placing bilateral continuous infusions not exceeding the toxic dose limit. We also wanted to study the opioid requirement in the first 24 h postoperatively, which would have been biased by a continuous block.

CONCLUSION

USG Guided TAP block is a promising technique in alleviating postoperative pain in patients undergoing lower abdominal gynaecological surgeries especially when used as part of multi-modal analgesia regimen. The procedural simplicity of this block, along with reliable level of analgesia (T10-L1), longer duration as well as quality, with lesser opioid requirement and their side-effects makes the TAP block makes a good option for lower abdominal gynaecological surgeries.

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