International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

IJMRP

Original Research Article

Comparison of Analgesic Efficacy of Transversus Abdominis Plane Block with Ilioinguinal-Iliohypogastric Nerve Block Using 0.5% Bupivacaine (2mg/Kg) in Lower Abdominal Including Gyanecological Surgeries Under Spinal Anaesthesia: A Double Blind Randomised Study

Parveen S[1*], Garg G. L.[2], Varshney R[3]

[1*]PG Resident (IIIrd Year), [2]Professor & Head, [3]Associate Professor, Department of Anaesthesia, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India.

ABSTRACT

Background: A substantial component of the pain experienced by patients after abdominal surgery is derived from the anterior abdominal wall incision. Regional blocks of the anterior abdominal wall including Transversus Abdominis Plane (TAP) block and ilioinguinal block can significantly help with intraoperative and postoperative analgesia. We conducted a randomized controlled trial to compare transversus abdominis plane block with ilioinguinal iliohypogastric block in patients posted for lower abdominal including gynaecological surgeries.

Methods: The study included 60 patients, ASA Grade I/II patients, 18-60 years of age undergoing lower abdominal and gynaecological surgeries under spinal anaesthesia. Randomisation was performed using chit and box method. The patients were divided equally into two groups of 30 each. Group T- Patients receiving bilateral transversus abdominis plane block with bupivacaine 0.5% (2mg/kg), 10 ml each side. Group I- Patients receiving bilateral ilioinguinal iliohypogastric block with bupivacaine 0.5% (2mg/kg), 10 ml each side. Pain severity using visual analogue score (VAS), post-operative rescue analgesic requirement, analgesia satisfaction score & adverse effects were assessed by an investigator blinded to the allotment every 2, 4, 6, 8, 12, 18 and 24 h using possible pain of the block performed.

Results: Total Tramadol consumption in 24 hrs was significantly lower in Group T (128.01mg ± 16.27) compared to Group I (211.63 mg ± 23.51) in Group I .Time for first request of analgesia was prolonged in Group T (12.052 hrs±0.78) in comparison to Group I (8.336 hrs±1.14). Postoperative pain score (VAS score) was reduced at 0, 6, 12 and 24 hours after both TAP block and IL-IH Block but was lesser in Group T as compared to Group I, which was statistically significant.

Conclusion: The transversus abdominis plane block was more effective in reducing severity of pain, delayed the demand of first postoperative analgesic and reduced the need of tramadol during first 24 hrs after surgery when compared with ilioinguinal iliohypogastric block.

Key Words: Transversus Abdominis Plane Block, Ilioinguinal Iliohypogastric Block, Visual Analogue Score (VAS).

***Correspondence to:**

Dr. Parveen S,
PG Resident (IIIrd Year),
Department of Anaesthesia,
Teerthanker Mahaveer Medical College & Research Centre,
Moradabad, Uttar Pradesh, India.

Article History:

Received: 04-05-2017, **Revised:** 24-05-2017, **Accepted:** 05-06-2017

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2017.3.4.005	

INTRODUCTION

A substantial component of the pain experienced by patients after abdominal surgery is derived from the anterior abdominal wall incision.[1] The anterior abdominal wall is innervated by nerve afferents that course through the transversus abdominis neuro-vascular fascial plane.[2] Poorly controlled pain after abdominal surgery is associated with a variety of unwanted post-operative consequences, including patient suffering, distress, confusion, chest and heart problems, and prolonged hospital stays.

The most commonly used modality for pain control after lower abdominal surgeries is opioid administration either systematically as intramuscular (IM) injection, patient controlled analgesia intravenous (IV) or as part of regional anaesthesia. Opioids have been seen to provide adequate analgesia but are associated with frequent side effects such as nausea, vomiting, pruritis, sedation and respiratory depression.

Regional blocks of the anterior abdominal wall including Transversus Abdominis Plane (TAP) block and ilioinguinal block can significantly help with intraoperative and postoperative analgesia. TAP block is a new regional analgesic technique where local anaesthetics are injected in to the transversus abdominis

plane which is an anatomic space between internal oblique and transversus abdominis muscle and spans the abdomen wherever these muscles exit. It targets nerves of anterio-lateral abdominal wall mainly T-10 to L1 or T-9 to T-11, therefore this technique is suitable for surgeries below umbilicus.[1] Ilioinguinal-iliohypogastric block can provide good analgesia for most operations in the inguinal region. These blocks may be very effective in reducing the need for opioids, and in paediatric patients, they have been found to be as effective as caudal blocks.

The advantages of TAP/Ilioinguinal-iliohypogastric block are that they provide excellent postoperative analgesia, decrease opioid requirements, allow patients to breathe and cough more comfortably, and facilitate early mobilization and discharge.

Based on the above beneficial effects of TAP/Ilioinguinal-iliohypogastric block we designed a randomized controlled trial to compare transversus abdominis plane block with ilioinguinal iliohypogastric block in patients posted for lower abdominal surgeries including gynaecological surgeries.

MATERIALS AND METHODS

After obtaining clearance from Institutional Ethical Committee, the study was conducted in Department of Anaesthesia, Teerthanker Mahaveer Medical College & Research Center, Moradabad from May 2015 till November 2016. The study included 60 patients, ASA Grade I/II patients, 18-60 years of age undergoing lower abdominal and gynaecological surgeries under spinal anaesthesia following detailed pre-anaesthetic checkup. Written informed consent was taken from all patients.

Exclusion Criteria

1. Patient refusal for the procedure.
2. ASA Grade III/IV
3. Presence of any contraindication to spinal anaesthesia.
4. Morbid Obesity.
5. Patients undergoing surgery under general anaesthesia.
6. Patients who have a prior epidural catheter placement for analgesia during the same hospital encounter.

Randomisation was performed using chit and box method. The patients were divided equally into two groups of 30 each.

Group T: Patients receiving bilateral transversus abdominis plane block with bupivacaine 0.5% (2mg/kg), 10 ml each side.

Group I: Patients receiving bilateral ilioinguinal iliohypogastric block with bupivacaine 0.5% (2mg/kg), 10 ml each side.

The patients, their anesthesiologists, and staff providing postoperative care were blinded to group assignment.

After securing 20 Gauge Intravenous cannula, Ringer lactate was started. Premedication with Inj. Metoclopramide (10 mg IV) and Inj. Ranitidine (50 mg IV) was administered. Standard monitors including pulse oximetry, Non-Invasive blood pressure and ECG was monitored. All patients were preloaded with 500 ml Ringer lactate before start of surgery. Spinal anaesthesia was administered using 25 Gauge spinal needle and 3.0 ml of Inj. Bupivacaine (0.5%, dextrose mixed) was given in subarachnoid space. With the onset of satisfactory block at the T6 level, the surgeon would proceed with the procedure. At the end of surgery bilateral transversus abdominis block or bilateral ilioinguinal block was given as per our study protocol.

TECHNIQUE OF TRANSVERSUS ABDOMINIS BLOCK

The block was performed by using a landmark technique as described by Rafi. The aim was to place a large volume of local anaesthetic in the fascial plane between the internal oblique and transversus abdominis which contains the nerves from T6 to L1. The TAP was accessed from the lumbar 'triangle of Petit', bounded anteriorly by the external oblique, posteriorly by the latissimus dorsi, and inferiorly by the iliac crest.

The triangle was identified just anterior to the latissimus dorsi muscle and a blunt tipped, short-bevelled needle was placed perpendicular to the skin immediately cephalad to the iliac crest. The needle was advanced through the external oblique and a first 'pop' sensation is felt when the needle enters the plane between the external oblique and internal oblique. Further advancement of the needle results in a second 'pop' after passing through the internal oblique fascia into the TAP. At this point, after careful aspiration, 10 ml of 0.5% bupivacaine was injected. The same procedure was applied on the other side and 10 ml 0.5% bupivacaine was given on the other side also (Fig 1).

Figure 1: Technique of Tap Block

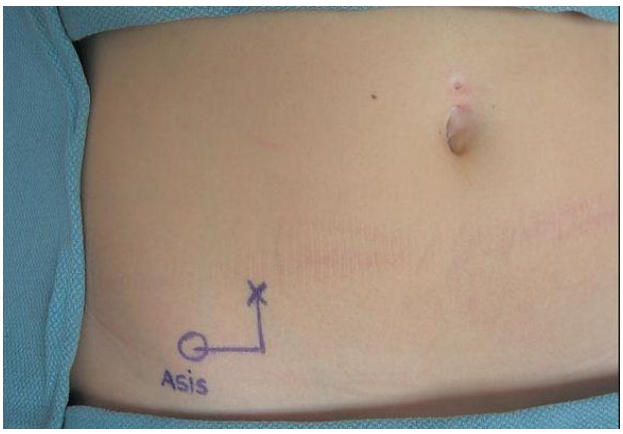


Fig 2: Technique of Ilioinguinal-Iliohypogastric Block

TECHNIQUE OF ILIOINGUINAL-ILIOHYPOGASTRIC BLOCK

The ilioinguinal-iliohypogastric nerve block was traditionally performed at a location 2cm medial and 2cm cephalad to the ASIS, using a 2-pop technique. The first pop felt by the physician was the needle piercing the fascia between the external and internal oblique muscles and the second pop was the needle piercing the internal oblique muscle fascia to lie between the internal oblique and transversus abdominis muscles. At this point of time bupivacaine 0.5 % (dose 2mg/kg amounting to 10 ml) was injected. The same procedure was repeated on the other side. (Fig 2)

The patients were shifted to Post- Operative care unit and following observation were made in 24 hours.

Pain severity 2qw assessed by an investigator blinded to the allotment every 2, 4, 6, 8, 12, 18 and 24 h. It was measured using visual analogue score (VAS) (0 = no pain and 10 = worst possible pain). Diclofenac 1 mg/kg 12 hourly was given as an intravenous infusion to all patients in both groups. Rescue analgesia was given to patients on demand or when VAS was more than 4 in the form of IV tramadol 2 mg/kg. Tramadol was given in incremental doses of 20 mg every 10 min up to maximum 250 mg/hour and 400 mg / 24 hours in patients with moderate and severe pain. Total dose was considered mild, moderate and high when up to 100mg, 100-300 mg and greater than 300 mg respectively.

The postoperative analgesia satisfaction score (0: poor, 1: moderate, 2: good, 3: very good, 4: excellent) was also evaluated and recorded.[3] The parameters were studied and compared in both the groups from the time to first request for analgesic, total tramadol requirement in 24 h and VAS at 2, 4, 6, 8, 12, 18, 24 h.

Pain severity based on VAS score.[4]

Grade 0 (0-1): Good analgesia.

Grade I (1-4): Moderate analgesia.

Grade II (4-7): Mild analgesia.

Grade III (7-10): No analgesia.

Haemodynamic parameters (heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate and SpO2), were also observed at 30 mins,2 hrs,4 hrs,6 hrs,12 hrs and 24 hrs after completion of surgery.

Complications like nausea, vomiting, sedation, pruritis and chills were also noted**.**

STATISTICAL ANALYSIS

For sample size calculation, we considered that a clinically important reduction in 24 h tramadol consumption would be 25% absolute reduction. This was a conservative assumption based on our pilot data. We calculated that 27 patients per group would be required for an experimental design incorporating two equal-sized groups, using 0.05 and 0.2 alpha and beta errors. To minimise any effect of data loss, we elected to recruit 30 patients per group into the study.

Statistical analysis was done using latest version of SPSS software. Demographic data was analysed using Student's *t*-test or Fisher's exact test as appropriate. The comparison of total tramadol requirement, time to first analgesic administration and VAS between the two groups was done by paired *t*-test. Confidence interval was 95%. $P < 0.05$ was considered statistically significant.

Table 1: Demographic Data

DEMOGRAPHIC DATA	GROUP T	GROUP I	p Value
Age (years)	47.48±7.91	47.55±6.62	0.07
Weight (kg)	59.60±4.17	60.24±5.51	0.48
Sex (M)	11(36.67)	10(33.33)	0.35
(F)	19(63.33)	20(66.67)	

Table 2: Antiemetic (Ondansetron) Requirement

INTERVAL	GROUP T	GROUP I	P Value
0-6 hours	0	0.14±0.74	0.156
6-12 hours	2±2.02	2.07±2.06	0.854
12-24 hours	3.59±1.23	3.93±1.18	0.126

Table 3: Postoperative Nausea And Vomiting Scores

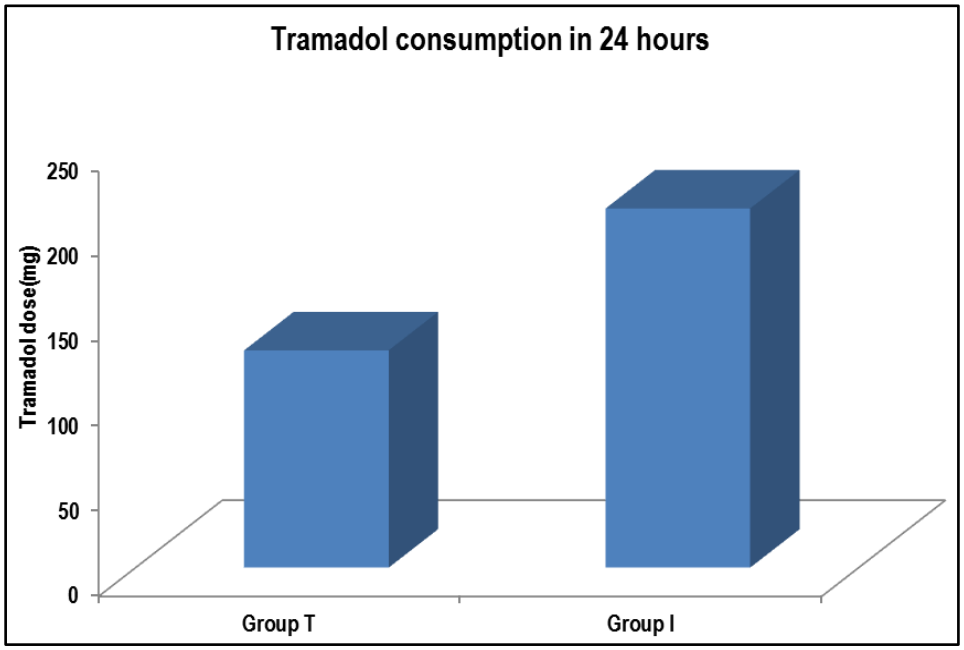
INTERVAL	GROUP T	GROUP I	P Value
0-6 hours	0	0.03±0.02	0.756
6-12 hours	0.55±0.54	0.62±0.52	0.395
12-24 hours	1.05±1.23	1.07±0.45	0.888

Table 4: Sedation Scores

INTERVAL	GROUP T	GROUP I	P Value
0-6hours	0.97±0.02	1.0±0.02	0.156
6-12 hours	1.07±0.03	1.22±0.06	0.854
12-24 hours	1.34±0.03	1.81±0.05	0.010

RESULTS

Sixty patients were entered into the study. Of all the patients, 30 were randomized to undergo TAP blockade (Group T) and remaining 30 were randomized to undergo IL-IH Block (Group I). All patients underwent abdominal surgical procedures requiring a midline abdominal incision. Both groups were comparable in age, gender, and operative procedures performed (Table 1). Total Tramadol consumption in 24 hrs was significantly lower in Group T (128.01mg ± 16.27) compared to Group I (211.63 mg ± 23.51) in Group I (Figure 3). Moreover, time for first request of analgesia was prolonged in Group T (12.052 hrs±0.78) in comparison to Group I (8.336 hrs±1.14) (Figure 4).


Tramadol consumption in 24 hours
Tramadol dose(mg)
250
200
150
100
50
0
Group T
Group I

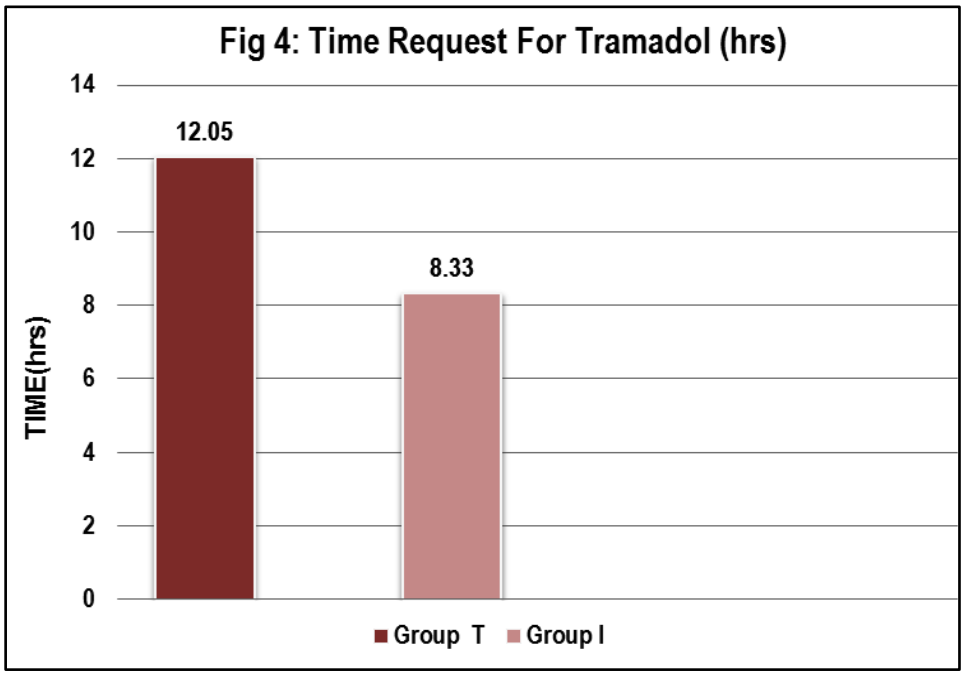


Fig 4: Time Request For Tramadol (hrs)
TIME(hrs)
14
12
10
8
6
4
2
0
12.05
8.33
Group T
Group I

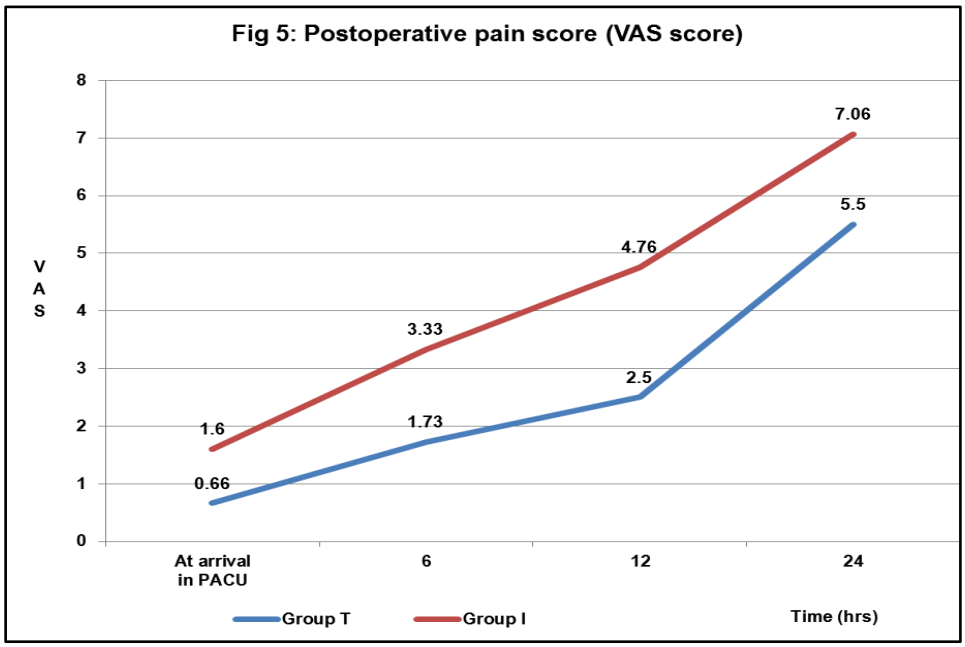


Fig 5: Postoperative pain score (VAS score)
V
A
S
8
7
6
5
4
3
2
1
0
7.06
5.5
4.76
3.33
2.5
1.73
1.6
0.66
At arrival in PACU
6
12
24
Group T
Group I
Time (hrs)

Postoperative pain score (VAS score) was reduced at 0, 6, 12 and 24 hours after both TAP block and IL-IH Block but was lesser in Group T as compared to Group I, which was statistically significant (Figure 5). Antiemetic requirement was reduced in both the groups with no significant difference between the two groups as is evident in Table 2.

There was no significant difference noted in post- operative nausea vomiting score (Table 3) and sedation score (Table 4) between both groups. Satisfaction scores were comparable in both the groups, 72.41% patients in Group T were satisfied while 20.68% were extremely satisfied regarding postoperative analgesia and 6.89% were not satisfied. In Group I, 81.03% patients were satisfied, 13.79% were extremely satisfied with analgesia provided and 10.34% were not satisfied.

DISCUSSION

The benefits of adequate postoperative analgesia are clear, and include a reduction in the postoperative stress response, reduction in postoperative morbidity, and in certain types of surgery, improved surgical outcome.[5,6] Effective pain control also facilitates rehabilitation and accelerates recovery from surgery. Other benefits of effective regional analgesic techniques include reduced pain intensity, decrease incidence of side effects from analgesics, and improved patient comfort.[7]

Traditionally, analgesia for abdominal surgery is provided either by systemic drugs such as opioids, ketamine, non-steroidal anti-inflammatory drugs, alpha-2 agonists, and paracetamol or by epidural anesthesia.[8] Post-operative wound pain may be reduced by infiltration of local anesthetic into the wound before closure.[5,9] Others have found preemptive local anesthetic nerve block to be useful in reducing post-operative pain in both minimally invasive surgery and "open" laparotomy cases. The analgesic regime used should be safe and effective with minimal side effects. A mutimodal analgesic regime is most likely to achieve these goals. Multimodal analgesia is an approach to prevent postoperative pain that involves administering a combination of opioid and nonopioid analgesics which act at different sites within the central and peripheral nervous systems in an effort to improve pain control while eliminating opioid-related side-effects. The use of continuous local anesthetic techniques (e.g., for perineural blocks or wound infiltration) has become increasingly popular due to their ability to control moderate- to-severe pain after major ambulatory orthopedic surgery procedure.

The current armamentarium of analgesic medications and techniques include a wide spectrum of pharmaceutical products and non-pharmacologic products with the aim to reduce postoperative pain, opioid use, and related adverse effects (such as nausea and vomiting, constipation, urinary retention), duration of the hospital stay, and perioperative care costs, while still providing for a high-quality recovery for the patient undergoing day-case surgery.[10,11]

Transversus abdominis plane block is a new regional analgesic technique which targets nerves of anterio-lateral abdominal wall mainly T-10 to L1 or T-9 to T-11.The block has been found to be effective after various abdomial surgeries like abdominal hysterectomy, open prostratectomy, laproscopic cholecystectomy and appendicectomy.[4,12,13] Ilioinguinal-iliohypogastric nerve block involves the blocking of ilioinguinal and iliohypogastric nerves (L1-L2) in the plane between the transversus abdominis and internal oblique. It has been found to reduce analgesic requirement after caesarian section, inguinal hernia surgerie.[14]

Several studies have documented that the transversus abdominis plane block provided effective analgesia during the first 24 hrs after surgery in a series of lower abdominal or pelvic surgical procedures. Up to now, these studies included a limited number of patients for each surgical procedure, and comparisons were performed with a control group receiving systemic analgesia.

Our study demonstrated that supplementing a standard multimodal analgesia regimen with transversus abdominis plane block resulted in reduced 24 hour tramadol consumption and pain scores as well as delayed request for supplemental opioid analgesia compared with the group which received ilioinguinal-iliohypogastric block. We found that the overall tramadol consumption was reduced by 30% in the first 24 hours postoperative group which received transversus abdominis plane block as compared to the group which received ilioinguinal-iliohypogastric block. Total tramadol consumption was 128.01mg in Group T as compared to 211.63 mg in Group I (p value <0.0001)

Our study also demonstrated reduced pain scores in Group T as compared to Group I at 0 hours (0.66±0.92 vs 1.60±1.45, p< 0.35), 6 hours (1.73±0.78 vs 3.33±1.15, p<0.0001), 12 hours (2.50±0.98 vs 4.76±1.62, p<0.0001) and 24 hours (5.50±1.91vs 7.06±1.16, p<0.0001). Along with reduced analgesic consumption we also observed that the group which received transversus abdominis plane block took a longer time to request for the first rescue analgesic dose as compared to the group which received ilioinguinal-iliohypogastric block. The mean time for 1st analgesic request analgesic in group T was 12.052±0.103 hours as compared to 8.336±0.15 hours in group I (P<0.0001).

Tramadol demand was decreased in patients who benefited from a transversus abdominis plane block, but the difference in tramadol consumption between the two groups was not important enough to account for a difference in the incidence of postoperative nausea and vomiting. Sedation scores observed were similar in both the groups. None of the patients were deeply sedated to require intervention in any group. Satisfaction scores were similar in both the groups implying that both transversus abdominis plane block and ilioinguinal-iliohypogastric block are in effective for postoperative pain management.

Very few studies have been done comparing the analgesic efficacy of transversus abdominis plane block and ilioinguinal iliohypogastric nerve block. Most studies have been performed comparing these two abdominal nerve blocks with a placebo group and both transversus abdominis plane bock and ilioinguinal-iliohypogastric block have proven to be effective in reducing pain scores and decreasing opoid consumption.

Molla et al (2015) conducted a comparative study between transversus abdominis plane block and routine postoperative analgesia in patients undergoing abdominal surgeries (caesarian section, total abdominal hysterectomy, open prostratectomy) and found results in favour of transversus abdominis plane block (TAP block). TAP block reduced visual analog scale pain scores as compared with Non-TAP at 2nd hr (24±8, 58±22), 6th h rest (22±6, 46±14), 6th h coughing (28±7, 61±19) and at 24th h (26±11, 53±16); P <0.001). It also significantly reduced total postoperative tramadol (mean (IQR) consumption: (90(150) mg, 38(50) mg; P=0.002). Time to first analgesic request were also

prolonged, in favor of TAP group (360(500) min vs 156(80) min; P<0.001).[15]

In another study conducted by Sharma et al (2013), transversus abdominis plane block was compared with a placebo group in which tramadol requirement and time for 1st request of analgesia were observed. Patients undergoing TAP block had reduced tramadol requirement in 24 h (210.05 ± 20.5 vs. 320.05 ± 10.6; *P* < 0.01) and 48 h (508.25 ± 20.6 vs. 550.25 ± 20.6; *P* < 0.01), and a longer time to the first PCA tramadol request (in minutes), compared to the control group (178.5 ± 45.6 vs. 235.45 ± 3.8; *P* < 0.001).[16]

Our results were consistent with those found by a study done by Aveline et al. in 2012. Aveline et al compared ultrasound guided Transversus abdominis plane block with ilioinguinal-iliohypogastric block in patients undergoing inguinal hernia repair. Median VAS pain scores at rest were lower in the ultrasound-guided Transversus abdominis plane group at 4 h (11 vs 15, P=0.04), at 12 h (20 vs 30, P=0.0014), and at 24 h (29 vs 33, P=0.013). Postoperative morphine requirements were lower during the first 24 h in the Transversus abdominis plane block group (P=0.03). Morphine demand was decreased in patients who benefited from a Transversus abdominis plane block, but the difference in morphine consumption between the two groups was not important enough to account for a difference in the incidence of PONV. Aveline concluded that after open inguinal hernia repair in ambulatory patients, ultrasound-guided transversus abdominis plane block provided better immediate postoperative pain relief and reduced opioid demand, when compared with conventional loss-of-resistance ilioinguinal-iliohypogastric blocks.[9]

Our findings that transversus abdominis plane block provides better analgesia can be explained on the fact that the site of penetration of the two nerves towards the abdominal wall muscles also varies, so that the more proximal the nerves are blocked, the more effective the block could be. Nerve endings anaesthetized by the transversus abdominis plane block originate from T7 to L1 and include the ilioinguinal-iliohypogastric nerves which is responsible for better analgesic efficacy of transversus abdominis plane block when compared to ilioinguinal-iliohypogastric nerve block.

CONCLUSION

We conclude that both the transversus abdominis plane block and ilioinguinal-iliohypogastric nerve block were easy to perform and effective in reducing analgesic demand (tramadol) as a part of multimodal analgesia regime but the transversus abdominis plane block was more effective in reducing severity of pain, delayed the demand of first postoperative analgesic and reduced the need of tramadol during first 24 hrs after surgery when compared with ilioinguinal iliohypogastric block.

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Source of Support: Nil.

Conflict of Interest: None Declared.

Cite this article as: Parveen S, Garg G. L., Varshney R. Comparison of Analgesic Efficacy of Transversus Abdominis Plane Block with Ilioinguinal-Iliohypogastric Nerve Block Using 0.5% Bupivacaine (2mg/Kg) in Lower Abdominal Including Gyanecological Surgeries Under Spinal Anaesthesia: A Double Blind Randomised Study. Int J Med Res Prof. 2017; 3(4):155-58. DOI:10.21276/ijmrp.2017.3.4.005