

Comparison of trans versus abdominis plane block versus epidural block for post-operative analgesia in renal transplant patients

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Abstract

Introduction

According to JCAHO (Joint Commission on Accreditation of Healthcare Organization) pain is regarded as 5th vital sign & requires caregivers to regularly address & assess pain. Postoperative pain is a result of direct trauma to the tissues caused by the pain producing substances such as prostaglandins, histamine, serotonin, substance P, bradykinin that are liberated during operation. Various analgesic methods are used for post-operative pain relief. Enteral and parenteral analgesics (both opioids and non-opioids) are associated with systemic side effects such as nausea, vomiting, respiratory depression, sedation, hepatotoxicity, nephrotoxicity. So other techniques like regional analgesic techniques, Transversus Abdominis Plane (TAP) block, Local wound infiltration, come in to pictures to avoid most of problems and are now a days

commonly used & very much effective. Epidural analgesia reduces the surgical stress by blocking the nociceptive impulses from the operative site and also improve respiratory and bowel function and decreases incidence of deep vein thrombosis by early mobilization. In the last decade, a novel approach to block the abdominal wall neural afferents via the “lumbar triangle of Petit” has been described by Rafi in 2001, known as Transversus Abdominis Plane (TAP) block. By introducing the local anaesthetics into the transversus abdominis plane (TAP) via the triangle of Petit, it is possible to block the sensory nerves of the anterior abdominal wall before they leave this plane and pierce the musculature to innervate the entire anterior abdominal wall (T7 to L1)

Materials and methods: The present study was a prospective randomized study. It was designed to compare the analgesic efficacy of TAP versus Epidural

block in 60 open renal transplant patients for post operative analgesia. After approval by the institutional ethical committee, written informed consent was obtained from all the patients. This study was carried out through a period of one year from June-2020 to June-2021 and was performed as per guide lines and principles of Declaration of Helsinki. 60 patients were divided randomly by the sealed envelope technique into two equal groups of 30 patients each.

GROUP T - Transversus abdominis block: 20cc of 0.125% ropivacaine + 2microgram / kg Dexmedetomidine

GROUP E – Epidural: 10cc of 0.125% ropivacaine + 2microgram / kg Dexmedetomidine

Study design: All Collected data are entered into the SPSS V20. Continuous data are expressed in Mean \pm SD form. It follows parametric and non-Parametric data both. Independent t test and Mann Whitney test have been used for carrying out significant P-value. Non-Continuous data are countable and are expressed as in frequency or in percentages. Chi Square test and Fisher Exact test have been used for carrying out significant p-value. P-value

Aims and objective:

1. Duration of post-operative analgesia that is the time required for first rescue analgesic.
2. To estimate additional doses of analgesics required in first 24 hrs.
3. Effect on cardiovascular and respiratory parameters.
4. To compare the side effects like nausea, vomiting, sedation, dryness of mouth, respiratory depression.

Procedure

All the patients were assured & explained about the procedure during the pre-operative visit. The detailed history of present & past illness was taken & a thorough general, systemic & local examination was done in the pre-operative visit. All routine investigations were

performed including • Complete blood count, • Renal function test, • Liver function test, • Coagulation profile, • ECG, • Chest Xray, • 2D Echocardiography • Fundus examination. All the patients were starved 8 hours prior to surgery. The patient underwent non heparinised haemodialysis in their last session & all had normal prothrombin time (PT), activated partial thromboplastin time (aPTT), platelet counts & serum potassium level after dialysis. All the patients have received their scheduled medications for systemic illnesses on the day of surgery. Post dialysis in morning on day of surgery, investigations like CBC, RFT, LFT, ECG, CXR, Coagulation profile were done. In the operating room, standard monitors were applied and measured. • Electrocardiography • Pulse oximetry • Non-invasive blood pressure Balance General Anesthesia was given which include:

Premedication

Inj. Glycopyrrolate 0.004mg/kg Inj. Fentanyl 2 μ g/kg Inj. Emset 0.1mg/kg IV slowly Preoxygenation: 100% O₂ for 3minutes.

Induction: inj. Thiopentone 5-7mg/kg Inj. Succinylcholine 1-1.5mg/kg. Laryngoscopy followed by endotracheal intubation was done. Muscle relaxant Atracurium 0.5 mg/kg given. Maintenance: O₂+ N₂O + sevoflurane/isoflurane + atracurium Intraoperative IV fluids 0.9% normal saline according to CVP (Target CVP 14- 16) & blood transfusion if required.

Technique: After induction of anesthesia & before starting of surgery in Group “E” had a lumbar epidural catheter (22-gauge, multi-orifice) placed at L1–L2 or L2–L3 (best available) intervertebral space. The catheter was placed with “Loss of resistance to air” technique with 18-gauge Tuohy needle (Perifix™, B. Braun Melsungen) will be used. A test dose of 3 ml solution of 2% lidocaine with 40 adrenaline was given to rule out intrathecal and

intravascular placement of the catheter. At the end of the surgery, they received 10 ml of 0.125% ropivacaine + 2 microgram/kg Dexmedetomidine through the epidural catheter. Post operative patient was observed for 24 hours. Patients in Group “T” received ultrasound-guided TAP block at the end of the surgery. A portable ultrasound machine (GE venue 40™, GE HEALTHCARE U.S.A) with a high-frequency linear probe of 8–13 MHz was used. The ultrasonography probe was placed transversely over the anterior abdominal wall over its anterolateral aspect, across the midaxillary line, and just above the iliac crest. At this location, the three muscle layers of the anterior abdominal wall were visualized. A 21 gauge stimuplex needle was advanced by the in-plane approach from the anterior direction. After placement of the needle between the internal oblique and the transversus abdominis muscles (TAP), 20 cc of 0.125% ropivacaine+ 2 microgram/kg Dexmedetomidine was injected and the spread of the local anaesthetic (LA) solution will be visualized in real time through ultrasound. After injecting the local anaesthetic solution. In both groups, Patients were assessed for pain at 1, 2, 4, 8, 16, 24 hours postoperative. Assessment of the pain will be done using visual analogue scale (VAS) and score noted for:

1. Pain at rest
2. Pain on movement

When patient complain of pain with modified VAS > 4/10 rescue analgesia injection tramadol 2mg/kg IV was

Demographic data

Table 1: Demographic Data

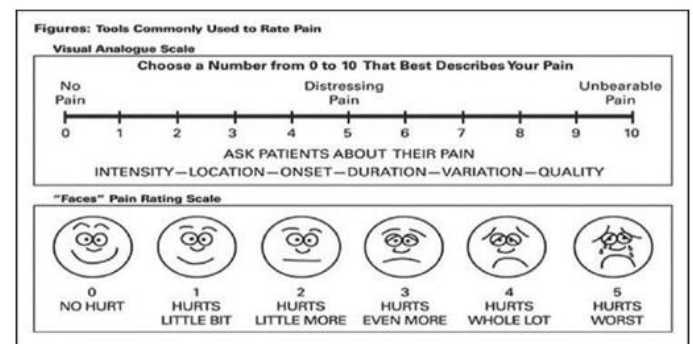
	Group of TAP (N=30) Mean ± SD	Group of Epidural (N=30) Mean ± SD	P value	T value
Age (years)	35+12	34+11	>0.05	0.37
Gender: M/F	23/7	24/6		
Weight (Kg)	60+12	58.5+9	>0.05	0.55

given, after giving injection ondansetron 0.15mg/kg. Total doses of tramadol in mg were recorded in first 24 hour. Post operative hemodynamic parameters observed & recorded up to 24 hrs. post operative sedation was assess by Modified RSS & any other side effects like nausea, vomiting, itching was observed.

Modified Ramsay Sedation Score

1. Anxious and agitated or restless, or both.
2. Co-operative, oriented and calm
3. Response to commands only
4. Exhibiting brisk response to light glabellar tap or loud auditory stimulus
5. Exhibiting a sluggish response to light glabellar tap or loud auditory stimulus.
6. Unresponsive

Figure 1: Visual Analogue Scale



Results and discussion

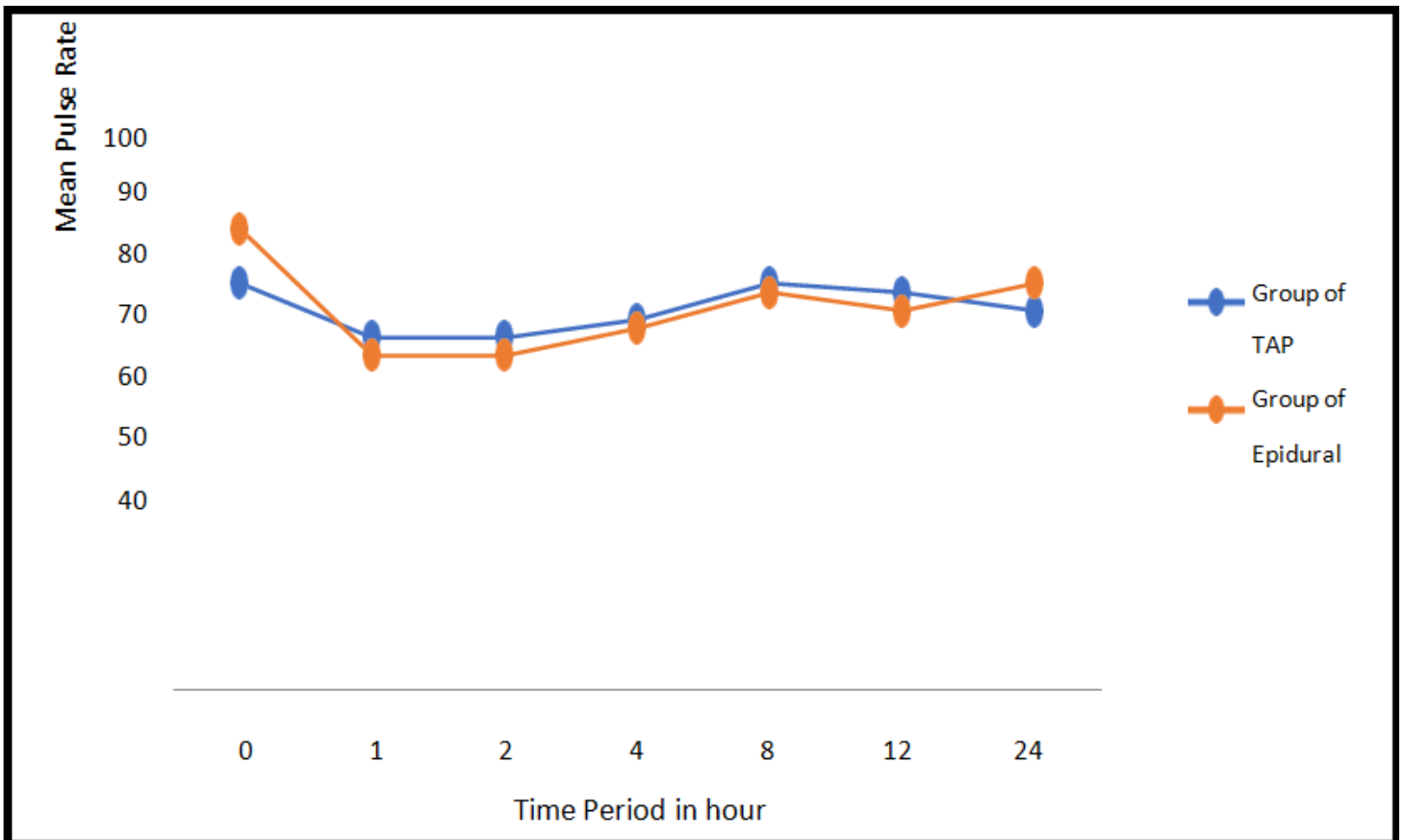
The demographic detail which included patients’ age, gender and weight were comparable and no statistically significant difference (p > 0.05) between the groups.

Postoperative Pulse rate

Table 2: Comparisons of mean Heart rate

Hour after Examination	Group of TAP (N=30) Mean \pm SD	Group of Epidural (N=30) Mean \pm SD	P value	T value
0	85 +9	91+15	0.04*	2.02
1	79 +7	77+12	0.34	0.95
2	79 +6	77+12	0.46	0.74
4	81+10	80+13	0.83	0.21
8	85 +8	84+12	0.79	0.26
12	84 +7	82+12	0.62	0.48
24	82 +8	85+12	0.31	1.02

Chart1: Comparisons of mean Heart rate



There was significant difference in mean pulse rate between these groups immediately after operation but after 1hr values is non-significant

Post operative Blood pressure

Table 3: Comparison of mean arterial blood Pressure

Hour		Group of TAP(N=30) Mean ± SD (mm hg)	Group of Epidural (N=30) Mean ± SD(mmhg)	P-value	T-value
0	Systolic	130+15	144+16	<0.05*	3.78
	Diastolic	82+11	94+11	<0.05*	4.6
1	Systolic	132+15	134+18	0.66	0.44
	Diastolic	82 +9	84+14	0.2	1.28
2	Systolic	134+12	132 +20	0.96	0.03
	Diastolic	84+10	86+12	0.6	0.52
4	Systolic	138+14	138+14	0.98	0.02
	Diastolic	84+10	86+10	0.26	1.13
8	Systolic	134+13	146+16	<0.05*	3.07
	Diastolic	84 +8	92+12	<0.05*	2.48
12	Systolic	136+14	142+15	0.06	1.8
	Diastolic	86+11	86 +9	0.65	0.44
24	Systolic	132+10	142+14	<0.05*	2.91
	Diastolic	82 +8	86+10	0.18	1.34

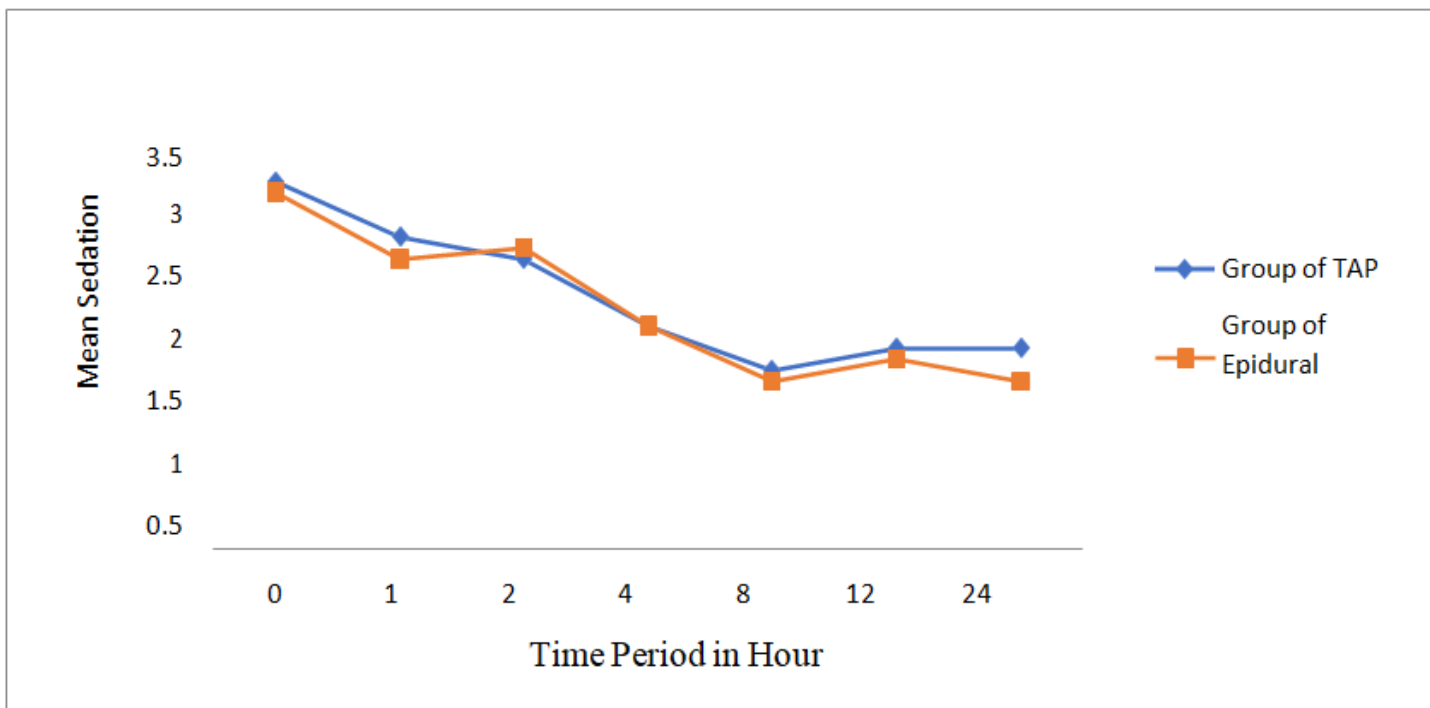
*Statistically significant difference (p<0.05)

Sedation (Ramsaysedation score)

Table 4: Comparison of Sedation Score

Hour	Group of TAP (N=30) Mean ± SD	Group of Epidural (N=30) Mean ± SD	P -value	T - value
0	3.3+0.5	3.2 +0.5	0.32	1
1	2.8+0.9	2.6 +0.6	0.22	1.22
2	2.6+0.7	2.7 +0.7	0.37	0.9
4	2+0.5	2+0.3	1	0
8	1.6+0.6	1.5 +0.5	0.26	1.15
12	1.8+0.4	1.7 +0.4	0.77	0.29
24	1.8+0.4	1.5 +0.5	0.005	2.87

Chart 2: Comparison of Sedation Score



Sedation score in both groups were comparable up to 12 hour and there was no statistically significant difference but after 24-hour, sedation scores were significantly high in TAP group.

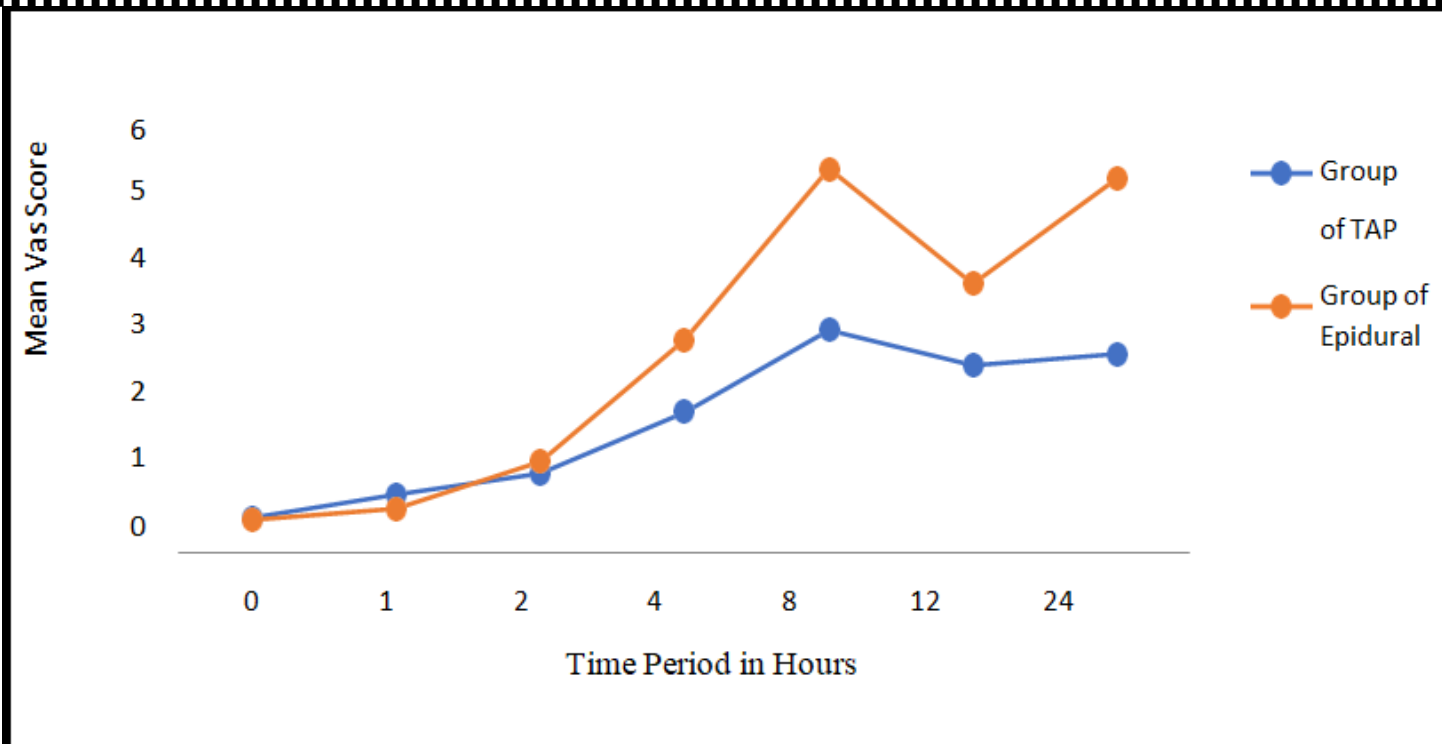
VAS(visual analogue scale)

Table 5: Comparison of vasscoreatrest

Hour	Group of TAP (N=30) Mean ± SD	Group of Epidural (N=30) Mean ± SD	P-value	T-value
0	0.5 ±0.6	0.47 ±0.5	0.82	0.22
1	0.83 ±1.17	0.63 ±0.76	0.44	0.78
2	1.13 ±1.1	1.3 ±1.3	0.6	0.53
4	2±2.05	3.03 ±1.35	<0.05*	2.3
8	3.17 ±2.12	5.47 ±2.06	<0.05*	4.25
12	2.67 ±1.83	3.83 ±2.13	<0.05*	2.27
24	2.83 ±1.78	5.33 ±2.21	<0.05*	4.81

*Statistically significant difference (p<0.05)

Vas Score significantly low after 4 hours in Group T compared to group E at rest



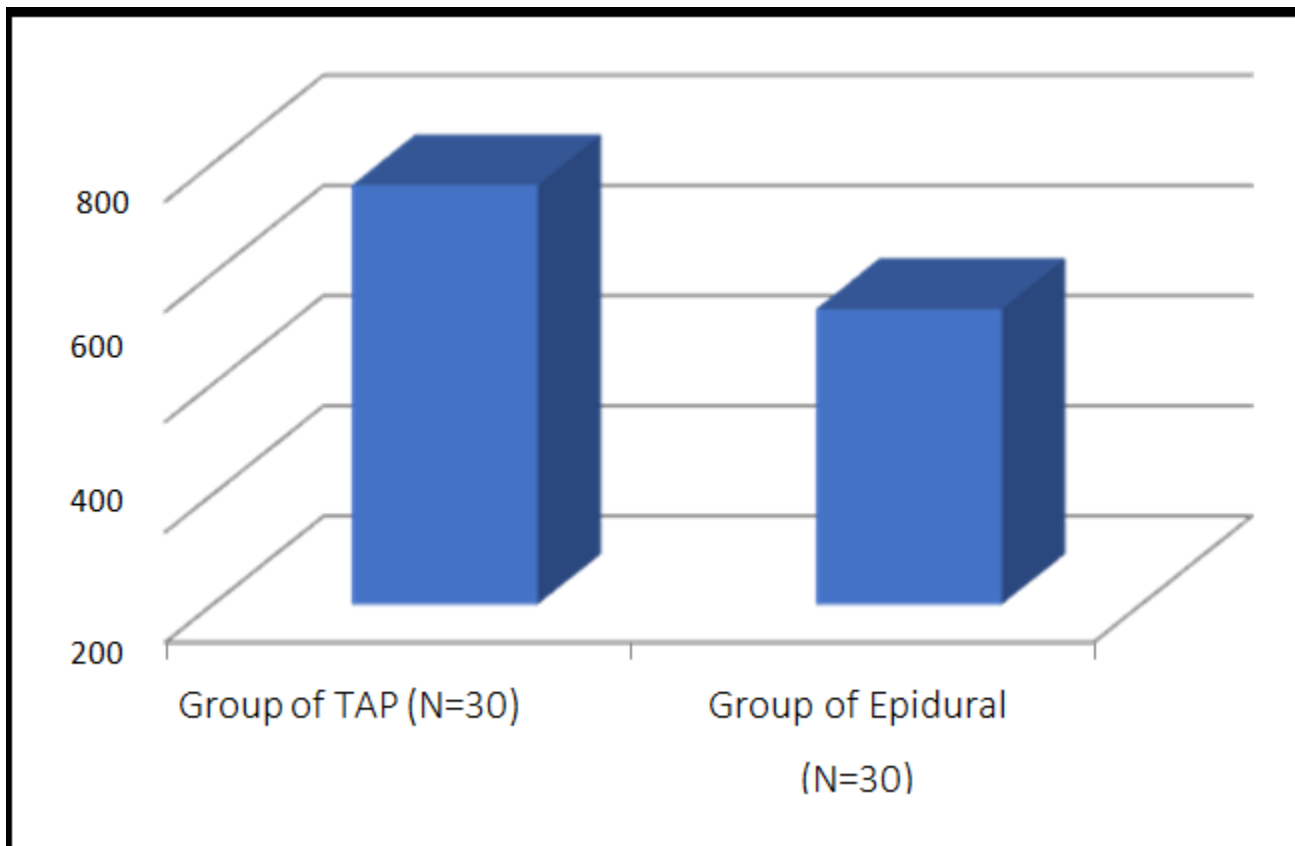
Duration of Analgesia

Table 6: Duration of analgesia

	Group of TAP (N=30)	Group of Epidural (N=30)	P-Value	T-Value
Duration of Analgesia (min)/ Time to first demand rescue analgesic (Mean ± SD)	761 ±457	536±299	<0.05*	2.26
Total Tramadol dose (in mg) in 24hr (Mean ± SD)	45±33	82±45	<0.05*	3.62

*Statistically significant difference (p<0.05)

Chart 4: Time to first demand rescue Analgesic (Mins)



The duration of analgesia, which is the time from administration of block to the time when 1st dose of rescue analgesic e.g. Inj. Tramadol was required. There was significant difference between groups Group A as higher duration of analgesia as compare to Group E. The main aim of post-operative pain relief is to provide to subjective comfort, in addition to inhibiting nociceptive impulses caused by surgery and to blunt autonomic as well as somatic reflexes to pain. Subsequently, this might enhance restoration of function by allowing the patient to breathe, cough and to be easily ambulant. Various analgesic techniques have been applied for post operative pain relief like enteral and parenteral analgesics (both opioids and non opioids) but they are associated with systemic side effects. The regional techniques avoid most of the problems and it is possible to achieve analgesia with minimum of drug dose and complication. Ultrasound-

guided TAP injection cephalad to the iliac crest is likely to involve the T10-L1 nerve roots, and implies that the technique may be limited to use in lower abdominal surgery.^[1] Dexmedetomidine has been shown to increase sensory and motor block duration during epidural anesthesia with ropivacaine, prolongs postoperative analgesia, and does not cause significant hemodynamic instability.^[2] Abdominal field block in the form of local infiltration, ilioinguinal and iliohypogastric block have been used for postoperative analgesia since many years, however the clinical utility of current approaches to the blockade of these nerve afferents is limited, and the degree of block achieved can be unpredictable. A major reason for the relative lack of efficacy of these blocks is the lack of clearly defined anatomic landmarks, leading to uncertainty regarding the exact needle positioning, and the lack of a clear indication that the local anesthetic is being deposited in the correct

anatomical plane. TAP block is a novel approach to block the sensory nerve supply to the anteriorabdominal wall. TAP block was first described by Rafi in 2001. In this technique local analgesic is administered between IOAM and TAM via superficial and mark i.e., POP technique described by Rafi, is associated with difficulties like anatomic variation of triangle of Petit, difficulty in palpation of triangle in obese patients and complications like colonic puncture, liver injury, nerve injury or unpredictable spread of local anaesthetic. [5] Direct visualization of abdominal structures, anatomy of the transverses abdominis plane, and spread of local anesthetic by ultrasound guidance may be accompanied with an increased margin of safety and optimal block quality. [6] The volume of local anesthetic used in the study must so be considered: 20 ml may be an adequate volume to block all the nerve roots in the TAP. A cadaveric study reported spread of 20 ml of dye from the iliac crest to the costal margin. However, this has subsequently been disputed. [4,7] Despite dye not teaching the costal margin, T11 was consistently dyed, and T10 was dyed in 50% of cadavers, suggesting that 20 ml is sufficient for lower abdominal surgery, such as renal transplant. [8] Both TAP block and TEA are accepted modalities of pain control, both TEA and TAP blocks provide adequate pain control, decreased narcotic use in the hospital, and earlier return of bowel function after surgery. We have observed their duration of analgesia, total rescue analgesic requirement, sedation score and hemodynamic parameters and any other side effects up to 24 hrs.

Duration of analgesia

Postoperative Pain was assessed by visual analogue scale (0 to 10) in postoperative period. Time to first rescue analgesic requirement was considered as duration of analgesia. In our study, TAP produced

longer duration of analgesia (761+457min) in comparison to Epidural (536 ± 299min). The longer duration of analgesia may relate to the fact that the TAP is relatively poorly vascularized, and therefore drug clearance may be slowed [9].

In **Sunil chiruvella et al** [10] study, the duration of analgesia prolonged indexmede to midline group (405.6±20.32min) compared to clonidine group (347.9±15.05) through epidural route. In **Sarabjit Kaur et al** [11] Study, duration of post-operative analgesia was (312.64 ± 16.21min) in Ropivacaine group and (496.56 ± 16.08min) in Ropivacaine and Dexmede to midline group [P<0.001] through Epidural route. In **Qi Chen et al** [12] study, PCIA was significantly longer in the TAP-DEX than in the TAP, TAP FEN, and control groups (591.6±46.2, 471.6±33.6, 527.4±33, and 93.6±39 minutes respectively; P<0.01). In **B Sarvesh et al** [13] The Group Ropivacaine and dexmedetomidine had significantly prolonged post operative analgesia (485.6 min) as compared to Group Ropivacaine (289.83min). Unlike our study, the study done by **Niraj et al** [6] have shown higher duration of analgesia that was (1440 min [285, 1440]) in TAP group compared with Group Control (50 min [30, 90]; P < 0.001) as the drug used was 0.5% ropivacaine.

Rescue analgesic requirement

In our study, there was significant decrease in total dose so tramadol (in mg) requirement in TAP group compared to Epidural group (45+33 VS 82+45) (P<0.05*). Rescue analgesic requirement was less in TAP even though it is single hot technique, the delayed clearance can cause more duration of analgesia. Similar results were observed by **Tamer M Shaker** [14], who assessed difference in pain

between TAP vs Epidural maintained the PCA for longer duration. **Kaur Setal** ^[15], also found decreased requirement of rescue analgesia with ropivacaine dexmedetomidine group compared to ropivacaine alone (1.44±0.5v/s2.56±0.67). **Niraj et al** ^[6] in patients undergoing open appendectomy to either right-sided TAP block or standard pain management. TAP block patients demonstrated significant reduction in morphine consumption at 24 hours compared to the control group(28(18)vs 50(19), $P<0.002$). **Yanagimoto et al** ^[16] compared epidural to a control group and found decreased additional use of narcotics. The Epidural group number of additional doses of analgesics was significantly lower (2.85 vs. 4.86 doses, $p = 0.007$) than in the control group. Similarly, our study demonstrated a markedly decreased amount of opioid use in the TAP block group as compared to the TEA group in a randomized, controlled fashion.

Sedation

Sedation in the initial post-operative period is beneficial to the patient as patients are sleepy but responding to loud noise and then verbal command. These sedative effects of dexmedetomidine are mediated by the activation of presynaptic α -2 adrenoreceptors in the locus coeruleus, which inhibit there lease of norepinephrine. In our study, we observed that Modified Ramsay sedation score was around 3 and comparable in both groups up to 4hr. In 2016 **Fatima N et al** ^[17] doing Comparative study of the effect of dexmedetomidine and butorphanol as epidural adjuvant sin abdominally stereotomy under intrathecal levobupivacaine anaesthesia and found that sedation scores were significantly higher in dexmedetomidine group compared to butorphanol group ($P<0.001$) in abdominal hysterectomy surgeries. Similarly, **Jain D et al.** ^[18] and **Salgado et**

al. ^[19] studies observed epidural dexmedetomidine had longer sedation compared to control group.

Hemodynamic changes

Hemodynamic parameters like pulse rate, blood pressure and respiratory rate were observed postoperatively and found to be stable in both groups. But in our study the BP @ 0th hour was found to be decreased in Epidural block more when compared to TAP block but the values were not significant and in normal range immediate to postop, after 1st, 2ndhr & soon up to 24hrs. this can also be explained that the on set was more or less equal but the duration of action was longer in TAP block without significant Hemodynamic in stability Our results concur with the results of **Fatima et al** ^[17] and **Fukushima et al** ^[20] studies who found better hemodynamic stability with epidural adjuvants.

Adverse effects

Nausea and vomiting occur in 16.6% of cases which is almost similar to the study done by **Fatima et al** ^[17] in Epidural group. Dry mouth has occurred in 10% of cases and bradycardia in 16% cases which has shown similar result with that of **Jain Det al.** ^[18] & **Fatima et al.** ^[17] This also emphasize that the approach through TAP block has shown to be better and efficacious when compared to epidural since these side effects are very much decreased in the former approach.

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