Original research article

An Observational Study to Evaluate USG Guided Transversus Abdominis Plane Block and Wound Site Infiltration Using 0.25% Bupivacaine for Post Operative Pain Relief in Patients Undergoing Open Inguinal Hernia Surgeries

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Abstract

Background: Postoperative analgesia remains a cornerstone in management of patients undergoing inguinal hernia repair. This study evaluates the analgesic efficacy of traditional wound site infiltration and recent ultrasound guided TAP block using VAS score. Sixty patients were divided into two Groups. Patients in Group 1 were given ultrasound guided TAP block with 20ml of 0.25% bupivacaine and patients in Group 2 received wound site infiltration with 20 ml 0.25% bupivacaine as per the discretion of anaesthesiologist. Postoperative parameters like VAS score, time to first rescue analgesia, total analgesic consumption, adverse events and hemodynamic parameters were assessed.

Methods: Sixty patients who met the inclusion criteria posted for elective unilateral inguinal hernia surgeries were divided into two Groups Group 1 received ultrasound guided TAP block with 20ml of 0.25% bupivacaine and Group 2 received wound site infiltration with 20 ml 0.25% bupivacaine. Postoperatively patients were shifted to post-operative ward and monitored for post-operative pain using VAS score at various postoperative intervals; 2, 4, 6, 12, 18, 24 hours and secondary parameters such as duration of analgesia, time to first rescue analgesia, total analgesic consumption and adverse events were also recorded.

Results: VAS scores recorded at various post-operative intervals, total analgesic consumption were significantly lower in USG-TAP block Group compared to WSI Group which was significant statistically. The mean time requirement for rescue analgesia was

shorter in the WSI Group (3.67h) than the USG-TAP block (6.43h) and was statistically significant.

Conclusion: Being simpler and accurate ultrasound guided TAP block can be utilised for providing sound analgesia for inguinal hernia surgeries postoperatively. As a multimodal analgesia regimen, TAP block has proven to reduce the total analgesic consumption and additional analgesics requirement, with additional advantage of mitigating complication by ultrasound guidance.

Keywords: Local infiltration, TAP block, Postoperative analgesia, Bupivacaine, Inguinal hernia repair.

Introduction

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Post-operative pain is the primary adverse outcome that distresses the patient. Inguinal hernia repair constitutes one of the widely performed procedures in the field of surgery worldwide[1]. Pain after this procedure is of significant concern; thus, addressing post-operative pain is the primary objective. Several factors contribute to pain after hernia repair, like somatic, visceral and neuropathic pain. The most common nerves involved are ilioinguinal and iliohypogastric nerves[2].

Traditional pain relief techniques include local wound infiltration, intravenous analgesics, ilioinguinal and iliohypogastric nerve blocks. These techniques have a limited period of pain relief. The transverses abdominis plane block (TAP block) is a novel technique, which was first described by Kuppuvelumani et al. in 1993[3] and was documented first by Rafi in 2001 utilizing surface anatomical landmarks in the lumbar triangle of petit.[4] TAP block provides excellent analgesia following abdominal surgery and plays a valuable role as a part of multimodal analgesia. TAP block effectively relieves pain, reduces post-operative use of opioids and other analgesics (NSAIDS) [5]

With the increasing acquaintance of ultrasound, regional analgesia techniques are emerging as a widespread modality in pain management postoperatively. An ultrasound-guided approach for this TAP block was described by Hebbard et al. in 2007 [6]. The ultrasound technique was introduced to improve the success rate by injecting an appropriate volume of drug, thus reducing the amount of local anaesthetic, decreasing the risk of complications. Real-time ultrasonography also allows providers to identify appropriate tissue plane and perform this block with great accuracy under direct visualization of adjacent structures, the position of the needle and spread of local anesthetic.[7]

This study intends to compare ultrasound-guided transversus abdominis plane block with local infiltration for post-operative analgesic efficacy in unilateral open inguinal hernia surgeries.

MATERIALS & METHODS

This clinical observational hospital based study was conducted in the Department of Anaesthesiology, Gandhi Medical College and associated Hamidia Hospital. After approval by Institutional Ethical Committee and written informed consent sixty patients of ASA grade 1, 2 posted for elective unilateral inguinal hernia surgeries with age ranging from 18-70 years were selected.

Patients with bilateral and recurrent hernias, severe broncho-pulmonary disease, chronic hepatic or renal failure, BMI more than 30 kg/m2, any contraindication to spinal anaesthesia,

tolerance to opioids were excluded from the study. Patients were allocated in one of two Groups as per the discretion of anaesthesiologist.
Group 1: Ultrasound guided TAP block with 20ml of 0.25% bupivacaine.
Group 2: Wound site infiltration with 20 ml 0.25% bupivacaine
Routine preoperative assessment was done one day prior to surgery. All the patients were educated preoperatively about the use of VAS score on a 10 point scale with 0 being no pain and 10 being the worst possible pain. A common standard anaesthetic regimen was followed for all patients. All the necessary equipments were made available.

All the patients who participated in the study received premedication in form of alprazolam 0.25-0.5mg and tablet ranitidine 150 mg on morning of day of surgery with sip of water. After shifting the patient to operation theatre, an intravenous access was established and monitoring was instituted. Preloading was done with 20ml/kg of ringer lactate. All patients selected for the study were given subarachnoid block and was performed by an anaesthesiologist, who was not involved in the study. At the end of surgery either TAP block or WSI was performed by the primary investigator and operating surgeon respectively after skin closure.

Patient's in Group 1 received TAP block. Block was performed with patient in supine position, parts cleaned and draped. Under all aseptic precautions, ultrasound guided TAP block was performed with portable ultrasound machine using linear high frequency probe (5-13Hz). Sterile ultrasound jelly was applied on probe and covered with sterile surgical gloves. Transducer was placed between anterior superior iliac spine and lower sub-costal margin behind the mid-axillary line on the side of surgery. The probe was kept transverse to the abdomen, the plane between the internal oblique and transversus abdominis muscle identified behind the mid axillary line. 23G Quincke spinal needle was introduced by in-plane technique, and 20ml of 0.25% bupivacaine was injected between the internal oblique and transversus abdominis (TA) muscle containing T7-L1 nerves that provide sensory blockade to the skin, muscles and parietal peritoneum of the anterolateral abdominal wall. Drug placement was confirmed by direct visualization of separation of the fascial plane on ultrasonogram.

Patients in Group 2 were given WSI subcutaneously with 20 ml of 0.25% bupivacaine in supine position under aseptic precautions on the incision site, after skin closure postoperatively by the surgeon. Postoperatively patients were shifted to post-operative ward and monitored for pain and other parameters.

Primary parameter assessed was post-operative pain using VAS score at various postoperative intervals; 2, 4, 6, 12, 18, 24 hours. Other secondary parameters such as duration of analgesia, time to first rescue analgesia, total analgesic consumption and adverse events were also recorded.
Vital parameters such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean blood pressure (MAP) were recorded at various post-operative intervals; 2, 4, 6, 12, 18, 24 hours. Duration of analgesia was defined from the time of administration of either ultrasound-guided TAP block or local site infiltration to the time of request of the first rescue analgesia by the patient. Tramadol 50mg intravenously was given as rescue analgesic when VAS score was more than 4. Total rescue analgesic consumption, defined as the total of number of rescue analgesic doses administered in the first 24 h postoperatively. Complications such as bradycardia, hypotension, nausea, vomiting,

headache, urinary retention were also recorded. Complications were treated accordingly. All the parameters were recorded by an anaesthesiologist who was not involved in the study.

Statistical Analysis

Data was entered in Microsoft excel software. Software Epi info 7 was used for performing the statistical analysis. Data analysis was done using appropriate statistical tools.

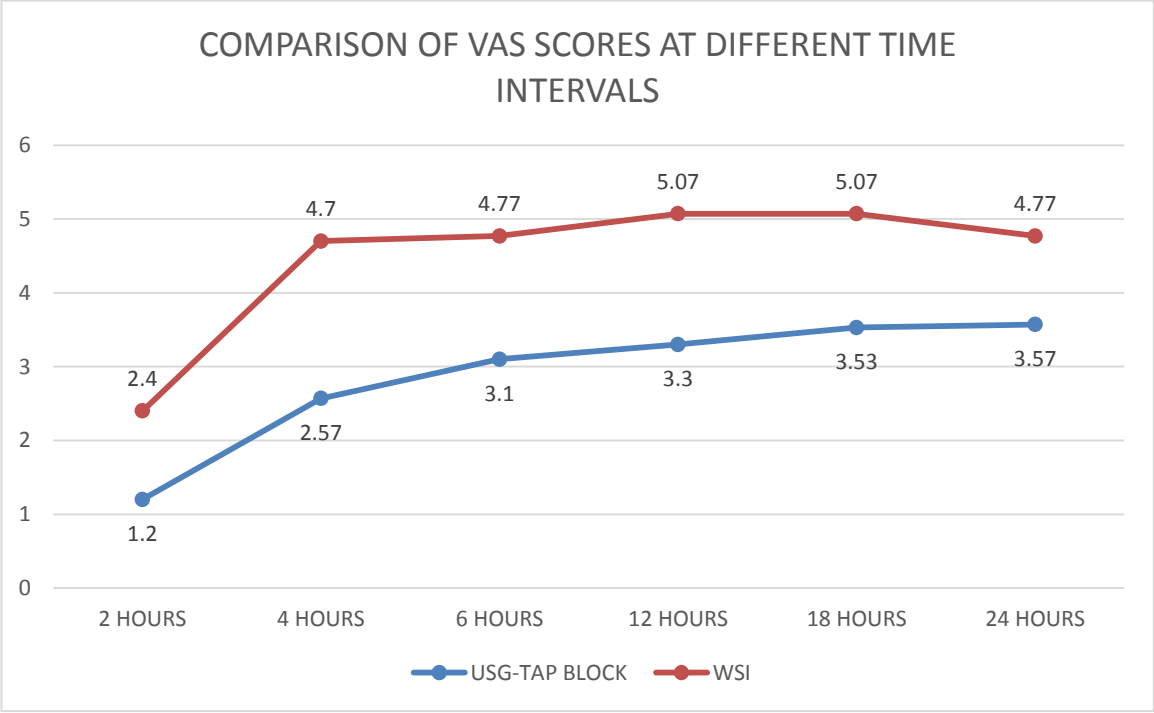
In both Groups the continuous variables such as age, SBP, DBP, MAP, HR, VAS SCORES, mean analgesic consumption and time required etc are expressed as mean and standard deviation. Categorical independent variables were summarized as proportions between both Groups.

Continuous variables were compared among both Groups using independent t-test while categorical variables were compared using Chi-square or Fisher's exact test depending on the distribution.

All statistical tests were performed with a confidence level of 95% and power of 80%. For all the statistical interpretation p value less than 0.05 was considered as significant.

RESULT

Demographic details like age and gender were comparable**.** The mean age was 50.70±12.098 in the USG-TAP block Group and 45.10 ± 12.71 in the WSI Group. Out of 60 participants, 54 were males that accounts for 90%. Post-operative vital parameters such as HR, SBP, DBP, MAP at different post-operative intervals; 2, 4, 6, 12, 18 and 24 h, were comparable between both the Groups and were statistically insignificant.



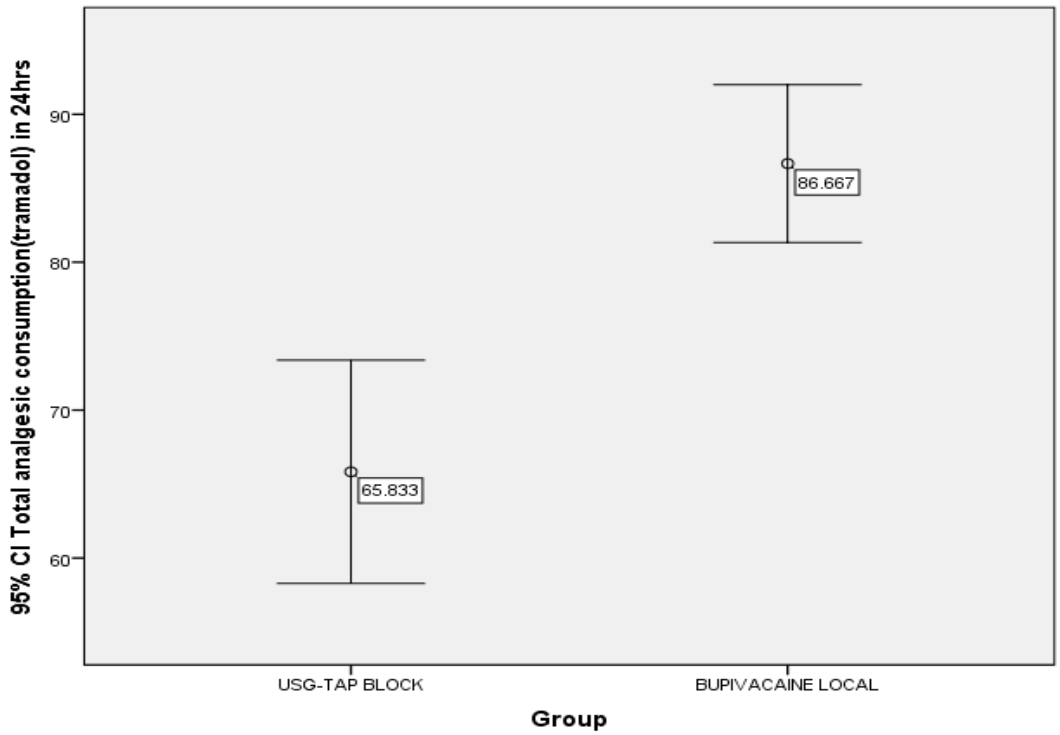
GRAPH 1: LINE DIAGRAM COMPARING VAS SCORES

TABLE NO 1: COMPARISON OF VAS SCORES AT DIFFERENT INTERVALS

	Group	Mean	Std. Deviation	
2 HOURS	USG-TAP BLOCK	1.20	.664	<0.001
	WSI	2.40	.814	

4 HOURS	USG-TAP BLOCK	2.57	.858	<0.001
	WSI	4.70	1.208	
6 HOURS	USG-TAP BLOCK	3.10	1.062	<0.001
	WSI	4.77	.935	
12 HOURS	USG-TAP BLOCK	3.30	.837	<0.001
	WSI	5.07	1.081	
18 HOURS	USG-TAP BLOCK	3.53	.681	<0.001
	WSI	5.07	.640	
24 HOURS	USG-TAP BLOCK	3.57	.935	<0.001
	WSI	4.77	.935	

Table No1 shows that VAS scores recorded at various post-operative intervals; 2, 4, 6, 12, 18, 24h are significantly lower in USG- TAP block Group compared to WSI.



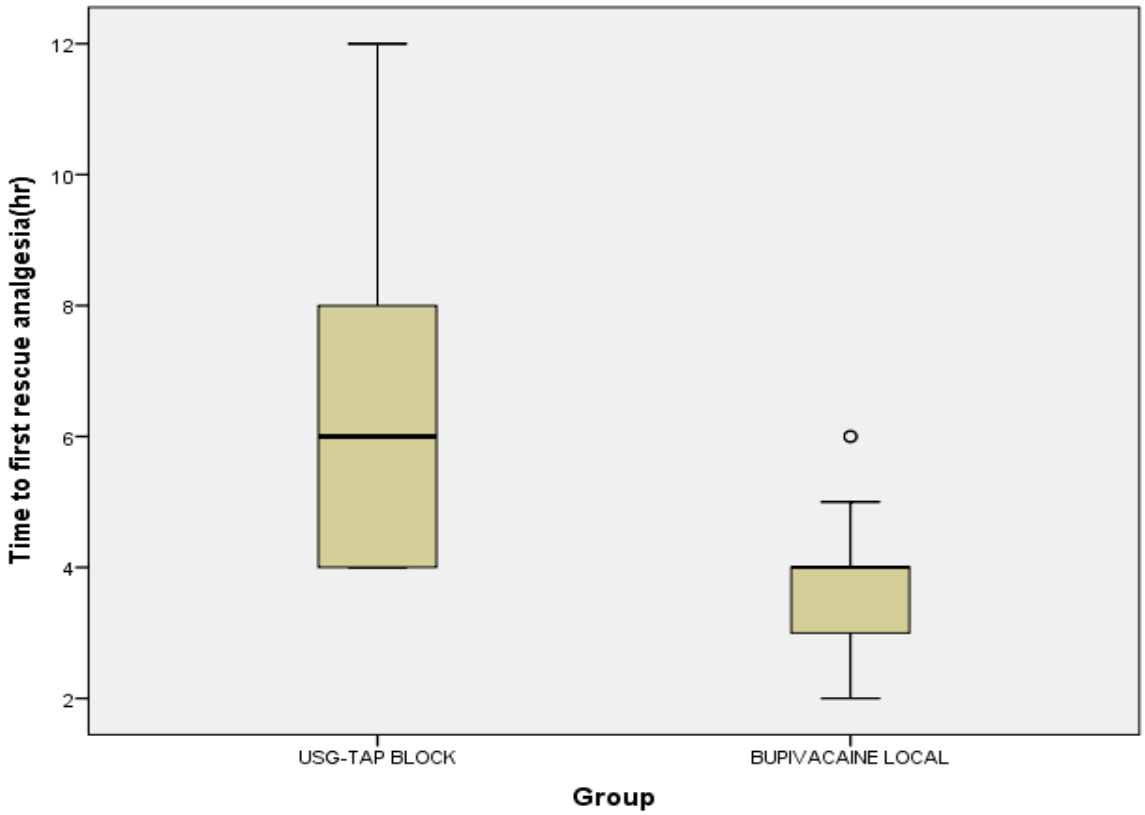
GRAPH 2: ERROR BAR SHOWING MEAN CONSUMPTION OF ANALGESICS IN BOTH GROUPS

The error bar shows mean consumption of analgesics to be higher among WSI Group compared to USG-tap block.

TABLE 2: MEAN TIME REQUIRED FOR FIRST RESCUE ANALGESIA AND MEAN ANALGESIC CONSUMPTION IN THE STUDY GROUPS

	USG-TAP BLOCK (Mean ±SD)	WSI (Mean ±SD)	P VALUE
Time to first rescue analgesia	6.43 ±2.388	3.67±1.093	<0.01
Total analgesic consumption	65.83±20.218	86.67±14.284	<0.01

Table no 2, shows that the mean time requirement for rescue analgesia was shorter in the WSI Group (3.67h) than the USG-TAP block (6.43h). Mean analgesic consumption in the study Group was lower in USG TAP block Group (mean ± SD; 65.83± 20.22) compared to WSI (mean ± SD; 86.67 ± 14.28) and was significant statistically ($p<0.05$).



GRAPH 3: BOX AND WHISKER PLOT SHOWING TIME TO FIRST RESCUE ANALGESIA

TABLE NO 3: ADVERSE EFFECTS-

Adverse effects	USG-TAP block (Group1) N (%)	WSI(Group2) N (%)	Total N (%)
Nausea	2(6.66)	2(6.66)	4(6.66)
Vomiting	2(6.66)	1(3.33)	3(5)
Headache	1(3.33)	2(6.66)	3(5)
Urinary retention	0(0)	0(0)	0
Bradycardia	2(6.66)	1(3.33)	3(5)
Hypotension	3(10)	2(6.66)	5(8.33)

Out of 60 participants, nausea was reported in 4 patients, vomiting in 3 patients. Headache was reported in 3 patients. 3 patients in USG-TAP Group and 2 patients in WSI had hypotension. Bradycardia was reported in 3 out of 60. None of the patients in any Group had urinary retention.

DISCUSSION

Hernia surgeries account for about 20 million annually performed surgeries worldwide[8].The prime factor that decides patient's recovery in post-operative period is a good pain control. Addressing post-operative pain is the most challenging problem for the anesthesiologist. Various pain relief methods for a good recovery include surgical site infiltration of local

anaesthetics, oral or intravenous analgesics like Nonsteroidal anti-inflammatory drugs, opioids and peripheral nerve block techniques, central neuraxial blocks [9]. All of these techniques have their own disadvantages regarding complications and limited periods of pain relief.

TAP block is a novel regional anaesthetic technique employed as a part of the multimodal analgesic approach to administering post-operative pain relief following lower abdominal surgeries. The technique for achieving this block has evolved from a blind landmark-based technique in early 2001 to a well-advanced USG-guided technique. Initially, the landmark-based blocks had 'pops' as blind endpoints with unpredictable success rates and complications. O'Donnell introduced the term transversus abdominis plane block in 2006 and modified Rafi's original description by advocating a double pop technique. Ultrasound was employed for this block by Hebbard et al. in 2007[6] and used to identify the intermuscular planes and use the midaxillary line (lateral approach) instead of the triangle of Petit. Regional anaesthetic techniques are emerging as a widespread modality for managing pain peri-operatively. The introduction of ultrasonography has added much more advantages to this TAP block improving its safety and efficacy.

TAP block, presently described as an efficient technique for reducing postoperative pain has extensively studied for lower abdominal surgeries especially for caesarean section. [10] Many other studies have previously documented the analgesic effect of TAP block for inguinal hernia repair. Meanwhile, wound site infiltration of local anaesthetic is a convenient postoperative analgesia method, which has been widely performed. But there was very little literature comparing the efficacy of TAP block with wound infiltration for inguinal hernia repair. Thus we chose to evaluate the efficacy of these two methods.

Evaluating postoperative pain was our primary outcome. Pain arising from an inguinal hernia incision can be because of different pathologies caused preoperatively and because of ischemia or neuropathy. Pain during the post-operative period is mainly due to traction on the peritoneum or inadequate analgesia. Many patients with acute post-operative pain may develop chronic groin pain later on that impairs their daily lives.[11] In our study pain was evaluated using VAS pain score which is considered the gold standard of pain quantification at different post-operative intervals; 2, 4, 6, 12, 18, 24 hours.[12]

Wound infiltration traditionally practised by surgeons; is an easy, simple technique and does not require specialised equipment. Both wound infiltration and TAP block alleviate the somatic component of pain; only a few authors have compared its efficacy for inguinal hernia repairs. **Guo et al.**[13] in their meta-analysis, showed TAP block to be superior to wound infiltration. They reported the quality of post-operative analgesia to be superior when TAP block was performed at the end of the surgery compared to that performed before incision. In our study, TAP block and WSI were also performed at the end of the surgery, which is analogous to the study done by Guo et al.

A study conducted by **Pratheeba et al.**[14] showed a significantly reduced post-operative VAS scores at 30min, first hour, 1hr 30min,2, 4, 6, 10, 12,18 and 24 hours, with a significant p-value ($p<0.001$). Our study had similar findings, with significantly lower VAS scores compared to WSI during all the post-operative intervals.VAS score was lower in the USG-TAP block Group even at 24 hours with a mean (SD); 3.57(0.935) compared to WSI, which was similar to a study conducted by **Mc Donnell et al.**[15]

In the present study, the mean time requirement for rescue analgesia was shorter in the WSI Group (3.67h) than the USG-TAP block (6.43h), which was statistically significant. It is analogous to a study done by **Chinthavali Sujatha et al.**[16] in respect to better VAS score, meantime (in hours) to require rescue analgesia in Group TAPB.
Local anaesthetic wound infiltration is limited to a short period of pain control, and the peak effect reaching at 1 h postoperatively; decreasing to minimum by 8h and then the effect weans off and is negligible at 16 h. This explains the shorter duration of analgesia in the WSI Group. In a questionnaire-based study conducted by Kang et al., [17] it was found that 70% of patients had pain in the early post-operative period. Thus, addressing pain in the initial post-operative stage is of prime importance. Our study found adequate analgesia for 6h with a reduced VAS score at the time of first rescue analgesic (3.10 ±1.062) compared to WSI (4.77 ± 0.935), which was consistent with the study mentioned above.

There are various approaches for administrating TAP block, depending on the site of surgery. Since there is a variation of anatomical plane depending on the different approaches used, the spread of local anaesthetic also varies. The posterior approach, which is anatomically proximate to the lumbar triangle of petit, provided consistent blockade of the T10-L1 abdominal dermatomes, which is sufficient to provide analgesia for inguinal hernia surgery.[18] In this study, we used the posterior approach of ultrasound-guided TAP block that enables a better spread of local anaesthetic and, hence, decreased rescue analgesic requirement compared to the anterior approach

In our study total analgesic consumption was lower in the TAPB Group with a mean ± SD; 65.83±20.22 compared to WSI with a mean± SD; 86.67±14.28 was statistically significant. **Atim et al** in their study, reported that total tramadol consumption was significantly lower in the TAP block Group compared to the subcutaneous infiltration Group[9]. Our study was analogous to the above-said literature in view of providing better analgesia for a longer duration of time and reduced requirement of additional analgesics in ultrasound-guided TAP block compared to wound infiltration.

Both somatic and visceral component contributes to pain arising from inguinal hernia incision. The TAP block mitigates only the somatic component of pain, which explains the additional analgesic requirement after 6 hours. Though the VAS score remained lower throughout the post-operative period till 24 hours in the USG-TAP block Group compared to the WSI Group, the need for additional analgesia requirement by the patient indicates that TAP block is better if used as a multi-modal analgesic regime.
Being a relatively simple block, TAP block has improved safety profile, and with ultrasound guidance, complications related to the blind block like block failure, vascular injury, abdominal viscera and nerve injuries are near to absent in USG- guided TAP block[20]. With adequate image quality and direct visualisation of local anaesthetic spread, there was no complication concerning TAP block in our study. This finding was in accordance with a study done by G. Niraj et al.[21] Since the surgery was carried out in spinal anaesthesia, there were complications related to it such as nausea, vomiting, headache, bradycardia and hypotension.
Despite showing the superior efficacy of USG-TAP block over wound infiltration in our study, there are certain limitations. Firstly, the sample size was small. Secondly, we evaluated pain on rest and not on movement. Both TAP block and WSI targeted the somatic component of pain arising from the anterior abdominal wall. Pain on movement is because of visceral components and was not assessed in our study. Another limitation of our study was that we did not assess the analgesic requirement after 24 hours. USG-guided TAP block requires

technical expertise and availability of USG-machine which can be a limitation for its use in a resource limited setting.

CONCLUSION

This study elucidated that TAP block performed by USG-guidance could account for sound analgesia postoperatively. Being simple by technique, TAP block can be utilised for providing analgesia for inguinal hernia surgeries. Needle placement under direct visualisation and injecting the drug in an accurate fascial plane by sonographic guidance has the advantage of mitigating the complications. As a multimodal analgesia regimen, TAP block has proven to reduce the total analgesic consumption and additional analgesics requirement. Thus, we conclude that TAP block is better than wound infiltration for postoperative analgesia for inguinal hernia surgeries.

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Conflict of Interest: None

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Ethical Approval: Approved

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