ORIGINAL ARTICLE

Comparison of ilioinguial/iliohyphogastic nerves block with wound-infiltration on postoperative pain: A randomised controlled trial

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Abstract

Objective: To compare postoperative pain scores at rest and on movement in patients undergoing open inguinal hernia repair between those receiving illioinguinal/illiohypogastric nerve block with ropivacaine or wound infiltration with ropivacaine.

Method: The randomised clinical trial was conducted at the Department of Anaesthesiology, Aga Khan University Hospital a tertiary care centre from March to August 2019 and comprised patients of either gender scheduled for elective unilateral open inguinal hernia repair under general anaesthesia. They were randomised into illioinguinal/illiohypogastric nerve block group A, and wound infiltration group B. In group A, 20 ml of 0.25% ropivacaine was infiltrated in the vicinity of the nerves under ultrasound guidance, while group B received wound infiltration with ropivacaine 10ml 0.25% at the end of surgery. Postoperative static and dynamic pain was assessed at 0, 2, 6, 12 and 24 hours using visual analogue scale. Total usage of opioids in 24 hours postoperatively in both groups, patient satisfaction and complications were recorded. Data was analysed using SPSS 19.

Results: Of the 60 patients, 30(50%) were in each of the 2 groups. There were 29(96.7%) males and 1(3.3%) female in group A with mean age 45.63±17.43 years, and 28(93.3%) males and 2(6.7%) females in group B with mean age 49.33±15.39. The mean pain score at rest was not significantly different between the groups (p>0.05). On movement, the mean pain score between the groups was different only at 6 hours (p=0.02). There were no significant intergroup difference in total usage of opioids in 24 hours postoperatively and patient satisfaction (p>0.05).

Conclusion: Illioinguinal/illiohypogastric nerve block and wound infiltration with ropivacaine were found to be equally effective methods in controlling postoperative pain.

ClinicalTrials.gov ID: NCT04462510.

Keywords: Local anaesthesia, Inguinal hernia, Pain management, Patient satisfaction. (JPMA 74: 1922 2024)

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Introduction

Inguinal hernia is a common surgical procedure associated with moderate to severe postoperative pain. Postoperatively, severe pain in patients undergoing open inguinal hernia repair can be a cause of unplanned hospital admission, prolonged length of hospital stay (LOS), patient dissatisfaction, and delayed return to normal activities.[1] In addition, severe postoperative pain is known to have physiological and psychological consequences with the potential to continue as persistent post-surgical pain (PPSP).[2] The incidence of PPSP is reported in literature to be up to a staggering 86%[3] while after open inguinal hernia repair, it ranges from 0.7% to 43.3% with 0.5% to 6% patients experiencing unbearable pain.[4] Various pain management interventions have been studied to address the problem, including regional and local anaesthesia techniques and use of parenteral medications.[5,6]

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Illioinguinal (ILI) and illiohypogastric (IHG) nerve block are commonly employed for anaesthesia or analgesia for inguinal hernia repair. Local infiltration of surgical wounds with ropivacaine is another method to manage postoperative pain.

The current study was planned to compare the effectiveness of ILI/IHG nerve block with ropivacaine given preoperatively in terms of controlling postoperative pain control compared to local wound infiltration with ropivacaine in open inguinal hernia repair cases. The primary outcome was analgesic efficacy as measured by visual analogue scale (VAS)[7] at rest and on movement, while the secondary outcomes included total opioid consumption and patient satisfaction with the technique used.

Patients and Methods

The randomised clinical trial was conducted at the Department of Anaesthesiology, Aga Khan University Hospital a tertiary care centre from March to August 2019. After approval from the institutional ethics review committee. The study was registered with ClinicalTrials.gov (NCT04462510), Consolidated Standards of Reporting Trials

(CONSORT) statement[8] as well as the guidelines of the International Conference on Harmonisation-Good Clinical Practice (ICH-GCP)[9] were followed.

The sample size was calculated by OpenEpi an online calculator[10] in the light of earlier studies reporting VAS pain score on rest at 24 hours postoperatively 2.0±1.5[11] in surgical wound infiltration patients and 3.74±0.88 in ILI/IHG patients.[12] Type 1 error was kept at 0.05 and type 2 error at 0.20 with 80% power of the test. The sample was raised using non-probability consecutive sampling technique. Those included were patients of either gender aged 18-75 years, having American Society of Anaesthesiologists (ASA) status I-IV, who were scheduled to undergo elective unilateral primary open inguinal hernia repair under general anaesthesia (GA). Those excluded were patients with body mass index (BMI) <18kg/m^2 or >35kg/m^2, having local anaesthesia hypersensitivity, pregnant women, patients having infection at the injection site, patients having coagulation disorders, and patients having contraindication to any drug used in the standardised study regimen.

After taking written informed consent from all the patients, they were randomised using the sealed opaque envelope technique on the basis of a computer-generated randomisation table into ILI/IHG group A and surgical wound infiltration group B. The envelopes were opened in the pre-operative area, and the intervention was assigned to the primary consultant anaesthesiologist.

The patients, their families, post-anaesthesia care unit (PACU) nurses, and postoperative data collector in PACU were blinded to the randomisation.

In the operating room (OR), non-invasive blood pressure (NIBP), oxygen saturation (SpO_2), electrocardiogram (ECG) and monitoring were applied before GA induction. GA was induced in all patients with propofol 2 mg/kg, tramadol 1 mg/kg, and atracurium 0.5mg/kg followed by aura once. Isoflurane in a mixture of 40% oxygen and 60% nitrous oxide (NO) was employed for anaesthesia maintenance with a mean alveolar concentration (MAC) 1.0.

In group A, after GA induction, ILI and IHG nerve block was performed under complete aseptic measures by the anaesthesiologist with the help of a portable ultrasound machine (M7, Mindray, China) using 14 MHz frequency probe. The ultrasound probe was placed oblique on a line joining the anterior superior iliac spine (ASIS) and umbilicus, immediately superior to ASIS. The probe was then tilted to visualise external oblique (EO), internal oblique (IO) and tranversus abdominus (TA) layers of muscle. The ILI and IHG nerves were identified as two hypoechoic structures just deep to the IO layer. The nerves typically run in a parallel orientation to each other and appeared as two distinct hyperechoic bands. A 20 G, 100mm long peripheral nerve block needle (EchoGlo, Smiths Medical ASD, Inc) was inserted under real-time ultrasound guidance to reach the vicinity of the targeted nerves, and 1ml of 0.9% saline was injected to confirm correct needle placement. Following negative aspiration, 20 ml of 0.25% ropivacaine was injected around the nerves while continuously observing the spread of the solution on the ultrasound monitor. This was followed by the planned surgical procedure of unilateral inguinal hernia repair.

In group B, the patients received a subcutaneous injection of 10ml of 0.25% ropivacaine hydrochloride post-procedure at the surgical site by the surgeon, followed by the dressing of the wound. The laryngeal mask was removed once the patients were fully awake, and they were then shifted to PACU.

A linear VAS was used for pain assessment in both the groups over 24 hours postoperatively. The scale consisted of a 10cm horizontal line ranging from 0=no pain to 10= worst imaginable pain. The patients were asked to mark the line at a point that matched their pain. The VAS score was recorded at an immediate postoperative period in the recovery room (0 hrs) and then at 2, 6, 12 and 24 hours postoperatively in the ward or by a phone call if the patient was discharged. Data was recorded by an independent observer (anaesthesia trainee) not involved in the study and blinded to the intervention. If a patient complained of postoperative pain >4/10 on VAS, intravenous (IV) tramadol 50mg and paracetamol 1g were given as rescue analgesia.

Patient satisfaction score was assessed on a five-point Likert scale[13] and early or late complications were recorded including bleeding at the site of injections, bruise, visceral damage, gut perforation, intravascular injection of local anaesthesia (LA), and LA toxicity.

Data was analysed using SPSS 19. Mean±standard deviation values were computed for age, BMI and length of PACU stay. Frequencies and percentages were computed for ASA status and gender. Postoperative VAS score was assessed at rest and with movement. Pain with movement was assessed by asking the patient to take deep breaths or cough. Postoperative VAS pain score at 2, 4, 6, 12 and 24 hours was compared using independent sample *t*-test. Stratification analysis was performed to control effect modifiers, like age, BMI, gender and ASA status to observe effect on outcome. Stratification effect was also assessed using independent sample *t*-test. P≤0.05 was considered significant.

Results

Of the 60 patients, 30(50%) were in each of the 2 groups (Figure 1). There were 29(96.7%) males and 1(3.3%) female in group A with mean age 45.63±17.43 years, and 28(93.3%) males and 2(6.7%) females in group B with mean age 49.33±15.39 (p>0.05) (Table 1).

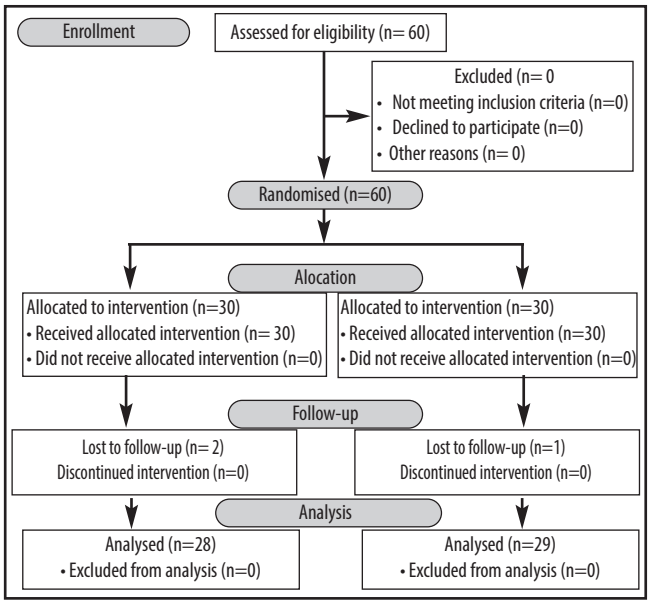

Figure-1: Consolidated Standards of Reporting Trials (CONSORT) flowchart.

Table-1: Demographic characteristics.

Variables	Local Infiltration Mean±SD (n=30)	Block Mean±SD (n=30)	*p*-value
Age (years)	49.33±15.39	45.63±17.43	0.387
BMI (kg/m^2)	25.25±4.09	26.15±4.33	0.410
Length of stay of PACU (min)	63.63±11.93	58.68±9.743	0.083
Gender	**n (%)**	**n (%)**	0.999
Male	28(93.3)	29(96.7)	
Female	2(6.7)	1(3.3)	
ASA			0.530
I	9(30)	13(43.3)	
II	15(50)	13(43.3)	
III	6(20)	4(13.3)	

BMI: Body mass index, PACU: Post-anaesthesia care unit. ASA: American Society of Anesthesiologists.

Table-2: Comparison of mean static and dynamic pain scores between the groups.

	STATIC				
Time	**Local infiltration (n=30)**		**Block (n=30)**		***p*-value**
	n	Mean±SD	n	Mean±SD	
0 hrs.	30	1.80±1.65	30	1.47±1.53	0.420
2 hrs.	30	1.20±1.37	30	.63±1.03	0.076
6 hrs.	28	0.68±0.95	29	0.31±0.71	0.102
12 hrs.	28	0.18±0.55	29	0.28±0.75	0.580
24 hrs.	28	0.21±0.63	29	0.24±0.98	0.90
	DYNAMIC				
0 hrs.	30	3.37±1.69	30	3±1.95	0.439
2 hrs.	30	2.67±1.54	30	1.97±1.35	0.066
6 hrs.	28	2.36±1.19	29	1.69±1.04	0.028
12 hrs.	28	1.54±1.32	29	1.62±1.68	0.833
24 hrs.	28	1±1.25	29	1.52±1.55	0.172

The mean pain score at rest was not significantly different between the groups (p>0.05) (Table 2, Figure 2). On movement, the mean pain score between the groups was significantly different only at 6 hours (p=0.02) even though

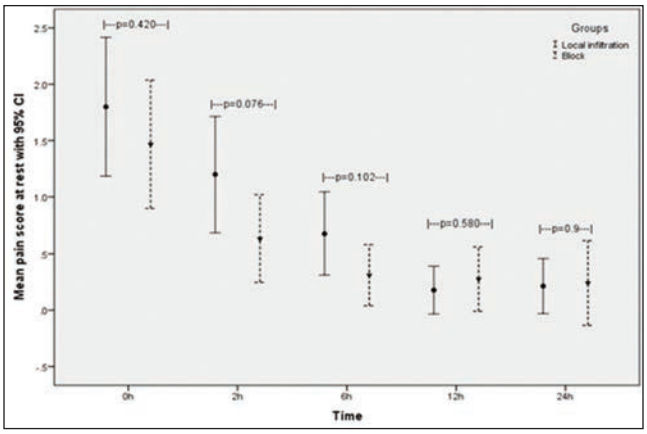

Figure-2: Comparison of mean static pain scores between the groups according to time point.

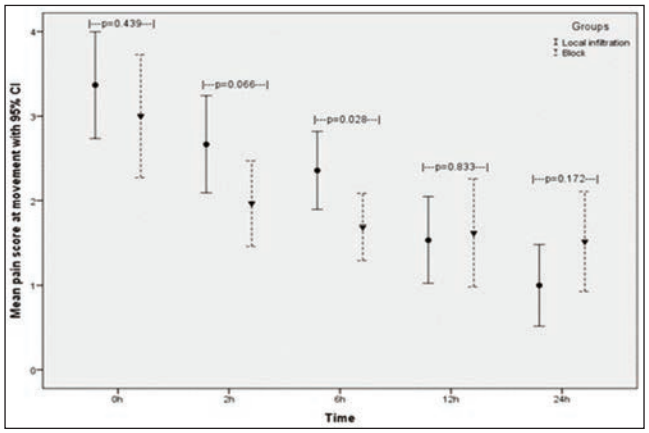

Figure-3: Comparison of mean dynamic pain score on movement between the groups according to time point.

Table-3: Comparison of tramadol consumption and patients' responses about of the modality

Variables	Local Infiltration n=30	Block n=30	*p*-value
Total IV tramadol consumption in 24 hours (Mean±SD)	86±24.01	88±19.54	0.725
Anaesthetic care and pain relief effectiveness	**n (%)**	**n (%)**	0.186
Disagree	0(0)	1(3.4)	
Neutral	4(14.3)	1(3.4)	
Agree	20(71.4)	18(62.1)	
Strongly Agree	4(14.3)	9(31)	
Recommend the same modality to your family/friends?	100%	93.1%	0.157

IV: Intravenous.

the score in both the groups at 6 hours was in the mild range (Table 2, Figure 3).

There were no significant intergroup difference in total usage of opioids in 24 hours postoperatively and patient satisfaction (p>0.05) (Table 3). Both the methods were equally safe as no postoperative complications were reported.

Discussion

The current study showed no significant differences between the two groups in terms of pain score at rest, pain score on movement, IV opioid consumption 24 hours postoperatively, and patient satisfaction. However, patients in the ILI-IHG nerves block group exhibited lower pain scores on movement at 6 hours postoperatively compared to those in the wound infiltration group. The probable reason for this observation was that ILI and IHG nerve-block effect lasts longer than the effect of wound infiltration with LA (2 hours vs 6 hours) subsequent to which time, the effect of both recedes.

Inguinal hernia repair is one of the most frequently performed procedures in the general surgery, with majority performed in the ambulatory care.[14] Pain at the incision site is a common occurrence following hernia surgery, and while there are several medications and non-pharmacological techniques available to manage postoperative pain, the optimal pain management approach remains uncertain.[15] Notably, pain arising from the abdominal wall incision is a significant contributor to the overall post-hernia surgery pain experience. Despite the availability of effective pain management methods, a considerable number of patients continue to experience moderate or severe pain, ranging 30-75%.[16]

Moderate or severe pain following inguinal hernia surgery can result in prolonged LOS, unexpected re-hospitalisation, delayed return to normal activities, and increased associated costs.[17,18] Studies have also suggested that inadequate postoperative pain management following herniorrhaphy may increase the risk of developing chronic pain.[19] Therefore, evaluating effective pain management strategies for patients undergoing hernia surgery is of paramount importance to minimise postoperative discomfort, and to promote optimal patient outcomes.

In this regard, there has been a growing interest in the use of nerve blocks as an alternative pain management strategy. However, the optimal technique for providing pain relief after inguinal hernia repair surgery is debatable. The current directly compared two specific techniques. A similar study conducted in paediatric patients reported the superiority of ILI-IHG nerve block over LA infiltration of the surgical wound.[20]

The probable reason was the placement of ILI and IHG block after the completion of surgery, which was at the same time as wound infiltration with LA. The significant difference was observed in only the first 2 hours postoperatively subsequent to which the two groups were comparable. The current study demonstrated that both techniques were effective in reducing postoperative pain and analgesic consumption, with no significant differences in outcomes between the two groups.

A meta-analysis in 2019 compared the effectiveness of TA plane block and ILI-IHG nerve block for pain management following inguinal hernia repair surgery. The meta-analysis found that there were no significant differences between the two methods regarding morphine consumption 24 hours postoperatively, postoperative nausea and vomiting (PONV) 24 hours postoperatively, the time to first request for rescue analgesia, the incidence of complication related with the nerve block, and patient satisfaction. However, the pain scores were significantly lower in the ILI-IHG nerve block group than in the TA plane block group at 6 and 8 hours, while no difference was found at all other time points.[21]

It is important to note that LA, during the ILI-IHG nerve block technique, may potentially spread to the deep ring, which can result in the blockade of the genital branch of the genitofemoral nerve.[21] However, there is less likelihood of such a medial spread occurring during the administration of the TA plane block technique or the LA infiltration technique that was used in the current study.

In previous studies, local infiltration of surgical wound was found to be more effective than placebo in decreasing pain scores, reducing the need for additional pain medication, and delaying the time to the first request for analgesia in inguinal hernia repair cases.[22] A randomised controlled trial to investigate the effects of ropivacaine as a local anaesthetic for wound infiltration after open inguinal hernia repair indicated that using ropivacaine resulted in decreased postoperative pain scores, a delay in the requirement for supplementary analgesics, and allowed earlier discharge.[23] In the current study, ropivacaine was used for local wound infiltration and it decreased mean pain scores postoperatively.

The current study has limitations as it had a relatively small sample size, which could have limited the generalisability of the findings. Additionally, the study only included patients undergoing elective unilateral inguinal hernia repair, and, as such, the results may not apply to other types of hernia repairs or other surgical procedures. The study only assessed pain scores up to 24 hours postoperatively, which means long-term efficacy of the techniques remained unexplored. Another limitation was the time of

administration of the two methods of pain relief, which was 45-60 minutes apart. This had the potential to affect the duration of analgesia in the postoperative period. Finally, the study was conducted at a single centre, which may limit its generalisability to other centres with different patient populations, surgical techniques and anaesthesia protocols.

Conclusion

ILI and IHG nerve block with ropivacaine and local wound infiltration with ropivacaine used for postoperative pain relief were both comparable in providing effective postoperative analgesia, patient satisfaction, and safety profile in adult patients who underwent open inguinal hernia repair.

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Author Contribution:

RIK: Concept, methodology, supervision, writing and final approval.

MH: Validation data curation, writing, review, editing and final approval.

SA: Concept, methodology, validation data curation, literature search, writing original draft and final approval.