fortune Journals

Research Article

JOURNAL OF SURGERY AND RESEARCH

ISSN: 2640-1002

Local Infiltration Anaesthesia for Inguinal Herniorrhaphy: A Comparison of two techniques

Alexander Akogwu Ohemu[1], Felicia Dele Asudo[2*], Ekundayo Stephen Garba[1], King-David Terna Yawe[1]

Abstract

Background: Local infiltration anesthesia for inguinal herniorrhaphy has already been established as effective with a good safety profile compared to other anesthesia methods. Adding regional nerve blocks (ilioinguinal, iliohypogastric, and genital branch of genitofemoral) offers peri-operative analgesia with a 60-70% success rate using the anatomic landmark technique. A stepwise infiltration technique may provide adequate peri-operative anesthesia without regional nerve blocks. This study compared the efficacy of anatomic landmark peripheral nerve block with stepwise local infiltration in providing anesthesia for inguinal herniorrhaphy.

Methods: Sixty-two consenting patients were randomized into two groups; stepwise local infiltration anesthesia group and anatomic landmark peripheral nerve block. Pain evaluation used the Verbal Numerical Rating Scale (VNRS). Intraoperative and postoperative analgesic requirements, pain score, volume of local anaesthetic used and patient acceptance of technique were compared.

Results: Pain scores at anesthesia infiltration were significantly higher in the regional nerve block group, while pain scores at sac ligation were higher in the stepwise group. Pain scores at other surgery stages showed no significant difference. The volume of Local anaesthetic used for infiltration was noted to be significantly more for patients in the anatomic landmark nerve group. More patients in the stepwise group said they would not want the same anaesthetic technique but this was not statistically significant.

Conclusion: No significant difference was observed in overall intra and post-operative analgesic effect between both groups. Stepwise infiltration anaesthesia for inguinal herniorrhaphy confers no added benefit to local anaesthetic efficacy when compared to anatomic landmark regional nerve block.

Keywords: Inguinal herniorrhaphy, Regional nerve block, Stepwise local infiltration, Verbal Numerical Rating Scale, Intraoperative analgesia, Postoperative analgesia, anatomic landmark peripheral nerve block

Introduction

Local anaesthesia is safe and effective allowing inguinal herniorrhaphies to be performed with minimal resources and remains the preferred choice for inguinal herniorrhaphies both in specialist [1-4] and rural [5] healthcare facilities in Nigeria [6].

The technique of inguinal nerve blocks as described by Harvey Cushing [7] has gained wide acceptance in the surgical community within tropical Africa and Nigeria [8,9]. A stepwise technique for local infiltration was

Affiliation:

[1]Department of Surgery, Fellow, West African College of Surgeons, University of Abuja Teaching Hospital, Gwagwalada, FCT, Nigeria

[2]Department of Anaesthesia, Fellow, West African College of Surgeons, College of Health Sciences, University of Abuja/University of Abuja Teaching Hospital Gwagwalada, FCT, Nigeria

***Corresponding author:**
Felicia Dele Asudo, Department of Anaesthesia, Fellow, West African College of Surgeons, College of Health Sciences, University of Abuja/University of Abuja Teaching Hospital Gwagwalada, FCT, Nigeria

Citation: Alexander Akogwu Ohemu, Felicia Dele Asudo, Ekundayo Stephen Garba, King-David Terna Yawe. Local Infiltration Anaesthesia for Inguinal Herniorrhaphy: A Comparison of two techniques. Journal of Surgery and Research. 7 (2024): 473-482

Received: August 06, 2024
Accepted: August 20, 2024
Published: November 07, 2024

Ohemu AA, et al., J Surg Res 2024
DOI:10.26502/jsr.10020398

described by Amid in 1993 [10] and reported good outcome with no need to perform percutaneous regional nerve blocks.

The ideal anaesthetic technique for inguinal herniorrhaphy should: Remove painful stimuli; Permit quick recovery for early ambulation and self-care; Minimize pulmonary, cardiac, urinary morbidity; and allow visual testing for adequacy of repair [11]. Local infiltration anaesthesia for surgeries via an anterior approach fulfils these requirements while remaining cheap and easy to perform. This may be achieved by infiltrating the surgical field with a local anaesthetic and performing a peripheral block of the sensory nerves subserving the area (ilioinguinal, iliohypogastric and genital branch of genitofemoral nerves) either by percutaneous infiltration (anatomic landmark or ultrasound scan guided nerve blocks) or by a stepwise local infiltration technique. The technique of anatomic landmark regional (Ilioinguinal, iliohypogastric and genital branch of the genitofermoral) nerve blockade for inguinal herniorrhaphy is commonly taught and practiced [8,4]. Studies however indicate that optimal nerve blockade is more reliably possible with ultrasound scan guided nerve blocks [12-14]. It can thus be implied that: a) anatomic landmark nerve blocks occasionally do not locate the nerves and in such circumstances, are not efficacious with the added risk of complications (transient femoral nerve block), b) injections for percutaneous nerve blocks cause unnecessary discomfort to the patient, and c) higher doses of local anaesthetic agents are used when unguided blocks are performed hence increasing the risk of toxicity.

Addition of regional (ilioinguinal, Iliohypogastric and genital branch of genitofemoral) nerve blocks has been reported to improve intra and post operative analgesia with 90% success when ultrasound scan guided. However, when an anatomic landmark technique is used to locate the nerves for blockade, the success rate drops to 60-70% with greater risk of complications.

Routine use of ultrasound scan guided blocks is not commonly feasible in Nigeria given that most cases affect the rural farming population who do not present at urban specialist centres where alternate options of anaesthesia are available [5]. The technique of stepwise local infiltration anaesthesia has been successfully utilized for large numbers of heniorrhaphies with good outcome and is reportedly used at the University of Port Harcourt Teaching Hospital in Nigeria [9,10]. An experimental model comparing the stepwise technique with anatomic landmark ilioinguinal/ iliohypogastric nerve block on cadaveric subjects was done by using both techniques to inject a blue dye with dissection to ascertain site of deposition of anaesthetic agent/evidence of nerve staining. The study reported better nerve localization and reduced unintended anaesthetic agent deposition in surrounding tissues in the stepwise technique [15]. Conversely, another study carried out on living subjects reported better intraoperative analgesia with the regional (ilioinguinal/iliohypogastric) nerve block method [16].

The aim of this study was to compare the efficacy of anatomic landmark regional nerve blocks and stepwise local infiltration (using a solution of 0.5% lidocaine and 0.25% bupivacaine) in providing anaesthesia for inguinal hernia surgery

Patients and Methods

This was a prospective double-blind randomized study that compared the efficacy of anatomic landmark regional nerve blocks and stepwise local infiltration (using a solution of 0.5% lidocaine and 0.25% bupivacaine) in providing anaesthesia for inguinal hernia surgery. The study was carried out at the surgical wards and main operating theatre suites of the University of Abuja Teaching Hospital following ethical approval by the hospital's Health Research Ethics Committee. Using a structured consent form written informed consent was obtained from all participants in the study.

Recruitment and Sampling

All eligible and consenting (written informed consent obtained by the researcher) patients were recruited for the study by the researcher at the surgical outpatient clinic after adequate education and counselling. Data obtained from the patients included age, gender, weight, height and type of hernia (inguinal or inguinoscrotal) and side of the body where the hernia was located. These data were recorded in a prepared data collection form.

Inclusion criteria

All patients >14yrs of age undergoing inguinal herniorrhaphy with local anaesthesia.

Exclusion criteria

These include: patients who did not consent to the study, with known allergy to local anaesthetic agents, Recurrent inguinal hernia, Emergency herniorrhaphy (obstructed/ strangulated/gangrenous hernia), Herniorrhaphy requiring general anaesthesia/subarachnoid block (e.g giant hernia), and Preoperative groin pain problems (neuropathies).

Sample size Determination

The minimum sample size for this study was estimated using the following formula for inferential studies [17]

$$N=K \times \frac{P_1(1-P_1)+P_2(1-P_2)}{(P_1-P_2)^2}$$

Where

N = Sample size

K = Constant which is a function of the power of the study

Ohemu AA, et al., J Surg Res 2024
DOI:10.26502/jsr.10020398

For type I error (α) of 0.05 and type II (β) of 0.2 at 80% power, K = 7.9 [17]

P_1 = Proportion of successes on standard treatment = 0.7 at 70% success rate (value obtained from percentage success rate of anatomically guided nerve blocks) [12,14]

P_2 = Proportion of successes on the new treatment which indicate it is more effective = 0.9 at 90% success rate (value chosen to coincide with success rate of ultrasound guided nerve blocks) [12,14]

Therefore,

$$N = 7.9 \times \frac{0.7(1-0.7) + 0.9(1-0.9)}{(0.7-0.9)^2}$$

N = 59.25

The sample size was approximated to 66 (taking note of 10% attrition rate), with 33 patients selected into each study group.

Sampling technique/ Randomization

A multistage sampling technique was used for this study and carried out by the research assistant. Eligible and consenting patients were randomly assigned into two groups with the aid of computer-generated numbers. This randomization was done using computer generated numbers by WINPEPI software by Abrahamson. Numbers generated were concealed in brown envelops, with the local anaesthesia type enclosed within it. After clinical evaluation, the patients were divided into two groups comprising those with inguinal hernia and those with inguinoscrotal hernia. Next, the first patient presenting in each group was randomly allocated (by picking a brown envelop) to the study group 1 or control group 2.

The research assistant educated each patient consenting to participate in the study on the use of the verbal numerical rating scale (VNRS). Patient education was done at the waiting room and comprehension reassessed on table prior to local infiltration.

GROUP 1 (STUDY GROUP): these had stepwise local infiltration at surgery site without a percutaneous regional nerve blockade.

GROUP 2 (CONTROL GROUP): these had anatomic landmark regional (ilioingiunal/iliohypogastric/genital branch of genitofemoral) nerve with local anaesthesia prior to surgery.

Conduct of Anaesthesia/Surgery

All surgeries were performed by 3 senior registrars in general surgery (the researcher and 2 other senior registrars who were well groomed by the researcher on both techniques of local infiltration. The researcher performed 41 (66%) of the cases, assisted in 10 and observed 11 of the surgeries by surgeons with at least three years of residency training and who had been trained on the techniques of infiltration by the researcher prior to the procedure). The researcher was present at all surgeries to ensure compliance with the research protocol.

The anaesthetic mixture was prepared by the anaesthetist who was blinded to the group the patient belonged to and was made up of 0.5% lidocaine and 0.25% bupivacaine constituted as follows:

i. The patient's weight was measured using a weighing scale

ii. The intended dose of anaesthetic solution was calculated to 3mg/kg body weight for lidocaine and 2mg/kg body weight for bupivacaine

iii. Calculated dose of lidocaine was obtained as a 2% solution (20mg/ml by Ancalima Lifesciences Ltd) and for bupivacaine as a 0.5% solution (5mg/ml Duracaine by Myungmoon Pharm Co)

iv. Obtained volume of 2% lidocaine was diluted to a 1% solution by mixing with equal volumes of sterile water for injection

v. Obtained volume of 1% lidocaine solution was then mixed with an equal volume of 0.5% bupivacaine solution to give the final mixture of a 0.5% lidocaine and 0.25% bupivacaine solution.

a. **Group 1**: Approximately 5ml of the mixture was infiltrated along the line of the incision using a 1.5-inch long 21-gauge needle inserted into the subdermic tissue. The needle previously inserted into the subdermic plane was slowly withdrawn until the tip of the needle reached the intradermic level. At this point, without extracting the needle completely, the intradermic infiltration and making of the skin wheal was performed by very slow injection of approximately 3ml of the mixture along the line of the incision. Ten milliliters of the mixture was then injected deep into the subcutaneous adipose tissue by vertical insertions of the needle (perpendicular to the skin surface) 2 cm apart. Test aspiration was done prior to infiltration to avoid intravascular infiltration. After waiting for 2 minutes, testing for absence of pain was confirmed by pinching the skin with a toothed forceps. The skin incision was made and 10ml of the anesthetic mixture was injected immediately underneath the aponeurosis of the external oblique through a window created in the subcutaneous adipose tissue at the lateral corner of the incision with the needle directed towards the anterior superior iliac spine to block the IH and IL nerves and then in the direction of the inguinal canal. Two milliliters of the mixture was infiltrated at the level of the pubic tubercle, then around the neck and again inside the

Ohemu AA, et al., J Surg Res 2024
DOI:10.26502/jsr.10020398

indirect hernia sac. Five milliliters of the mixture was splashed into the inguinal canal before the closure of the external oblique aponeurosis and into the subcutaneous space before the skin closure. A total volume of about 44mls of the anaesthetic mixture was hence used.

b. **Group 2**: A skin wheal was raised 2 finger breadths medial to the anterior superior iliac spine (ASIS) with 3mL of the anaesthetic mixture. The needle was advanced first perpendicular to the skin and then at 30-45^0 medially and laterally while observing for the loss of resistance on needle penetration of the muscular fascial sheaths. On penetrating this sheath, 20mls of the local anaesthetic agent was infiltrated after test aspiration. The genital branch of the genitofemoral nerve was blocked by repeating the same procedure at two points (2cm lateral to the pubic tubercle and 0.5cm above the midpoint of the inguinal ligament) with 5ml of the mixture at each point after raising a skin wheal with 2mls of the mixture. Infiltration was then done along the intended line of the surgical incision with 10mls of the mixture. After waiting for 2 minutes, absence of pain was confirmed by pinching the skin with a tooth forceps following which the surgical incision was made. A total volume of about 47mls of the anaesthetic mixture was hence used.

During and after the procedure, the Verbal Numerical Rating Scale (VNRS) was used by the researcher/ research assistant to assess the pain experienced on administration of anaesthesia (VNRS1), after sac ligation (VNRS2), at completion of posterior wall repair (VNRS3), at the end of the procedure (VNRS4) and coughing 4hrs post operatively (VNRS5). Beyond the predetermined local anaesthetic dose for each group, additional infiltration with the local anaesthetic mixture was given (within the maximum acceptable dose of 3mg/kg and 2mg/kg of lidocaine and bupivacaine respectively) if patient complained of pain at surgery after initial infiltration and this was noted, Pain score ≥4. Intra-operative doses of 1–2 mg midazolam and 30mg of pentazocine was administered if patient complained of pain not controlled by local infiltration and this was noted pain score ≥4. To assess for complications of local anaesthetic infiltration, the ipsilateral lower was assessed for sensation changes in the thigh, knee or leg such as decreased sensation, numbness, tingling and burning pain as well as unexplained weakness, loss of muscle strength or paralysis in the immediate post operative period to assess for transient femoral nerve palsy. The pulse rate and blood pressure were also assessed prior to administration of anaesthesia and every 15 minutes after administration of anaesthesia till the end of surgery. Symptoms of perioral numbness and tinnitus were enquired within 15 minutes of administration of anaesthesia. For postoperative pain management, acetaminophen l g every 8hours together with aceclofenac 100 mg every 12hours was utilized (additional tramadol 50 mg to a maximum of 4 doses a day was to be used and noted if pain remained uncontrolled with the aforementioned) Pain score ≥4. Information about post operative analgesic use was obtained at the first post operative clinic visit (1 week post operatively). Acceptance of the procedure was assessed by asking the patients if they would choose the same technique of anaesthesia if required to repeat the procedure.

Outcome parameters

a. Intraoperative anaesthetic efficacy was assessed by

- Pain scores (VNRS) on administration of anaesthesia (VNRS1), after sac ligation (VNRS2), at completion of posterior wall repair (VNRS3), at the end of the procedure (VNRS4)
- Need for intraoperative intravenous analgesia/sedation

b. Post operative anaesthetic efficacy was assessed by

- Pain score (VNRS) on coughing 4 hours post operatively (VNRS5)
- Increased post operative oral analgesic requirement beyond routinely prescribed drugs

c. Volume of anaesthetic agent used was assessed by

- Noting total volume of local anaesthetic mixture used beyond volume initially intended

d. Complications of local anaesthesia was assessed by

- Assessing for tinnitus and vertigo within 15 minutes of administration of local anaesthesia
- Assessing the pulse rate and blood pressure prior to administration of anaesthesia and then at 15 minutes intervals till completion of surgery.
- Assessing for ipsilateral lower limb paresis at completion of surgery (after application of wound dressings)

Data analysis

The data collected was filled into a structured data collection form and analyzed using Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics was used to find proportion, mean, standard deviation and range of variables in the two groups and the results presented as tables and percentages. Groups were compared using t-test and Chi-square test. $P < 0.05$ was considered statistically significant at a 95% confidence interval.

Results

Sixty-six (66) patients were recruited but Sixty two (62) completed the study; Thirty-one (31) patients in each study group. Four patients (4) were excluded from the study as they had incompletely filled forms. Baseline demographic and

Ohemu AA, et al., J Surg Res 2024
DOI:10.26502/jsr.10020398

clinical characteristics were comparable in the two groups for age, body mass index (BMI), sex, weight, nature of hernia and side of hernia (Table 1).

The mean age of the patients in the study group (group 1) was 49.94±13.62 years and 47.84±14.45 years for patients in the control group (group 2)(P=O.560). Sex distribution was comparable in both groups with 29 males and 2 females in GROUP 1 as against 30 males and one female in group 2(P=0.554). Bodymass index was comparable in both groups 25.69±5.64 in Group 1and 24.83±6.20 in Group 2(P=0.574). Location of the hernia and nature of hernia was comparable in both groups with P values of 0.796 and 1.00 respectively. There was significantly higher mean pain score at infiltration of anaesthetic (VNRS1) in the regional block group (5.29±1.32) compared to the stepwise group (3.29±1.27). P==0.01).Mean pain scores at high ligation of the sac (VNRS2) were higher in the stepwise infiltration group (2.13±2.19) compared to the regional nerve block group (1.11±1.63) and this was statistically significant (P= 0.042). Average pain scores at completion of posterior wall repair (VNRS3), end of procedure (VNRS4) and 4 hours post operatively (VNRS5) were consistently higher in the regional block group butnostatistically significant difference was observed. (P values of 0.214, 0.175, and 0.163 respectively). When all intra-operative scores were combined from infiltration of anaesthesia (VNRS1) to end of surgery (VNRS4), no statistically significant difference was observed between both groups (P=0.213) (Table 2).

Intraoperative intravenous analgesia was required in two (6.5%) patients in each group. No patient required an increase in oral post operative analgesic beyond what was already prescribed (Table 3).

The volume of Local anaesthetic agent used for infiltration was noted to be significantly more (p-value<0.01) for patients in group 2 (59.52±15.35 mL) compared to those in group 1 (47.26±8.84 mL). (Table 4) Conversely, the duration of surgery was significantly longer in group 1 patients (62.81±10.16 mins) as against group 2 patients (55.32±14.77 mins) with a p-value of 0.023 (Table 4).

Three patients (9.7%) in the stepwise group and two (6.5%) in the regional block group said they would not want the same anaesthetic technique with no statistically significant difference observed among both groups (P=0.614) (Table 5).

One (3.2%) patient had transient (<2 hours) ipsilateral femoral nerve palsy (power of 2/5) in the regional nerve block group and none in the stepwise group. No perioperative circum-oral numbness or tinnitus was observed in both groups (Table 6).

Table 1: Socio-Demographic/Clinical Parameters

Socio-demographic characteristics of patients				
Variables	**Regional (Group 2) n=31(%)**	**Stepwise (Group 1) n=31(%)**	**χ^2/FET**	***p-value***
Age (mean±SD)	49.94±13.62	47.84±14.54		*0.56*
Sex				
Female	2(6.5)	1(3.2)	0.3503	*0.554*
Male	29(93.5)	30(96.8)		
Age grouping				
≤44 years	12(38.7)	12(38.7)	2.949**	*0.407*
45-64 years	14(45.2)	12(38.7)		
>64 years	5(16.1)	7(22.6)		
	1.71±0.07	**1.69±0.07**		
Height (m)			**0.893**	***0.375***
Weight (Kg)	74.55±15.32	70.76±16.58	0.935	*0.354*
BMI (Kg/m²)	25.69±5.64	24.83±6.20	0.565	*0.574*
Sidedness				
Left	13(41.9)	12(38.7)	0.067	*0.796*
Right	18(58.1)	19(61.3)		
Nature				
Inguinal	20(64.5)	20(64.5)	0	*1*
Inguinoscrotal	11(35.5)	11(35.5)		

**p-value significant at <0.05*
**FET: Fischer Exact Test

Ohemu AA, et al., J Surg Res 2024
DOI:10.26502/jsr.10020398

Table 2: Verbal Numerical Rating Scale

VNRS				
Variables	**Regional n=31 (Mean±SD)**	**Stepwise n=31 (Mean±SD)**	**t-test value**	***p-value***
VNRS1	5.29±1.32	3.29±1.27	6.076	*<0.001**
VNRS2	1.11±1.63	2.13±2.19	2.08	*0.042**
VNRS3	1.13±1.67	0.69±0.97	1.258	*0.214*
VNRS4	1.00±1.41	0.59±0.78	1.38	*0.175*
VNRS5	1.55±1.12	1.21±0.73	1.41	*0.165*
Combined intra-operative scores (VNRS1+2+3+4)	2.13±1.51	1.68±1.30	1.258	*0.213*

**p-value significant at <0.05*

Table 3: Perioperative analgesia

Analgesia				
Variables	**Regional**	**Stepwise**	**χ^2**	***p-value***
	n=31(%)	**n=31(%)**		
Use of intraoperative intravenous analgesia				
No	29(93.5)	29(93.5)	0	*1*
Yes	2(6.5)	2(6.5)		
Increase post operative oral analgesics				
No	31(100.0)	31(100.0)	-	-
Yes	-	-		

Significant p value <0.0001*

Table 4: Volume of anaesthetic agent used and duration of surgery

Volume of anaesthetic agent used and duration of surgery				
Variables	Regional n=31 (Mean±SD)	Stepwise n=31 (Mean±SD)	t-test value	*p-value*
Duration of surgery (mins)	55.32±14.77	62.81±10.16	2.325	*0.023**
Volume of anesthetic agent used (mls)	56.52±15.35	47.26±8.84	3.854	*<0.001**

*p-value significant at <0.05

Table 5: Acceptance of anaesthestic technique

Acceptance of anaesthesia				
Variables	**Regional n=31(%)**	**Stepwise n=31(%)**	**χ^2**	***p-value***
Acceptance of procedure				
No	2(6.5)	3(9.7)	0.218	*0.641*
Yes	29(93.5)	28(90.3)		

Ohemu AA, et al., J Surg Res 2024
DOI:10.26502/jsr.10020398

Table 6: Perioperative anaesthetic complications

Complications				
Variables	**Regional n=31(%)**	**Stepwise n=31(%)**	**χ^2**	***p-value***
Paresis				
No	30(96.8)	31(100.0)	1.016	*0.313*
Yes	1(3.2)	0(0)		
Circum-oral numbness				
No	31(100.0)	31(100.0)	-	-
Yes	-	-		
Tinnitus				
No	31(100.0)	31(100.0)	-	-
Yes	-	-		

Discussion

Inguinal hernia is a commonly occurring surgical pathology whose definitive treatment requires operative repair. The conduct and success of this repair is strongly dependent on achieving adequate pain control which in most cases is safely and cost effectively achieved by local infiltration anaesthesia. This study was designed to compare the efficacy of two techniques of local infiltration anesthesia for inguinal herniorrhaphy.

The ratio of males to females in this study was 19.7:1. This finding of gender disparity is in keeping with local reports of male preponderance with ratios of 18:1 reported in south western Nigeria by Etonyeaku et al [1] and 20:1 in north western Nigeria by Sheshe et al [5]. Most patients were middle aged (45-64 years) with a mean age of 49±14 years which is also in keeping with 50.1±18.1 years reported in south western Nigeria [1] and 49.5yrs in north western Nigeria [5] but differed from a mean age of 35.7±16.6 years in southeastern Nigeria by Obguanya et al [18]. Both study groups were comparably matched for age groups (using the WHO grouping) and gender to ensure that results would not be confounded by a possible differential pain threshold for the sexes or age groups [19].

Among the study patients, right sided hernia was observed in 37(59.7%) patients as against 25(40.3%) on the left. This finding was similar to other reports [1,5,18] which show a predilection for right sided hernia resulting from delayed descent of the right testis with delayed obliteration of the right processus vaginalis. As a result of the sampling technique utilized, both groups were comparably matched for nature of hernia (inguinal or inguinoscrotal).

Using the verbal numerical rating scale, it was observed that patients felt significantly less pain on administration of anaesthesia (VNRS 1) when the stepwise infiltration technique was used (p-value of <0.01). This technique (stepwise infiltration) involved a single percutaneous needle prick through unanaesthesized skin with all subsequent pricks going through anaesthesized tissues. The regional nerve block technique however would involve percutaneous needle pricks at a minimum of 3 places to achieve a block resulting in higher pain scores recorded with this technique.

Conversely, at high ligation of the hernia sac (VNRS2), average pain scores were higher in the stepwise infiltration group (2.23±2.19) than the regional block group (1.11±1.63) with a statistically significant difference (p-value of 0.042). Pain at this phase of the procedure was noted to be marked in group 1 (stepwise infiltration) when dissecting around the cutaneous branch of the iliohypogastric nerve prior to subfascial infiltration. Subfascial infiltration (infiltrating underneath the external oblique aponeurosis with the needle directed towards the anterior superior iliac spine) ensured blockade of impulses travelling along the ilioinguinal and iliohypogastric nerves [10]. The anterior branch of the iliohypogastric nerve pierces the external oblique aponeurosis at a region between the anterior superior iliac spine to 4cm above the superficial inguinal ring and supplies the groin skin [20]. Any attempt at dissecting around the nerves prior to subfascial infiltration would cause pain to the patients hence identification and safeguarding the iliohypogatric nerve was done after its administration. In some instances however, avoiding the nerve at dissection was difficult hence the pain observed in the stepwise group. Most patients in group 2 (regional block group) did not experience significant pain at this stage of dissection attesting to the efficacy of the percutaneous nerve block.

No statistically significant difference in pain scores was observed in subsequent pain assessments at completion of posterior wall repair (VNRS3) and at the end of the procedure (VNRS4) between both groups though consistently lower scores were recorded in the stepwise infiltration group.

Greater pain scores at operation were reported by Andersen et al. [16] who conducted a double-blind randomized control trial on 160 patients and reported significantly higher pain scores in the stepwise group. Vessichio et al. [21] also reported increased intraoperative pain in patients

Ohemu AA, et al., J Surg Res 2024
DOI:10.26502/jsr.10020398

randomized to receive stepwise infiltration as against those who had ilioinguinal nerve blocks. These studies however administered placebo at the regions of percutaneous nerve blocks in the stepwise group in other to blind the study. This abolished the advantage of reduced pain on administration of anaesthesia expected in the stepwise infiltration group. Unlike their study which took a single intraoperative pain score measurement, this study attempted (by assessing pain scores at various points) to gauge the relative performance of both techniques at various stages of the surgery and thus identify their strengths and weaknesses.

When all intra-operative pain scores were combined (from infiltration of anaesthesia i.e. VNRS1 to end of surgery i.eVNRS4), lower mean ± standard deviation scores were observed in the stepwise infiltration group with no statistically significant difference (p-value=0.213). Better anaesthetic efficacy was reported with adoption of the stepwise local infiltration technique at the Lichtenstein hernia institute. Amid et al [10] while reporting on 12000 herniorrhaphies performed over a 20year period (done by regional nerve blocks for the earlier 15 years and stepwise infiltration in the latter 5 years), they reported improved pain control with the stepwise technique. Though no randomized controlled trial was performed, their report formed the basis for further research.

The need to augment infiltration with intraoperative intravenous analgesia/sedation was similar in both groups (2 patients each) making up 6.5% of the study population. All four patients who received intraoperative analgesia/sedation had inguinoscrotal hernia with pain experienced on attempting to free the hernia sac. Added local infiltration into the sac did not relieve the pain necessitating intravenous analgesia/ sedation. The European Hernia Society Guidelines suggests that local anaesthesia may not be suitable for inguinal herniae that are difficult to reduce/irreducible [22]. Though this study did not assess reducibility of the hernia, difficulty in reduction is more commonly expected in inguinoscrotal hernia which may explain this finding.

The pain scores obtained at coughing 4 hours post operatively (VNRS5) were higher in the percutaneous nerve block group but this was not statistically significant. There was no need to increase oral post operative analgesics for patients in both groups beyond what was initially prescribed. Amid et al[10] had postulated that stepwise local infiltration, by blocking the release of nociceptive substances at the site of surgery, would reduce the post operative pain observed in these patients. The findings of this study do not support that hypothesis as no significant difference was observed in both groups. Vessichio et al [21] and Andersen et al [6] also did not find a reduction in post operative pain among the patients who had stepwise local infiltration.

Three patients in the stepwise infiltration group (two of whom had previously required intraoperative intravenous sedation/analgesia) and two in the percutaneous nerve block group (both previously requiring intraoperative intravenous sedation) stated that they would not choose the same anaesthetic technique if a repeat procedure was required. There was no statistically significant difference in responses for both groups. The total dissatisfaction rate in this study of 8.1% differed slightly from results obtained by Callesen et al [23] who reported a 0.7% need for sedation/conversion to general anaesthesia with 13.2% of patients expressing dissatisfaction with anaesthesia/surgery out of 912 patients operated under local anaesthesia.

Being able to achieve pain control with low volume of local anaesthesia is an attractive prospect in resource poor settings or surgical outreaches where judicious utilization of materials and resources is mandatory against the background of a high patient load [5]. The volume of local anaesthetic agent used (mean ±SD of 47.26±8.84mls) in the stepwise group was significantly less (p-value <0.01) than 59.52±15.35mls in the regional percutaneous nerve block group. The volume used in the stepwise group in this study is similar to the average volume of 45mls reported by Amid eta al[10]. The duration of surgery was however significantly longer (p-value = 0.023) in the stepwise group with a mean difference between both groups of 7.49 minutes. This difference may be due to the conduct of anaesthesia in the stepwise group requiring repeated infiltrations and brief delays to ensure onset of anaesthetic action.

Transient femoral nerve block is a noteworthy but infrequent complication of percutaneous nerve block occurring as a result of deposition of anaesthetic agent around the femoral nerve. This complication was noted in one patient in the percutanous nerve block group making up 3.2% of 31 patients. Power in the ipsilateral thigh flexors dropped to 2 (movement with gravity eliminated) from 5 (normal power) preoperatively. This paresis was transient lasting 2 hours post operatively. During this period, the patient remained anxious and had to be repeatedly reassured. He was discharged home on full recovery with no persisting neurologic deficits. Udo et al [4] reported that this complication occurred in 3(2.6%) of 112 patients operated using percutanous nerve blocks in south-southern Nigeria.

No incidents of systemic manifestations of local anaesthetic toxicity (tinnitus, circum-oral numbness, cardiovascular depression) were noted in this study. This may be attributed to intravascular injection of anaesthetic agent being avoided by aspirating before infiltrating and total quantities of local anaesthetic agents used being within the calculated required doses for the patient's weight.

Ohemu AA, et al., J Surg Res 2024
DOI:10.26502/jsr.10020398

Limitation

A single surgeon could not perform all surgeries as performing this procedure is a requirement for other residents in training. Uniformity in operative technique is however difficult to obtain with 3 surgeons operating.

Conclusion

This study sought to comparatively assess the efficacy of stepwise local infiltration anaesthesia for inguinal herniorrhaphy as against the percutaneous regional nerve block. It found no statistically significant difference in intraoperative analgesic efficacy between both techniques. There was also no statistically significant difference in post-operative analgesic efficacy of local infiltration between both techniques despite the finding of a significantly lower volume of local anaesthestic agent required to perform stepwise infiltration anaesthesia compared to that required for the regional nerve block. The study also showed no significant difference in anaesthetic complications between both techniques.

It is however noteworthy that pain at infiltration of anaesthesia is significantly higher in the percutaneous regional nerve block group while operative pain is significantly higher in the stepwise infiltration group at the initial part of surgery (prior to sac ligation). Overall Stepwise infiltration anaesthesia for inguinal herniorrhaphy confers no added benefit to local anaesthetic efficacy when compared to anatomic landmark regional nerve block. Its efficacy remains comparable to the anatomic landmark regional nerve block technique of local infiltration for inguinal herniorrhaphy.

Recommendations

Though lower volumes of local anaesthetic agent are required to perform the stepwise infiltration technique, its efficacy remains comparable to the anatomic landmark regional nerve block technique of local infiltration for inguinal herniorrhaphy. Either of both techniques may therefore be effectively used in performing inguinal herniorrhaphy in accordance with the surgeon's preference while monitoring for the patient's discomfort and utilizing intraoperative sedation/analgesia as required. A combination of both techniques may also be expected to give improved analgesic efficacy.

Financial support and Funding: None

Conflict of interest: No conflict of interest

References

1. Etonyeaku A, Olasehinde O, Talabi A, et al. Groin hernias at the Wesley Guild Hospital Ilesa, Nigeria: Characteristics and emerging patterns of repair. Niger J Surg Sci 25 (2015): 9-14.
2. Ayandipo O, Afuwape O, Irabor D, Abdurrazzaaq I. Adult abdominal wall hernia in Ibadan. Ann Ib Postgrad Med 13 (2015): 94-99.
3. Agbakwuru E, Etonyeaku A, Olasehinde O, et al.Recurrent inguinal hernia in Ile-Ife Nigeria: Characteristics and outcome of management. Niger J Surg Sci 26 (2016): 33-38.
4. Udo IA, Umeh KU, Eyo CS. Transient femoral nerve palsy following ilioinguinal nerve block for inguinal hernioplasty. Niger J Surg 24 (2018): 23-26.
5. Sheshe AA. Feasibility of elective mass hernia repair in Kano State, Northwestern Nigeria. Niger J Basic Sci 11 (2014): 30-35.
6. Andersen F, Nielsen K, Kehlet H, et al. Inguinal region anatomy. Medscape (2017).
7. Cushing H. The employment of local anaesthetics in the radical cure of certain cases of hernia with a note on the nervous anatomy of the inguinal region. Ann Surg 31 (1900): 1-344.
8. Aniteye E, Baddoo HK, Anaesthesia. In: Archampong EQ, Naaeder SB, Ugwu B, editors. Principles and practice of surgery: Including pathology in the tropics. (5th edtn), Ghana publishing corporation (2015) pp: 1292-1232.
9. Igwe P, Dodiyi-Manuel A, Nwankwo N. Hernia In South Southern Nigeria: Five Year Retrospective Study. IOSR-JDMS 15 (2016): 96-111.
10. Amid PK, Shulman GA, Lichtenstein IL. Local anesthesia for inguinal hernia repair step-by-step procedure. Annals of Surgery 220 (1994): 735-737.
11. Wagner JP, Brunicardi CF, Amid PK, et al. Inguinal hernias. In: Brunicardi CF, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Matthews JB et al, editors. Schwartz's Principles of Surgery. (10th edtn), USA: McGraw-Hill Education (2015): 1495-1516.
12. Wang Y, Wu T, Terry M, et al. Improved perioperative analgesia with ultrasound-guided ilioinguinal/iliohypogastric nerve or transversus abdominis plane block for open inguinal surgery: A systematic review and meta-analysis of randomized controlled trials. J Phys Ther Sci 28 (2016): 1055-1060.
13. Yang L, Xu Y, Wang Z, et al. Application of ultrasound-guided ilioinguinal/iliohypogastric nerve block in pediatric same-day surgery. Indian J Surg 77 (2015): 512-516.
14. Eichenberger U, Greher M, Kirchmair L, et al. Ultrasound-guided blocks of the ilioinguinal and iliohypogastric nerve: accuracy of a selective new technique confirmed by anatomical dissection. Br J Anaesth 97 (2006): 238-243.

Ohemu AA, et al., J Surg Res 2024
DOI:10.26502/jsr.10020398

15. Kulacoglu H, Ergul Z, Esmer F, et al. Percutaneous ilioinguinal-iliohypogastric nerve block or step-by-step local infiltration anesthesia for inguinal hernia repair: what cadaveric dissection says? J Korean Surg Soc 81 (2011): 408-413.

16. Andersen H, Nielsen K, Kehlet H. Combined ilioinguinal blockade and local infiltration anaesthesia for groin hernia repair- A double-blind randomized study. British Journal of Anaesthesia 94 (2005): 520-523.

17. Fox N, Hunn A, Mathers N. Sampling and sample size calculation. The NIHR RDS-YH 2 (2009): 21-29.

18. Ogbuanya AU, Emedike SC. Elective repair of uncomplicated inguinal hernia in south eastern Nigeria. Asian Journal of Medical Sciences 9 (2016): 90-95.

19. Bartley EJ, Fillingim RB. Sex differences in pain: a brief review of clinical and experimental findings. Br J Anaesth 111 (2013): 52-58.

20. Yarwood J, Berrill A. Nerve blocks of the anterior abdominal wall. Contin Educ Anaesth Crit Care Pain 10 (2010): 182-186.

21. VessichioL, Mingione M, Dimarzio G, et al. What is the benefit of associating a blockade ilioinguinal and local anaesthetic infiltration in elderly patients undergoing hernia repair surgery: A double blind randomized study. BMC Surgery 13 (2013): A48.

22. Simons M, Aufenacker T, Bay-Nielsen M, et al. European hernia society guidelines on the treatment of inguinal hernia in adult patients. Hernia 13 (2009): 343-403.

23. Callesen T, Bech K, Kehlet H. One thousand consecutive inguinal hernia repairs under unmonitored local anesthesia. AnasthAnalg 96 (2001): 1373-1376.