

# Postoperative Pain in Lichtenstein Repair with Iliohypogastric Neurectomy Compared to Standard Lichtenstein Repair, for Inguinal Hernias at Mulago Hospital, A Sub Saharan Africa Tertiary Centre

Francis Basimbe, Peter A Ongom\*, Stephen C Kijjambu and Olivia Kituuka

Department of Surgery, Makerere University College of Health Sciences, Uganda

## Abstract

**Introduction:** Groin hernias comprise a large proportion of the surgical volume, worldwide. Inguinal hernia repair is possibly the commonest general surgical procedure. In recent years, greater focus has been put on the quality-of-life of the patient, using postoperative pain as an indicator. Iliohypogastric neurectomy has been shown to significantly reduce postoperative pain. It was considered necessary to evaluate the effectiveness of iliohypogastric neurectomy in day surgery at a tertiary hospital, in a low income country. A study to compare the short-term and medium-term postoperative pain following Lichtenstein hernia repair, with and without iliohypogastric neurectomy, was conducted.

**Methods:** It was a double-blinded randomized parallel clinical trial. A total of 96 patients, out of 106 eligible patients, with primary inguinal hernias were recruited in Mulago National Teaching and Referral Hospital's Surgical Outpatient Department, Kampala, Uganda. Participants were randomized into either a standard Lichtenstein repair group (46 patients) or a standard Lichtenstein repair with iliohypogastric neurectomy group (50 patients), and underwent day surgery. The participants and outcome assessors were blinded to the treatment method. Outcome variables were postoperative mean pain scores at rest and following activity. Pain assessment was done with the Visual Analogue Scale at different time intervals; 2 hrs, 7 days and 28 days postoperative.

**Results:** There was a significant difference in mean pain scores between the standard Lichtenstein repair (0.957) and the Lichtenstein repair with iliohypogastric neurectomy (0.34) groups ( $P<0.001$ ). There was less task-induced pain in the Lichtenstein repair with iliohypogastric neurectomy group (0.140) compared to the standard Lichtenstein repair group (0.739) ( $P<0.001$ ).

**Conclusion:** Postoperative pain in Lichtenstein repair with iliohypogastric neurectomy is less in comparison to Lichtenstein repair alone, in the treatment of inguinal hernias. Iliohypogastric neurectomy is thus an effective method of controlling postoperative pain in Lichtenstein hernia repair.

**Keywords:** Lichtenstein; Repair; Iliohypogastric Nerve; Neurectomy; Mesh; Postoperative pain; Visual analogue scale

## Introduction

Groin hernias contribute a large part of the global volume of surgery. Inguinal hernia repair surgery is one of the most frequently performed surgical procedures worldwide. It is estimated that more than 20 million inguinal hernias are repaired every year around the world; specific rates by country vary from 100 to 300 per 100,000 populations per year [1]. In Mulago National Referral Hospital, Uganda, emergency hernia operations constitute 68% of all emergency operations [2]. Surgeons have used the adage “the history of groin hernias is the history of surgery itself” to lay emphasis on the repairs of inguinal hernias as being possibly the most common surgical procedures. Efforts at achieving even modest improvements in clinical outcomes of a procedure offer important practical applications. Over the years, there has been an evolution in the methods of surgical repair that range from facial repairs, tension-free mesh repairs and laparoscopic repairs.

In recent years, greater attention has been put on the patients' quality-of-life, measured by postoperative pain and the length of convalescence [2,3]. Anterior tension-free techniques, including various patches and plugs, have produced excellent results with low recurrence rates compared to the conventional tension fascial methods [2-7]. Day Surgery, increasingly becoming standard practice, has documented advantages. These include: patient convenience, cost reduction, decreased incidence of hospital-acquired infections,

shortened waiting time for surgery and less demand on the nursing staff, already overstretched in our low income setting [8,9]. Day Surgery which entails that a patient recovers from home, makes use of the observation that a familiar domestic environment hastens recovery due to earlier mobilization [8,10].

In many centres in Uganda, fascial hernia repairs are still being widely practiced [2]. There is an increased interest in the tension free repairs due to the superior short-term, medium-term and long-term outcomes, particularly reduction in recurrences [2]. An ideal method for modern hernia surgery ought to be simple, safe, cost-effective, permanent and tension-free, with a short “learning curve”. The Lichtenstein operation, to a great extent, meets these criteria [3,5,6]. The limitation in our setting and many other low income countries

**\*Corresponding author:** Peter A. Ongom, Department of Surgery, School of Medicine, Makerere University College of Health Sciences, Uganda, Tel: 256 772454936, 256701629160, E-mail: [petongom@yahoo.co.uk](mailto:petongom@yahoo.co.uk)

**Received** September 28, 2013; **Accepted** October 21, 2013; **Published** October 26, 2013

**Citation:** Basimbe F, Ongom PA, Kijjambu SC, Kituuka O (2013) Postoperative Pain in Lichtenstein Repair with Iliohypogastric Neurectomy Compared to Standard Lichtenstein Repair, for Inguinal Hernias at Mulago Hospital, A Sub Saharan Africa Tertiary Centre. J Gen Pract 1: 128. doi: 10.4172/2329-9126.1000128

**Copyright:** © 2013 Peter A. Ongom, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

has been the cost and availability of the mesh. In spite of this, the commonest anterior mesh hernia repair in our environment is still the Lichtenstein repair; a method quick to learn and use.

Inguinodynia or chronic groin pain following this operation is a potential complication and its incidence can be as high as 62.9% [11]. The pain is classified as neuropathic and non-neuropathic related to nerve damage and to the materials used for the repair, respectively [12]. Neuropathic pain is considered to be due to damage to the inguinal nerves and usually develops in the sensory distribution of the injured nerve. Non-neuropathic pain is caused by either mesh-related fibrosis or post-operative fibrosis. The nerves involved are the ilioinguinal nerve (IIN), the iliohypogastric nerve (IHN) and the genital branch of the genitofemoral nerve (GFN). The commonest form of pain is of neuropathic origin. There is evidence of less postoperative pain and early return to work following mesh repair as opposed to fascial repairs. For mesh-associated pain per se, the material used matters, with heavyweight and composite meshes being more associated with severe postoperative pain as compared to light weight meshes [13]. Hernia surgeries in which nerve identification is done are observed to have lower postoperative pain rates compared to those with no nerve identification [13-15]. Importantly, inguinal nerve neurectomies have shown significant reduction in chronic groin pain post-neurectomy [12,16]. Significant shortcomings of some previous studies were that: their design was mainly observational; they did not use the VAS; and they were conducted in Caucasians only.

Much as there are several studies on tension versus tension free repairs, no studies to date have been done in Sub-Saharan Africa's low income countries, comparing the short-term and medium-term postoperative pain outcome between a tension-free mesh repair method (Lichtenstein), with and without IHN neurectomy [3]. Moreover, hernias in Sub-Saharan Africa present unique challenges when compared to hernias in Western countries, making extrapolation of study inferences conducted there not obviously applicable. Hernias tend to present in younger age groups and are larger, in addition to the race factor [3]. Patients present after long periods of the disease-majority of them presenting to Mulago National Referral Hospital have pain and irreducibility as features at presentation. This is uncommon in the western world. Also, follow up of patients in Sub Saharan Africa tends to be short [3].

Numerous tension free repairs both open and laparoscopic have been devised. These mainly include the Lichtenstein repair, plug and patch, Kugel and Prolene Hernia System (PHS) [1,4-7]. Studies have shown that repairs with the above techniques have less complications and recurrence rates. However postoperative pain, especially with activity, is the main problem in these tension free repairs [11,12]. The Lichtenstein repair is considered to be a standard mesh repair with recurrence rates of less than 1% and a short "learning curve" [3,6]. We set out to conduct a study whose objective was to compare short-term and medium-term outcome between the widely accepted standard tension-free Lichtenstein mesh repair and a modification involving iliohypogastric neurectomy, for postoperative pain control in patients undergoing day surgery hernia repair. A similar study was conducted in Europe, in a Caucasian population [14]. It is thought that this study will guide clinical practice in the region.

## Methods

### Design, setting and participants

A single-centre double-blinded randomized controlled clinical

trial was designed; participants and pain assessors were blinded to the interventions used. The study was conducted at Mulago National Referral and Teaching Hospital, Department of Surgery, Surgical Out Patient Department Clinic. Patients aged 18 years and above, presenting between July 2012 and February 2013 with primary inguinal hernias and giving consent to participation, were enrolled. Other inclusion criteria were: American Society of Anesthesiologists (ASA) score I or II; accessible telephone contact; residence less than 1 hour travel time, or a distance not >20 km from study site; and availability of a responsible accompanying attendant (on the day of surgery). Patients with known bleeding disorders were excluded from the study.

Participants were assessed in the clinic and given appointment dates on which to return for day surgery. A minimum sample size requirement of 86 participants was calculated using the student t-test formula [3]. A total of 96 participants were enrolled. These were assigned randomly to one of two groups according to the type of procedure to be done: 46 underwent the standard Lichtenstein repair and 50 underwent the standard Lichtenstein repair with IHN nerve neurectomy. Randomisation was by the block design method, on an intent-to-treat principle. Computer generated random numbers were used for group assignment which was done on the operation day. Sealed opaque envelopes were utilised to effect blinding, and the number within the envelope and the subsequent procedure were concealed up to after the 28<sup>th</sup> day, postoperative. The study was approved by the Makerere University School of Medicine Research and Ethics Committee and the Mulago Hospital Research and Ethics Committee, and written informed consent was obtained from each patient. The independent intervention was IHN neurectomy. Predictor variables included: demographic/biodata-age, gender, body mass index (BMI) and occupation; hernia location-left or right; hernia type-direct or indirect; and hernia size-Nyhus classification. Outcome variables were pain scores-at rest, while walking, while coughing and while squatting.

Pain was assessed for using the Visual Analogue Scale (VAS). The VAS is a psychometric response scale, which grades levels of pain severity. Scores are allotted by the patient, on a scale of zero (no pain) to 10 (worst pain), in response to being questioned about the severity of pain felt at rest, or while performing a specific task.

### Surgical techniques

For all patients, skin was prepared with povidone iodine, and the operation site standard draped. All operations were carried out under local anesthesia. A 40 mL solution containing 0.5% lignocaine (with 1:400,000 epinephrine solutions) was prepared for each patient. The lignocaine was used as a local nerve block for the IHN, IIN and GFN at three points located along a line about 2 cm above and parallel to the inguinal ligament.

The first nerve block was made at a point 2 cm superior and medial to the anterior superior iliac spine (ASIS). A weal was raised on the skin with a gauge 24 needle. The rest of the procedure was the standard IHN and IIN block [15].

The second block was for the GFN. This was at a point immediately superior to the pubic tubercle on a line joining the ASIS to the pubic symphysis, deep to the aponeurosis of the external oblique muscle. The third nerve block was at the mid-inguinal point, catering for the GBGF nerve as it emerges through the deep ring. Diffuse infiltration was also applied in areas along the area for the incision.

## Lichtenstein repair

A 5 to 8 cm incision was made in the inguinal region, and the external oblique aponeurosis divided [16]. The necessary space for the mesh was created laterally along the inguinal ligament from the pubic tubercle towards the ASIS. In males, the spermatic cord was mobilised by placing a finger around the cord at the level of the pubic tubercle. It was from the underlying inguinal ligament. The sac was mobilised and dissected off the spermatic cord with a combination of sharp and blunt dissection up to the level of the deep inguinal ring. The spermatic cord was protected using a gauze piece (loop) or a hernia ring. In females, the round ligament was left attached to the sac.

The hernia sac was then opened and visceral contents reduced. It was subsequently twisted using hemostats attached to the cut edges, and transfixed with atraumatic Vicryl 1 suture. The hernia sac was excised about 1 cm distal to the ligature and hemostasis ensured. For small direct hernias the sac was invaginated back into the peritoneal cavity. Size 7.5×15 cm polypropylene mesh was used. The mesh was fashioned to fit the posterior wall of the inguinal canal. In males, a slit, 2 to 5 cm in length, was made in the lateral aspect of the mesh, and the spermatic cord was placed between the two flaps of the mesh. The cord was then displaced cephalad to allow placement of the medial end of the mesh over the pubic tubercle. It was secured to periosteum using nylon 3/0 suture. A continuous running suture was placed laterally from the pubic tubercle, securing the mesh to the inguinal ligament to a point 2 cm lateral to the deep inguinal ring. The superior edge of the mesh was secured using interrupted nylon 3/0 to the conjoint tendon. The cord was allowed to fall back to its anatomical position. The external oblique aponeurosis was repaired with a continuous Vicryl 2/0 suture and skin closed with a subcuticular Vicryl 3/0 suture. Dry cotton gauze dressing was finally applied.

## Iliohypogastric neurectomy

For patients in the neurectomy group, a 5 to 8 cm incision was made in the inguinal region, the external oblique aponeurosis divided, and the necessary space for the mesh created laterally along the inguinal ligament from the pubic tubercle towards the ASIS, as described above. The superficial branch of the iliohypogastric nerve was identified and excised as far as possible, proximally and distally. After transection of the nerve, its proximal end was left free on the internal oblique muscle, without tension. The rest of the procedure was as stated in the previous section. The excised iliohypogastric nerve was placed in a 20 mL solution of formalin and taken for histological confirmation.

## Postoperative follow up

All patients received analgesics postoperatively. Intramuscular diclofenac, 75 mg was given immediately after surgery. Patients were discharged the same day after a evaluating their fitness for home recovery [14,17-19]. Oral (tablets) diclofenac, 50 mg, 8 hourly was prescribed for home use. They were given the freedom to increase the amount and frequency, depending on need, but in any case not exceeding 100 mg, 6 hourly. Instructions on keeping the wound dressed and dry were given. They were also instructed to return immediately in case of excessive pain, bleeding, wound discharge abdominal distension, vomiting, and failure to pass flatus, stool or urine. Patients were encouraged to feed orally as early as the need arose.

The first follow-up was done 2 hrs after the operation, with pain assessed for using the Visual Analogue Scale (VAS). The second follow-up was done on the 7<sup>th</sup> postoperative day, at which any complications present were noted and managed. Dressings were removed. The patient

was allowed home to return on the 28<sup>th</sup> post operative day for the third follow up. A blinded research assistant conducted the wound and pain assessments.

## Data analysis

Data were collected using pretested questionnaires and data entry forms, entered into Epi Info™ then exported to MS Excel, GenStat and Stata® version 10 (StataCorp, Texas, USA) for analysis. Analysis was based on an intention-to-treat design. Categorical data (pain scores) were summarized in means. Comparison between the two groups was done using the ANOVA test. Complication rates in the two groups of patients were compared using the  $\chi^2$  test. Bivariate analysis was used to determine the influence of baseline characteristics in the two groups, with the key outcomes. There were no crossovers in this study. The power of the study was 80%, with a confidence interval of 95%, and a *P* value<0.05 being of statistical significance. Testing for confounders was done.

## Results

A total of 96 patients were enrolled, following 10 exclusions from an initial total of 106 eligible participants. All the enrolled participants were randomized in the two study arms and received the allotted intervention. This is illustrated in Table 1. Those coded as others included: drivers, motorcycle taxi ('boda-boda') operators, housewives and shopkeepers. Nyhus IIIB and IV classifications were represented

Characteristic	Number (%)	CI (95%)
<b>Sex</b>		
Male	73 (76.04)	66.6 – 83.5
Female	23 (23.95)	16.5 – 33.5
<b>Age</b>		
<20	7 (7.29)	3.3 – 14.5
20 - 29	24 (25.00)	17.4 – 34.6
30-39	29 (30.20)	21.9 – 40.0
40-49	13 (13.54)	78.0 – 21.9
50-59	15 (15.62)	9.6 – 24.3
>60	8 (8.33)	4.1 – 15.8
<b>Occupation</b>		
Student	18 (18.75)	12.1 – 27.8
Peasant	18 (18.75)	12.1 – 27.8
White-collar	5 (5.21)	2.0 – 11.9
Manual laborer	8 (8.33)	4.1 – 15.8
Security guard	21 (21.74)	14.7 – 31.2
Business operator	6 (6.25)	2.6 – 13.2
Others	20 (20.83)	13.8 – 30.1
<b>Hernia duration</b>		
<36 mths	40 (41.66)	32.3 – 51.7
>36 mths	56 (58.33)	48.3 – 67.7
<b>Hernia location</b>		
Left	31 (32.29)	23.8 – 42.2
Right	65 (67.70)	57.8 – 76.3
<b>Hernia type</b>		
Direct	8	4.1 – 15.8
Indirect	88 (91.66)	84.2 – 95.9
<b>Nyhus classification</b>		
I	1 (1.04)	< 0.01 – 6.2
II	68 (70.83)	61.1 – 79.0
IIIA	16 (16.66)	10.4 – 25.5
IIIB	11 (11.45)	6.4 – 19.5

**Table 1:** Baseline characteristics of the study population.

since they describe femoral and recurrent hernias respectively, which were not included in the study. The demographic characteristics of participants in the standard Lichtenstein group and the Lichtenstein with IHN neurectomy were comparable (Table 2).

### Primary outcome

There was a significant difference between the two groups in mean pain scores ( $P < 0.05$ ), both 2 hrs postoperative and on the 28<sup>th</sup> day postoperative (Table 3). This meant Lichtenstein repair with iliohypogastric neurectomy was associated with less pain than standard Lichtenstein, in the immediate postoperative period and 28 days following surgery. There was significantly less pain on coughing, walking a distance of 10 m and on squatting in patients who had a Lichtenstein Repair with neurectomy as compared to the standard Lichtenstein group,  $P < 0.05$ . Of the variables noted above, it is only the intervention group (standard Lichtenstein and Lichtenstein with IHN neurotomy) that influenced the outcome of pain in this study ( $P < 0.001$ ) (Table 4). Gender, location and type of hernia did not significantly influence the outcome in relation to pain.

### Discussion

This RCT culminated in analysis of 96 patients treated for inguinal hernias by either of 2 surgical procedures; standard Lichtenstein and Lichtenstein with IHN neurectomy. Male patients constituted 76% of participants, while patients aged  $< 50$  yrs constituted 75%. The patients who underwent the Lichtenstein with neurectomy procedure, significantly had lower mean pain scores at rest both at 2 hrs and at 7 days postoperative (short-term). They also had lower pain scores following performance of physical tasks 28 days postoperative (medium-term).

### Demographic and clinical characteristics

There was a male to female ratio of 3.2:1. This is comparable to previous studies done at this centre which described ratios of 4:1 [2], 4.4:1 [20] and 5.3:1 [21]. This is explained by the embryological process of descent of the testis through the inguinal canal leaving a potential space and point of weakness in the groin area, in males. Of the patients recruited in this study 75% of them were below 50 years of age. Similar findings have previously been documented from this centre [2,20,21]. A possible explanation is the increased levels of activity among the young and middle aged groups predisposing them

Characteristic	Lichtenstein group (n)	Lichtenstein with neurectomy (n)	Both groups (n)	p value
<b>Sex</b>				
Female	10	13	23	0.814
Male	36	37	73	
<b>Age</b>				
<20	6	1	7	0.199
20 – 29	9	15	24	
30 – 39	14	15	29	
40 – 49	8	5	13	
50 – 59	5	10	15	
>60	4	4	8	
<b>BMI</b>				
< 20	3	9	12	0.087
20 - 25	34	37	71	
26 - 30	9	4	13	
> 30	0	0	0	

Table 2: Comparison of baseline characteristics.

Characteristic	Standard Lichtenstein	Lichtenstein with neurectomy	p value
<b>At rest (no activity)</b>			
2 hrs, post operative	0.957	0.34	<0.001
28th day, post operative	0.739	0.14	<0.001
<b>Task-induced - 28<sup>th</sup> day post operative</b>			
Coughing	0.723	0.144	<0.001
Walking	0.633	0.126	<0.001
Squatting	0.542	0.176	0.004

Table 3: Distribution of pain (mean pain scores; VAS) at follow up.

Characteristic	p value
Intervention group	<0.001
Gender	0.457
Location of hernia	0.457
Type of hernia	0.926

Table 4: Bivariate analysis.

to raised intra-abdominal pressures, a trigger for the pathogenesis of inguinal hernias. The occupations which had dominant proportions were students (18.8%; CI 12.1-27.8) and security guards (21.7%; CI 14.7-31.2). This is different from what was observed in a previous study in this centre, where casual laborers constituted the majority (41.6%) [3]. Seasonal variations in activity could have made a significant effect on student enrolment. Most of the enrolment in this study covered the student holiday periods of August and September, and December and January. Aside from that, students (adolescents and young adults) and security guards indulge in sports, exercise and other strenuous manual activities, all of which are risk factors.

Location of hernia in this study was comparable to other studies done at this centre [2,3,20,21]. The majority of hernias were located on the right side and several authors have postulated that this may be related to the delayed descent of the right gonad in males. This may therefore account for the presence of the persistent processus vaginalis on the right and subsequent development of the hernia [2,3]. This inference is in no way a conclusive explanation given that this is a RCT not designed primarily for prevalence. There was a high proportion of patients with Nyhus II (70.8%); indirect medium sized hernia, associated with an enlarged internal ring and the sac not reaching the scrotum. This differs from the finding in other studies from the same centre [2,3,20,21]. The majority of participants in one study had Nyhus IIIA type hernias, associated with a chronic clinical course and physical strain [3]. Most participants in that study were casual labourers who generally were more likely to have had the hernias for longer periods, coupled with the constant occupational risk of lifting heavy loads. This contrasts with our study where the students were likely to present early and thus had a lower Nyhus class of hernia.

Indirect hernias constituted 91.7% (CI 84.2-95.9) of cases, a percentage higher than what was seen in previous studies conducted at this centre, 81.5% [2] and 75% [21]. This was possibly because a number of patients excluded from this study had direct hernias along with obstructive urinary symptoms, a predisposing factor for development of inguinal hernias. The management plan for these patients entailed treatment of these urinary tract diseases prior to definitive hernia repair. However, due to the short duration of the study, many of these patients did not return to have hernia repair done, and this could account for the comparatively high percentage of patients with indirect hernias in this study.

Of the patients recruited, 74% (CI 64.3-81.7) had normal BMI, a finding comparable to that of a previous Mulago Hospital study, 69.6% (CI 60.1-77.7) [3]. The occupation of the majority of participants can plausibly explain these findings. Security guards are likely to have a normal BMI since their work involves regular and vigorous physical exercise. On the part of students, they are equally active (young adults) who have not yet adopted the sedentary life style that is associated with an increase in BMI. Only 13.5% of patients in this study had a high BMI. They consisted mainly of business operators and housewives. Their less active and confined life style may be a contributory factor.

Hernias that had been present for >36 months constituted 58.3% of the cases. Pain was a presenting complaint in almost all patients. This is a larger proportion for a longer duration of symptoms before presentation as compared to what is seen in studies on inguinal hernias conducted in western countries [4,6,7,14]. In this study, this may be attributed to several anthropological factors differing in these settings. Issues like culture, poverty, inadequate health facilities, low education status, low income and poor health seeking behavior, among others, play a role in late presentation to hospital in our setting. A previous Mulago Hospital study showed that 68% of emergency operations done were hernia surgeries-obstructed and strangulated [2]. It is therefore possible that many of these patients wait until the pain is unbearable or when complications develop, before presentation to hospital.

### Post operative pain

Pain, the primary outcome measure, was scored using the VAS (0-10). The mean pain scores for participants in the Lichtenstein with IHN group were significantly lower, 2 hrs postoperatively. This is essentially

a manifestation of the “no nerve, no pain” concept. Excision of this nerve means that there was no nerve to conduct the stimulus of pain resulting from tissue dissection. In comparison with a previous study conducted in this centre, this study registered lower mean pain scores 2 hrs postoperative, 1.18 [3] versus 0.34. These pain scores cannot entirely be attributed to the postoperative analgesic given, since the same analgesic (parenteral diclofenac) was used in the same quantities in both studies [3]. Essentially, the effect of lignocaine had worn off 2 hrs post operative. Medium term post operative mean pain scores were significantly lower in the Lichtenstein with IHN group as compared to the standard Lichtenstein group ( $P<0.001$ ). Similar observations were made in a European study which described significant reductions in postoperative pain in male patients who had undergone Lichtenstein repair with IHN neurectomy [14].

Bivariate analysis of the location of Hernia, whether right or left sided, with respect to postoperative pain both in the short term and medium term, showed no significant difference ( $P=0.457$ ). This expected finding is in tow with the normal anatomy of the right and left IHNs. Participant gender too, male or female, did not influence postoperative pain. Gender is not previously documented to be a factor influencing either postoperative pain or normal nerve anatomy and function. The type of hernia, whether direct or indirect did not influence the postoperative mean pain scores. This is ostensibly because in both types of hernias, the same operative technique was used, and therefore there was essentially similar tissue dissection for all cases. Furthermore, all surgeries were performed by the same surgeon, ensuring standardization.

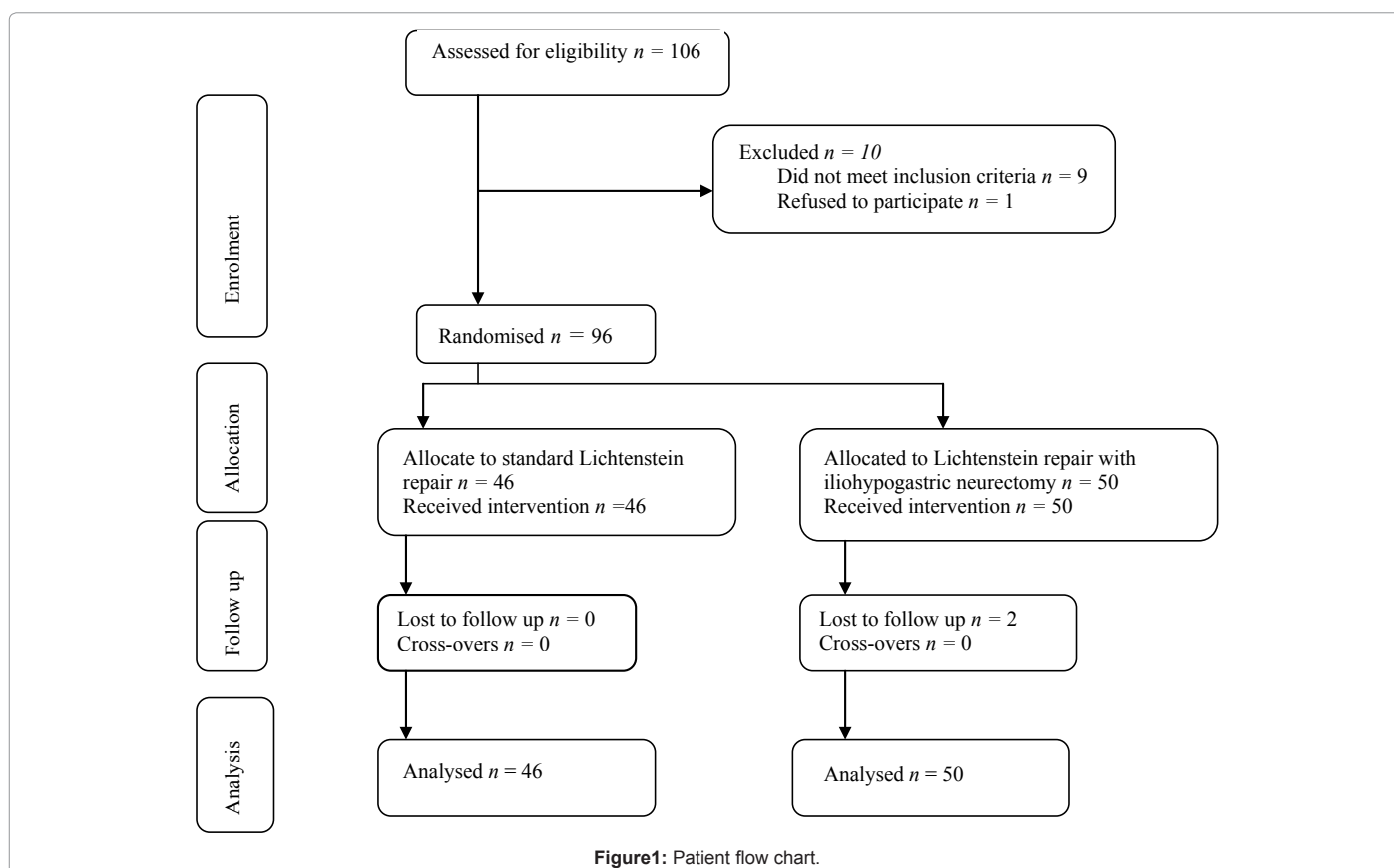


Figure1: Patient flow chart.

## Task induced pain

In the study, pain on walking a distance of 10 m and on coughing and squatting, was significantly reduced in the group that had IHN neurectomy as compared to the standard Lichtenstein group. Postoperative pain can either be neuropathic (direct insult to the nerve) or non-neuropathic (indirect) [12]. Generally, nerves can be damaged (neuropathic) either by partial or complete transection, stretching, contusion, crushing, electrical damage or by being caught in the suture used. Secondary nerve damage (non-neuropathic) occurs as a result of adjacent inflammatory processes or because of excess fibrotic reaction or mesh encasement [22]. Non-neuropathic pain may also be caused by rolling up of the mesh or mesh-related excess fibrosis [23]. The procedures that we have used, alone, may thus cause medium-term and chronic pain, albeit inadvertently [24]. In this case, we set out to look at the advantage of controlling this pain with neurectomy. Walking and hyperextension of the hip may trigger both forms of postoperative pain. This was significantly reduced by neurectomy done in this study. In this study, pain may result from impingement of sutures and prosthetic material on nerves [12,23-25]. With no transmitting nerve present following neurectomy, there is reduced pain even with performance of tasks.

In this study non-neuropathic pain per se, can be initiated by scar tissue, mechanical pressure by the folded mesh, and excess fibrosis [12]. Coughing and squatting result in increased intra abdominal pressure which in turn stretches out the layers of the anterior abdominal wall resulting in pain. We chose squatting as a parameter because it is associated with 2 vital physiological activities in a typical low-income environment: defaecation (in both males and females) and micturition (in females). In this study, pain on performance of these tasks was significantly reduced in the group that had IHN neurectomy.

There were limitations encountered during the study. Firstly, assessment of pain using the VAS, to some extent, lacks objectivity. Pain thresholds tend to vary from person to person. It may affect outcomes of this study. Secondly, comprehensive evaluation of hernia repairs ought to include long-term outcome by assessing rates of recurrences and the occurrence of chronic postoperative pain, months to years later. These were not assessed for in this study. Thirdly, the amount of activity of the participants after surgery may influence the feeling of pain, the primary outcome.

## Conclusion

IHN neurectomy significantly reduced postoperative pain in patients who underwent Lichtenstein repair in the short-term and medium-term postoperative period. Task induced pain was also significantly reduced in patients who had IHN neurectomy as compared to those who did not have the neurectomy as part of their hernia repair. In future studies, it would be important to evaluate for neuropathic and somatic pain after a longer follow up period of 6 months to 2 years. During this period tissue repair would have gone through its entire process, including reorganization and remodeling, allowing for a more comprehensive evaluation.

We recommend IHN neurectomy as a procedure to reduce postoperative pain in patients undergoing Lichtenstein repair for inguinal hernias (Figure 1).

## Authors' contributions

FB conceptualized the theme, conducted procedures, collected and analysed the data, and co-wrote the manuscript. PAO designed and wrote the manuscript.

SCK edited the manuscript. PAO, SCK and OK monitored the study. All authors read and approved the final manuscript.

## Acknowledgement

The authors wish to warmly thank SRs. Juliet Nabayego, Juliet Ochom and Agnes Navuga for the practical assistance rendered in conducting the study. We are also most grateful to surgeons and residents of the Department of Surgery, and the other nursing staff of Surgical Out Patient's Department Clinic, Mulago Hospital, for the moral and material support.

## References

1. Bay-Nielsen M, Kehlet H, Strand L, Malmstrøm J, Andersen FH, et al. (2001) Quality assessment of 26,304 herniorrhaphies in Denmark: a prospective nationwide study. *Lancet* 358: 1124-1128.
2. Odula PO, Kakandel (2004) Groin Hernias in Mulago Hospital, Kampala. *East Central Afr J Surg* 9: 48-52.
3. Manyilira W, Kijambu S, Upoki A, Kiryabwire J (2009) Comparison of non-mesh (Dersada) and mesh (Lichtenstein) method of inguinal hernia repair among black African patients, a short-term double-blind RCT. MMed (Surgery) Dissertation, Makerere University, Kampala.
4. Kingsnorth AN, Wright D, Porter CS, Robertson G (2002) Prolene Hernia System compared with Lichtenstein patch: a randomised double blind study of short-term and medium-term outcomes in primary inguinal hernia repair. *Hernia* 6: 113-119.
5. <http://ptolemy.library.utoronto.ca/reviews/2010>
6. Shulman AG, Amid PK, Lichtenstein IL (1992) The safety of mesh repair for primary inguinal hernias: results of 3,019 operations from five diverse surgical sources. *Am Surg* 58: 255-257.
7. Gilbert AI, Graham MF, Voigt W (1999) A bilayer patch device for inguinal hernia repair. *Hernia* 3: 161-166.
8. Kakande I, Nassali G, Kituuka O, Day Surgery (2005) The norm for elective surgery. *East Central Afr J Surg* 11: 23-27
9. Joysna W (2005) The current status of day care surgery: a review. *Indian J Anaesth* 49: 459-466.
10. Marshall SI, Chung F (1999) Discharge criteria and complications after ambulatory surgery. *Anesth Analg* 88: 508-517.
11. Poobalan AS, Bruce J, King PM, Chambers WA, Krukowski ZH, et al. (2001) Chronic pain and quality of life following open inguinal hernia repair. *Br J Surg* 88: 1122-1126.
12. Hakeem A, Shanmugam V (2011) Current trends in the diagnosis and management of post-herniorrhaphy chronic groin pain. *World J Gastrointest Surg* 3: 73-81.
13. Joshi GP, Rawal N, Kehlet H, PROSPECT collaboration, Bonnet F, Camu F, et al. (2012) Evidence-based management of postoperative pain in adults undergoing open inguinal hernia surgery. *Br J Surg* 99: 168-185.
14. Caliskan K, Nursal TZ, Caliskan E, Parlakgumus A, Yildirim S, et al. (2010) A method for the reduction of chronic pain after tension-free repair of inguinal hernia: iliohypogastric neurectomy and subcutaneous transposition of the spermatic cord. *Hernia* 14: 51-55.
15. New York school of regional anaesthesia: Ilioinguinal and iliohypogastric blocks.
16. Wijsmuller AR, van Veen RN, Bosch JL, Lange JF, Kleinrensink GJ, et al. (2007) Nerve management during open hernia repair. *Br J Surg* 94: 17-22.
17. Aasvang E, Kehlet H (2005) Surgical management of chronic pain after inguinal hernia repair. *Br J Surg* 92: 795-801.
18. Association of Anaesthetists of Great Britain and Ireland; British Association of Day Surgery (2011) Day case and short stay surgery: 2. *Anaesthesia* 66: 417-434.
19. Jacquet E, Puche P, Alahyane J, Jaber S, Carabalona JP, et al. (2004) Evaluation of inguinal hernia in ambulatory surgery. *Journal of ambulatory surgery* 15: 144-154.
20. Kyamanya P (2002) Modified Bassini versus Lichtenstein technique of inguinal

- 
- hernia repair in Mulago Hospital, Kampala. MMED (Surgery) Dissertation, Makerere University, Kampala.
21. Matovu A (2007) Short term clinical outcomes following elective day care primary inguinal hernia repair in Mulago Hospital, Kampala. MMED (Surgery) Dissertation, Makerere University, Kampala.
22. Cunningham J, Temple WJ, Mitchell P, Nixon JA, Preshaw RM, et al. (1996) Cooperative hernia study. Pain in the postrepair patient. *Ann Surg* 224: 598-602.
23. Heise CP, Starling JR (1998) Mesh inguinodynia: a new clinical syndrome after inguinal herniorrhaphy? *J Am Coll Surg* 187: 514-518.
24. Bay-Nielsen M, Nilsson E, Nordin P, Kehlet H; Swedish Hernia Data Base the Danish Hernia Data Base (2004) Chronic pain after open mesh and sutured repair of indirect inguinal hernia in young males. *Br J Surg* 91: 1372-1376.
25. Aasvang E, Kehlet H (2005) Chronic post operative pain: the case of inguinal herniorrhaphy. *Br J Anaesth* 234: 345-353.