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Outcome of Lichtenstein inguinal hernioplasty with self gripping polyester mesh

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Abstract

Background: The introduction of synthetic prosthesis for open inguinal hernia repair has reduced the rate of recurrence, allowing research to focus on safeguard against postoperative pain. In an attempt to decrease chronic pain, a partially absorbable, light weight and self-gripping mesh was invented. This study evaluated short-term outcomes of Lichtenstein technique of hernia repair using Parietex ProGrip monofilament polyester mesh in Egyptian patients with inguinal hernias.

Patients and Methods: Prospective analysis of 50 patients underwent Lichtenstein technique for hernia repair using the Parietex ProGrip mesh between October 2013 and April 2016 at Al-Azhar university hospital, Assiut, Egypt. The primary outcome was chronic pain measured at 3 weeks, 3, 6, and 12 months postoperatively. Secondary outcomes were perioperative and early postoperative complications, return to usual activities and recurrence rate of the hernia. A difference in pain between preoperative and postoperative values was calculated at all follow-up time points.

Results: Fifty cases (all males) were studied. Mean ± standard deviation (SD) patient age was 39.2 ± 10.4 (range 18–60) years. Most hernias were Gilbert's type II [12 (24%)] or III [16 (32%)]. During 12 months postoperatively, none of the patients developed systemic postoperative complications or recurrent hernia. The mean ± SD pain visual analog scale score decreased from 12.8 ± 8.4 after 3 weeks to 0.72 ± 2.2 after 6 months. From postoperative 3 weeks to 6 months, there were notable improvements in health and also in health-related quality of life; mean ± SD visual analog scale EuroQoL score increased from 72.1 ± 5 to 93.2 ± 4 and mean ± SD HR EuroQoL score from 0.60 ± 0.3 to 0.92 ± 0.2. At 6 months, mean scores of the eight dimensions of the short form SF-36 questionnaires had raised from baseline.

Conclusion: The use of self-gripping Parietex ProGrip composite monofilament polyester mesh in Lichtenstein inguinal hernia repair is rapid, effective, simple, and safe. It is correlating with low postoperative groin pain and improved quality of life activities patients.

Keywords: inguinal hernia, lichtenstein repair, parietex progrip, pain, quality of life

1. Introduction

Inguinal hernia regardless of sub-type is one of the commonest surgical diseases that a general surgeon has to repair. Understanding of the anatomical nature of the inguinal canal and pathophysiological basis of inguinal hernia and improved surgical management have certainly improved surgical outcomes for most patients. The pace of evolution of new techniques of inguinal hernia repair has been accelerated with the introduction of the tension-free inguinal hernioplasty, the laparoscopic hernioplasty and with development of the specialized hernia clinics. Traditional herniorrhaphy is fast giving way and replaced with routine tension-free hernioplasty. Mesh repair is now the procedure of choice than suture repair all over the world. The Lichtenstein tension-free technique has become the most considerably used one. Since its introduction, it became the most widely performed repair of groin hernia. There is a consensus that tension-free hernioplasty is the gold standard in the repair of inguinal hernia because of lower recurrence rates and higher patient comfort [1].

Among the several tension-free techniques, the Lichtenstein's method has gained remarkable popularity due to its advantages of easy-to-perform, better patient comfort and less tissue dissection. [2] Because of the fact that the rate of chronic pain is higher than the rate of recurrence after open repair of inguinal hernia, the tension-free inguinal hernia repair introduces questions concerning the long-term safety of implantation of mesh material, especially the risk of chronic pain [3]. The rate of chronic groin pain following inguinal hernia repair ranges from 11 to 40 per cent [4], furthermore, the incidence of awful postoperative inguinal pain that interruption with life daily activities is recorded to be as high as 6% [5]. Meanwhile such chronic pain can be disabling, and in half of the cases, it leads to depression and time off from work, with job loss as an ultimate result in one-fourth of patients [6].

The reason for such chronic inguinal pain subsequent to hernia repair is unclear. It may results from mesh material, its structure and interaction with tissue, scarring, direct nerve damage, entrapment by fixation sutures, entrapment in fibrous tissue, or following genesis of meshoma [3]. Although pain may be decreased by meticulous identification of groin nerves, other authors have studied alternative prosthetic materials. Use of lightweight polypropylene mesh accompanied by less postoperative pain [7] and diminution of foreign body sensation [8]. Because of these facts, fixation of the mesh during operation continues to be a focus of interest. Different fixation materials and procedures have already been investigated to determine whether and to which extended fixation of mesh is a source of acute and chronic pain [9].

A new self-gripping mesh (Parietene Progrip, Covidien, Zurich, Switzerland)) has been developed to replace suture fixation and also to diminish the formation of excessive fibrosis during healing. This self-gripping mesh is made of

lightweight isoelastic large-pore knitted monofilament polypropylene [approximately 45 per cent lighter than standard polypropylene mesh (38 g/m 2 versus 85 g/m 2)]. It incorporates absorbable microgrips to provide self-gripping fixation during the first few months after implantation [10]. It secures quickly without sutures, tacks, fibrin glue, or any other form of fixation. The microgrips are club-shaped 1mm prominences that are manufactured from biodegradable polylactic acid (PLA). Polylactic acid micro-hooks adhering to the environment tissues are absorbed over time, resulting in actually sutureless repair. The microgrips amalgamate into the tissue for about 0.5 mm below the lower rim of the mesh and provide stronger tissue incorporation at 5 days than fixation with staples [11]. Fixation is, therefore, greatly facilitated without the requirement for sutures that can perforate underlying tissues and damage groin cutaneous nerves. One study 10 using ProGrip™ demonstrated that patients reported virtually no pain (median score 0 on a 0–10 visual analogue scale (VAS)) after 1 year of follow-up. Interim results of a recent multicentre study [12] found that duration of surgery was 6·5 min (17 per cent) shorter with the ProGrip™ mesh. The aim of the present study is to evaluate clinical outcomes following sutureless ProGrip™ mesh repair as regard to chronic pain as the main endpoint, and with other postoperative complications as secondary.

2. Patients and Methods

This was a prospective study investigating the outcomes of open hernia repair with Covidien Parietex ProGrip low density monofilament polyester mesh between October 2013 and April 2016 at Al-Azhar university hospital, Assiut, Egypt. Sixty two patients underwent inguinal hernia repair with this type of mesh. Twelve patients were lost in follow up period. Only 50 patients completed follow up for one year and were included in the study.

Inclusion and exclusion criteria

All male patients aged from 18 years to below 60 having an elective open primary inguinal hernia repair with porsthesis were eligible for the study. Exclusion criteria were: bilateral inguinal hernia, recurrent hernia, complicated hernia, inguinoscrotal skin infection, femoral hernia, chronic pain associated with previous locoregional surgery or inability to complete follow-up.

Self-gripping mesh

In 2008, Covidien launched ProGrip™ mesh (Figure 1), a self-gripping mesh indicated for the use in inguinal and incisional hernia repairs. ProGrip™ as designed to offer patients greater comfort following surgery, and allow physicians the ability to position and secure the mesh in less than 60 seconds, which may contribute to the reduction of operation time. The macroporous polyester mesh has resorbable micro-grips on one side of the mesh made from polylactic acid (PLA), with adhesive properties without fibrin glue, tacks, sutures, or any other fixative (Figure 2) [13]. The aim of the current study was to evaluate short term outcome (one year postoperatively) following sutureless ProGrip mesh repair. Specifications of the mesh are: prosthetic material: monofilament polyethylene terephthalate (PET); selfgripping material: monofilament polylactic acid (PLA); microgrips/cm^2: 36; microgrip absorption time: >18 months; weight before absorption: (82g/m^2); weight after absorption: (49g/m^2 - lightweight); pore size (height by width): 1.8 x 1.8mm (macroporous); sterilization method: ethylene oxide; shelf-life: 18 months. Ordering codes [left side: TEM1208GL 12 x 8 cm (4.7”x 3”); right side: TEM1208GR 12 x 8 cm (4.7”x 3”)].

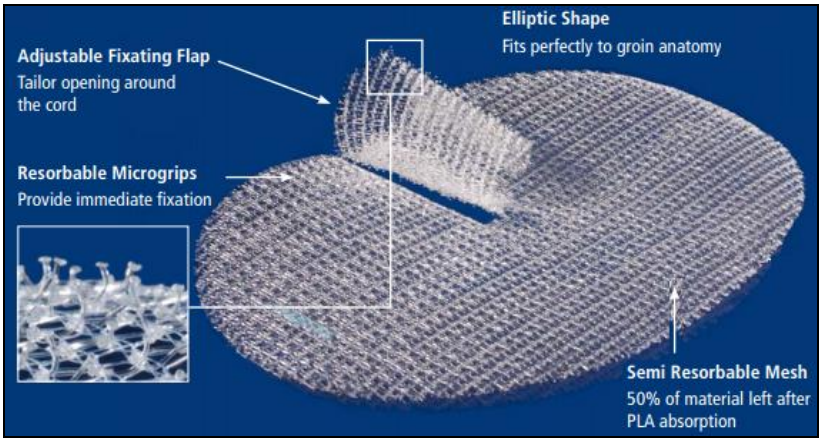

Fig 1: Covidien ProGrip self-gripping mesh. [13]

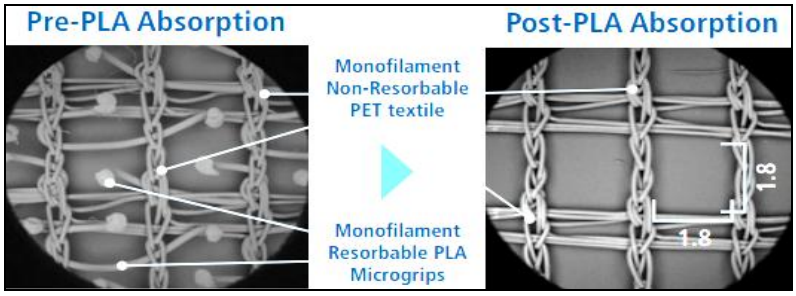

Fig 2: The macroporous polyester mesh (monofilament polyethylene terephthalate - PET) has resorbable polylactic acid (PLA) micro-grips on one side of the mesh. [13]

Data collection

The Gilbert's classification [14] was used for classification of the hernias in this study. Cases were also classified according to the American Society of Anesthesiologists (ASA) criteria for assessment of comorbidities present before the surgical procedure. [15] Outcome measures included the duration of surgery and also the duration of mesh placement, health status during follow-up, and postoperative hernia recurrence. Pain was estimated using the EuroQoL visual analog scale (EQ-VAS) (it includes scores from 0 - 100, where 0 represents no pain at all and 100 indicates the most severe type of pain). The EuroQoL–Five Dimensions (EQ-5D) questionnaire and short form-36 (SF-36) were used to assess general health. The EQ-5D consists of the EQ-5D descriptive system and the EQ-VAS. The descriptive system consists of the following five criteria: (1) mobility; (2) self-care; (3) usual activities; (4) pain/discomfort; and (5) anxiety/depression [16]. The EQ-VAS records the respondent's self-rated health on a vertical, visual analogue scale where the endpoints are labeled "Best imaginable health state" and "Worst imaginable health state". [16] Health scores (EQ-VAS) ranged from 0 (the worst imaginable health state) to 100 (the best imaginable health state) [16] while health-related quality of life (HR-EuroQoL) ranged from 0 (worst) to 1 (best). [17] The EQ-5D health state may be converted to a single summary index by applying a formula that essentially attaches weights to each of the levels in each dimension (VAS Euro-QoL). The SF-36 consists of eight scaled scores, namely, general health, mental health, vitality, physical functioning, role physical, role emotional, social functioning, and bodily pain, and. Each scale is directly transformed into a 0 – 100 scale on the pretension that each question carries equal weight. The outcomes of the SF-36 were transformed from 0 (worse) to 100 (best) points based on those eight dimensions [18].

Surgical technique

All patients received spinal anesthesia. An 8–10-cm skin incision just cranial to the inguinal ligament allowed identification of the external oblique aponeurosis. This was opened, followed by dissection and dealing with the hernial sac. A direct type hernia was redressed using a running stitch. The prefabricated neo-annulus of the mesh was wrapped around the spermatic cord and placed beneath the aponeurosis of the external oblique muscle. Overlap on the pubic tubercle and the inguinal ligament was at least 1 cm (Figure 3). Thanks to the micro hooks grip, fixation of the mesh is immediate, additional fixation suture is not required. The aponeurosis of the external oblique was then closed over the mesh using a running polypropylene suture. Subcutaneous tissue and skin were closed with absorbable sutures [19].

The surgeon was cautious to identify the ilioinguinal nerve, the iliohypogastric nerve and, if possible, the genital branch of the genitofemoral nerve. A nerve was resected prophylactically if it was injured or interfering with proper mesh positioning. Immediately after surgery a questionnaire evaluating the type of anesthesia, duration of surgery (skin-to-skin), handling of the hernia and its characteristics, nerve identification and possible resection, perioperative complications, and the quality of the mesh fixation. This case record form was stored in a separate file. All operations were performed by single surgeon who was experienced in Lichtenstein and self-gripping mesh techniques.

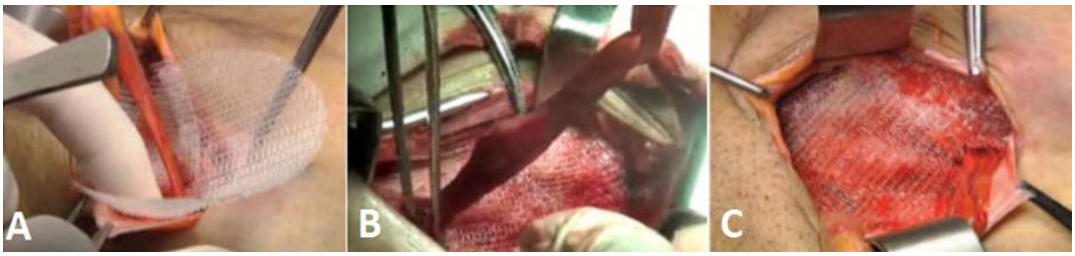

Fig 3: (A) Closure of the self-gripping flap around the cord. (B) Spreading mesh under of the external oblique aponeurosis. (C) The mesh anchors to the tissue with the micro-grips immediately with no need for suture fixation.

Follow-up

Before surgery, patients were informed about the nature of the study, and after 2 weeks for consideration they completed an informed consent form. Baseline questionnaires were then obtained concerning patient characteristics, levels of groin pain using a standard VAS (150-mm scale) and a six-point verbal rating scale (VRS), and influence of pain on daily activities. At 3 weeks after surgery, patients fulfilled a similar questionnaire in the outpatient clinic investigating return to work, hobbies and household duties. Wound healing was checked, postoperative complications and somatosensory alterations in the groin. Three months and 6 months after the operation, the same questionnaires were repeated. One year after surgery, patients were invited to attend for a physical examination at the outpatient department, followed by completion of the same set of questionnaires.

Primary and secondary outcome measures

The primary outcome measure was chronic pain measured at 3 weeks, 3, 6, and 12 months postoperatively. Secondary outcomes were perioperative and early postoperative complications, return to work and hernia recurrence rate. A difference in pain between preoperative and postoperative values was calculated at all follow-up time points.

Statistical analysis

The hypothesis was that the reported rate of chronic pain of any intensity (40 per cent) could be reduced in the self-gripping mesh. Analysis was done with SPSS version 17.0 (IBM, Armonk, New York, USA). $P < 0{\cdot}05$ was considered statistically significant.

3. Results

Patient characteristics

A total of 50 eligible patients, mean ± standard deviation (SD) age 39.2 ± 10.4 years, were included in the study (Table 1); all of them were males (100%). The majority of patients with inguinal hernia were diagnosed as Gilbert's type II (n = 12;

24%) and type III (n = 16; 32%). Most patients in the study group were ASA Grades 1 (n = 23; 46%) or Grade 2 (n = 22; 44%), with ASA Grade 3 accounting for 10% (n= 5) of all patients. No patient was classified as ASA Grade 4 or Grade 5. The mean ± SD surgical duration was 28 ± 5.6 minutes (range, 22–58 minutes) and the time taken for self-gripping mesh placement ranged from 40 seconds to 180 seconds (mean 70 ± 42 seconds).

Table 1: Patient characteristics and surgical details

Patient characteristics		All patients (n = 50)
Age (y)		39.2 ± 10.4 (18–60)
Gender	Female	0 (0%)
	Male	50 (100%)
BMI (kg/m^2)		24.2 ± 2.2 (16.8–30.2)
Hernia location	Left	18 (36%)
	Right	32 (64%)
Symptomatic hernia	Yes	42 (84%)
	No	8 (16%)
Duration of hernia (years)		6 ± 3.4
Risk factors	No risk factors	26 (52%)
	COPD	3 (6%)
	Chronic constipation	3 (6%)
	BPH	6 (12%)
	Obesity	2 (4%)
	Smoking	32 (64%)
	Heavy manual labour	10 (20%)
	Aortic aneurysm	1 (2%)
ASA score	1	23 (46%)
	2	22 (44%)
	3	5 (10%)
	4	0
	5	0
Gilbert classification	I	10 (20%)
	II	12 (24%)
	III	16 (32%)
	IV	7 (14%)
	V	4 (8%)
	VI	1 (2%)
Surgical duration (min)		28 ± 5.6 (22–58)
Mesh placement time (sec)		70 ± 42 (40–180)

Hernia characteristics

There were more right-sided hernias [32 (64%) versus 18 (36%) on the left side]. The mean duration of symptoms before surgical intervention was 6 ± 3.4 years. Just 8 hernias were asymptomatic (16%). Most hernias were either medial or lateral, but 12 (24%) were found to have both a lateral and a medial component.

Surgical characteristics

Ilioinguinal nerve was identified and preserved in all patients. The iliohypogastric nerve and the genital branch of the genitofemoral nerve were identified in 17 (34%) and 22 (44%) of the patients respectively. Each nerve possibly interfering with proper mesh positioning was resected, in accordance with the protocol. Accidental nerve resections were also recorded. In total, 2 iliohypogastric nerves (4%), 3 ilioinguinal nerves (6%) and one genital branches of the genitofemoral nerve (2%) were resected prophylactically. Mean duration of surgery was 28 ± 5.6 (22–58 min), and mean mesh placement time was 70 ± 42 (40–180 sec).

Primary outcome (Health, pain, and health-related quality of life)

Postoperative pain, health status, and HR-QoL at 3 weeks, 3, 6, and 12 months of follow-up are shown in Table 2. The mean ± SD pain VAS score decreased from 12.8 ± 8.4 at 3 weeks to 0.2 ± 0.5 at 12 months. Of the 50 cases, 41 (82%) patients reported no/slight postoperative pain at 3 weeks; this number increased to 50 (100%) at 3 months. The mean ± SD health VAS EuroQoL score increased from 72.1 ± 5 at 3 weeks to 98.8 ± 1 at the end of the follow-up period. The number of patients classified as having good health status was 43 (86%) at 3 weeks and 50 (100%) at 3 months postoperatively. In addition, the mean ± SD HR-QoL scores increased dramatically from 0.60 ± 0.3 at 3 weeks to 0.98 ± 0.1 at the end of the follow-up period. The number of patients who complained of bad health-related quality of life (score < 0.3) dramatically declined from 12 (24%) at 3 weeks to 0 (0%) at 3 months postsurgery. The incidence of moderate HR-QoL was 21 (42%) at 3 weeks and 0 (0%) at 3 months. Overall, none of the patients reported severe pain (score > 60) or low health status (score < 30) during the entire follow-up. All 50

cases achieved good quality of life with good health status and no/slight pain after 3 months of follow-up.

All 50 patients completed the SF-36 assessment at baseline and at 12 month follow-up (Figure 4). The postoperative SF-36 score decreased in all eight domains at three weeks. However, the SF-36 scores in five of the eight domains (role emotional, mental health, vitality, bodily pain, and general health) were lower at 3 months than at baseline. At the end of the follow-up, there were marked improvements in mean SF-36 scores over baseline for all eight dimensions.

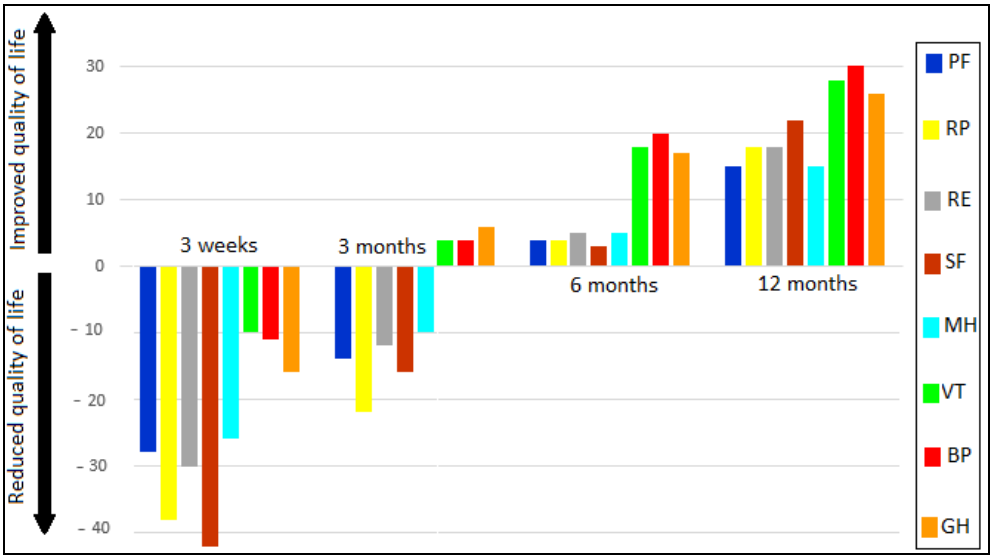

Fig 4: Changes from 3 weeks to 12 months follow-up in mean SF-36 dimension scores. PF = physical functioning; RP = role physical; RE = role emotional; SF = social functioning; MH = mental health; VT = vitality; BP = bodily pain; GH = general health.

Table 2: Postoperative health, pain, and health-related quality of life.

Postoperative Characteristics	All patients (n = 50)			
	3 weeks	3 months	6 months	12 months
Pain (visual analog scale) 0–100				
Pain VAS score	12.8 ± 8.4	3.2 ± 5.1	0.72 ± 2.2	0.2 ± 0.5
No/slight (< 30)	41 (82%)	50 (100%)	50 (100%)	50 (100%)
Moderate (30–60)	9 (18%)	0 (0%)	0 (0%)	0 (0%)
Severe (> 60)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Health (visual analog scale EuroQoL) 0–100				
VAS EuroQoL score	72.1 ± 5	82.3 ± 4	93.2 ± 4	98.8 ± 1
Bad (< 30)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Moderate (30–60)	7 (14%)	0 (0%)	0 (0%)	0 (0%)
Good (> 60)	43 (86%)	50 (100%)	50 (100%)	50 (100%)
Health-related quality of life (HR EuroQoL) 0–1				
HR EuroQoL Score	0.60 ± 0.3	0.82 ± 0.1	0.92 ± 0.2	0.98 ± 0.1
Bad (< 0.3)	12 (24%)	0 (0%)	0 (0%)	0 (0%)
Moderate (0.3–0.6)	21 (42%)	0 (0%)	0 (0%)	0 (0%)
Good (> 0.6)	17 (34%)	50 (100%)	50 (100%)	50 (100%)

Secondary outcomes

No anesthesia-related or treatment-related morbidities or mortalities were reported. Five patients (10%) developed complications (seroma, 2; superficial wound infection, 1; urinary retention, 1; and scrotal edema, 1). haematoma, deep wound infection, urinary tract infection, epididymitis, and ischaemic orchitis were not recorded. At the 3-week follow-up, 36 patients (72%) had returned to work. The proportions of patients who were able to do their hobbies or household duties were also similar. There was no readmission, hernia recurrence, systemic complications, or death during 12 months of follow-up.

4. Discussion

The ideal outcome in inguinal hernia surgery is to provide a recurrence-free repair while minimizing the morbidity, disability and both acute and chronic pain that the patient may experience. At the present time, this outcome must be definitively achieved after more than 100 years of hernia surgery. The introduction of mesh prosthesis helped surgeons to decrease recurrence rate of less than 5%. On the contrary, chronic pain (of neuralgic origin) has elicited as one of the most important negative clinical sequel which can follow inguinal hernia repair. The pathogenesis of chronic pain which is defined as defined as sustained discomfort and/or pain after 3 months of surgery is not clearly understood [20].

A prosthetic mesh has certain features like elasticity, density, material, strength, and pore size. Standard heavy weight polypropylene mesh is the most frequently used one because it is affordable, available in most hospitals, inert, non-absorbable, and have tensile strength enough to prevent recurrence. Nevertheless, there are actual problems with mesh

usage as foreign body sensation at the site of surgery and chronic postoperative pain or discomfort. This created a disagreement about standard heavy weight polypropylene mesh. Mesh made of Polyester might be an appropriate alternative, but it is not popular as polypropylene mesh [21].

Newer light weight meshes have been manufactured to overcome those problems. Nevertheless, all light weight meshes are very expensive than standard heavy weight meshes. There are also coated and composite polyester and polypropylene meshes in the market. The aim of the coating is to prohibit host response to the prosthesis, yet still provide adequate strength for repair [22].

The absence of tension during positioning of the mesh and closure of the prosthesis around the cord can decrease pain created by tension on surrounding tissues and more particularly if sutures can be avoided. The grip provides the advantage of obtaining uniform fixation on the whole surface of the mesh that can decrease the like hood of hernial sac sliding between the prosthesis and the transversalis fascia. The development of chronic pain is of ongoing concern, as its onset is unpredictable. Chronic pain rates vary from 11 to 40 per cent, depending on definition [23, 24].

With this mesh, improved quality of life of the patients was expected by reducing post-operative pain. The lightweight mesh can contribute to reduce this adverse outcome [25], in case of neurological pain, the resorption of fixating grip in about one and half year should allow reduction and disappearance of the pain.

To the best of my knowledge, this report is the first study evaluating the use of Parietex ProGrip low density monofilament polyester mesh in open inguinal hernia repair in in the Egyptian population. The results of the current short-term study suggests that repair of inguinal hernia with the Lichtenstein technique using self-gripping mesh is efficient and safe procedure for the Egyptian patients. Similar conclusions were drawn from previous studies conducted in China [26] and Western countries [27]. Furthermore, in the current study, superior results were encountered with regards to postoperative pain, discomfort, health status, HR-QoL, and eight characters of the SF-36.

The sutureless ProGrip mesh is a revolutionary modification as it can be secured without sutures, avoiding any risk for nerve entrapment, and preserving relationship of anatomical structures. Moreover, the resorbable PLA micro-grips of the ProGrip mesh are substantially blunt to prevent damage to the surrounding tissues including delicate ductus deferens and nerve fibers. Kolbe *et al*. [28] examined the impact of ProGrip mesh on fertility in rat models and found that self-gripping mesh posed no harm to the ductus deferens. Given the larger dimensions of the human ductus deferens, there is little or no risk for a detrimental effect on fertility by application of a ProGrip mesh on exposed tissue [28].

In general, the ProGrip mesh is disentangled and kept flat using two graspers during placement [29]. This, however, can make operative manipulation less difficult, particularly if the size of the incision is kept to > 6 cm for aesthetic reasons. For obese patients, more than one attempt may be needed to attach the mesh in place through the incision in deep fat layers. Repeated manipulation of mesh placement should be avoided as it may reduce the adherence of the mesh to the tissues, thus increasing the risk of mesh dislocation or migration which may predispose to hernia recurrence and chronic pain after surgery.

The mean operation time in present study was 28 ± 5.6 (22–58) minutes, which is comparable to times reported in other clinical trials using the laparoscopic or open approach [30-32, 33, 34-36]. There were also no reports of hernia recurrence or postoperative complications among the present cohort. The self-gripping mesh provides the advantage of obtaining fixation without using any sutures entrapping nerves in the groin. Furthermore, this method of mesh placement minimized the time of operative manipulation. This may have contributed to the significantly lower pain VAS scores in the current study compared with those described in previous studies [33, 37].

Potential advantages of a self-gripping mesh need to be balanced against a possible disadvantage of higher recurrence rates in the long term. Other ProGrip™ studies [31, 38, 39] have shown recurrence rates of up to 2 per cent after 1 year. Unlike these, the present study protocol did not allow for a medial stitch to fix the mesh, which has been shown to result in more postoperative pain [30].

All patients reported no/slight pain with good health status and high HRQoL scores after 3 month follow-up. While there were decreases in the SF-36 dimension scores at 3 weeks and 3 months after surgery compared with baseline scores, the SF-36 values showed a remarkable improvement at 6 and 12 months of follow-up. Scores in all eight health parameters of the SF-36 were above baseline at 6 months of follow-up assessment, demonstrating the actual benefits of using the ProGrip mesh on postoperative health and quality of life. Analogous results were published recently by Post *et al*. [40] The prospective nature of this study may be viewed as an advantage; as the surgical technique was standardized, and careful postoperative follow-up was carried out to assess the hernia recurrence rate, pain, general health status, and patient quality-of-life. Further long-term follow-up studies in Egyptian populations need to be undertaken.

5. Conclusion

Lichtenstein open inguinal hernia repair using Parietex ProGrip low density polyester mesh is a simple, rapid, effective, and safe method for inguinal hernia repair, and may reduce postoperative pain, improve patient general health, and quality of life.

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