Application of cyanoacrylate for mesh fixation in open inguinal hernia repair

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Aim
This work aimed to identify the outcomes of mesh fixation using cyanoacrylate in open inguinal hernia repair with regard to long-standing groin pain, operative time, rate of recurrence, degree of postoperative pain, and other complications.
Patients and methods
This was a prospective cross-sectional analytic study on 54 patients complaining of unilateral inguinal hernia that evaluated the usage of cyanoacrylate in open inguinal hernioplasty as a material for mesh fixation. The study was conducted in the General Surgery Department between November 2016 and February 2018. Male patients with denovo unilateral inguinal hernia suitable for elective open mesh repair were involved in the study and gave informed consent. Follow-up was carried out during a period ranging from 1 to 6 months. The primary outcome was early complications including early postoperative pain, bleeding, infection, seroma, and operative time. Secondary endpoints were long-standing groin pain and recurrence rate.
Results
About 48 cases of 54 (88.9%) needed less than 4 min for mesh fixation in open inguinal hernia repair. An overall 44% of cases have reported no early postoperative pain. Only 5.6% of cases have reported a status of chronic groin pain, and no cases have been reported for recurrence.
Conclusion
The results have led us to recommend the usage of cyanoacrylate for fixation of mesh in inguinal hernia repair to decrease the occurrence of postoperative complications in inguinal hernioplasty, generally, and the long-standing groin pain particularly, especially in patients who are more prone to experience pain.

Keywords:
cyanoacrylate, fixation, glue, hernia, inguinal, mesh

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Introduction

Inguinal hernioplasty is one of the most common surgical procedures, and hence improvements in clinical outcome are important. About 3.6% of the male population in the USA and France are subjected to inguinal hernia repair, and it is the second most common operation [1].

Lichtenstein hernioplasty, first recorded in 1989 [2], is accepted widely for inguinal hernioplasty due to its efficacy, safety, and low rates of recurrence [3]. Despite the success of such a technique in inguinal hernia repair, postoperative long-standing groin pain occurrence has posed a great challenge to surgeons [3]. The recorded incidence of chronic groin pain (CGP) ranged from 0.7 to 62.9% [4,5]. The cause of CGP can be either neuropathic or non-neuropathic in origin.

Neuropathic causes include trauma to the regional nerves of the inguinal region or nerve entrapment due to mesh-related fibrosis, postoperative fibrosis or suture fixation.

Non-neuropathic causes of CGP include the periosteal reaction of sutures at the pubic tubercle, mesh displacement, inflammatory reaction to mesh, and heavy weight mesh usage for the repair [6].

Various techniques have been used to reduce CGP. Careful dissection by identification and preservation of the regional nerves during the operation have been found to reduce the occurrence of CGP from 21.6 to 5.5% [7]. The use of lightweight mesh has been proved to reduce the occurrence of CGP without increasing the rates of hernia recurrence [6].

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Recently, the techniques of an atraumatic mesh fixation by using fibrin or butyl-2-cyanoacrylate glues have increased in the general surgery field. Glue mesh fixation may decrease the whole operating time and reduce the frequency of postoperative pain when compared with mesh fixation by suture [8].

Tissue glues have been found for over 20 years and used in surgery in various indications like skin wound closure [9], hemostasis during liver surgeries [10], and endoscopic treatment of gastroesophageal variceal bleeding [11]. Usage of fibrin-based (Tissucol/Tisseel e Baxter Healthcare) and Nbutyl-2-cyanoacrylate-based adhesives (Glubran 2, GEM Srl) in inguinal hernioplasty was reported for the first time in the mid1990s [12,13].

Apprehensions remain with regard to the potential for displacement of the mesh that may occur secondary to reduced adherence strength of the glue over time. This may lead to increased recurrence rates or abnormal sensation of the mesh by the patient [14].

Aim

This work aimed to identify the outcomes of mesh fixation using cyanoacrylate in open inguinal hernia repair with regard to long-standing groin pain, operative time, the rate of recurrence, the degree of postoperative pain, and other complications.

Patients and methods

This was a prospective cross-sectional analytic study that was carried out in the Department of General Surgery, Assiut University Hospital, during the period spanning from November 2016 to February 2018. It included 54 patients with unilateral inguinal hernia elected for open hernioplasty using cyanoacrylate (Histoacryl B Braun Surgical AG, GMBH (Braun Surgical AG. Melsungen, Hessen, Germany), Pack of five vials 0.5 ml REF 0052, 0105, CE 0123) as a material for mesh fixation. The study received approval from Faculty of Medicine Ethics Committee.

Inclusion criteria

Male patients, unilateral inguinal hernia, denovo with intact other hernia orifices were the inclusion criteria.

Exclusion criteria

Age under 20 or more than 70, recurrent hernia, complicated hernia, sliding hernia, bilateral oblique inguinal hernia were the exclusion criteria.

All who met the inclusion criteria had been admitted at Assiut University Hospital and underwent open inguinal hernia repair using an inguinal incision above the medial half of the inguinal ligament under local, spinal, or general anesthesia using cyanoacrylate as a material for mesh fixation and evaluated by the following:

(1) Postoperative pain.
(2) Duration of hospital stay.
(3) Long-standing groin pain.
(4) Postoperative complications such as bleeding, infection, recurrence, reaction (mesh seroma).
(5) The ratio of reduction of operative time.

Surgical technique

Operations were carried out under general, spinal, and local anesthesia using the same surgical technique (Lichnestien technique) using a polypropylene mesh as a prosthetic material. An inguinal incision of 5–7 cm was made to expose the external oblique aponeurosis. The external oblique fascia was then divided to expose the underlying cord and hernia. The hernia sac was dissected free from the associated cord structures.

Careful dissection should be considered to identify the regional nerves and retract them away from the area of dissection to avoid their injury. After complete separation of the sac from the cord, it was resected and then closed with absorbable suture material.

A 6×11 cm polypropylene mesh was placed against the floor of the inguinal canal extending from the pubic tubercle to behind the spermatic cord above the internal inguinal ring and overlapping both conjoint tendon and the shelving portion of inguinal ligament or pubic tract. The glue application is carried out through an insulin syringe or applicator to facilitate drop-wise distribution of the glue. An experienced assistant is able to apply over 20 drops. The drops of the glue were placed on the mesh, which was pressed gently against the floor of the inguinal canal (Figs 1 and 2).

Results

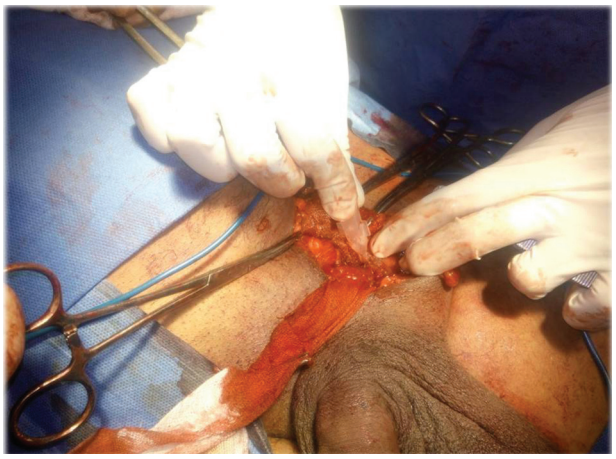
The study was conducted on 54 patients admitted to the General Surgery Department with a complaint of unilateral inguinal hernia. Male patients with primary unilateral inguinal hernia suitable for an elective open mesh repair were involved in the study and gave their consent. Site of hernia and comorbidities are shown in Tables 1, 2.

We experienced no intraoperative complications as well as no recurrence had occurred. About 48 cases of 54 (88.9%) needed less than 4 min for mesh fixation

in open inguinal hernia repair, and no case needed more than 4 min (Table 3).

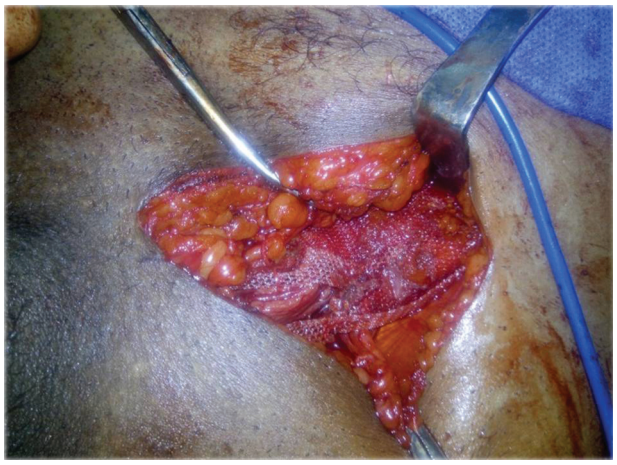
In particular, the 'glue' technique was considered easier and quicker with regard to its method of application and reduction of the whole surgical procedure. At postoperative follow-up, it was significant that most patients showed satisfactory results in terms of less pain and quicker return to their normal activities. They also showed smoother course with regard to secondary postoperative complications (infections, hematomas, seromas, and recurrence). Only nine (16.7%) cases reported early postoperative complications (Table 4).

Figure 1



Application of cyanoacrylate after the process of herniorraphy and mesh preparation.

Figure 2



View of the mesh after cyanoacrylate application.

A clinical check was performed at 3 and 6 months after the operation. According to Alfieri *et al.* [15], CGP was considered significant if it was still present at the surgical site for a period of more than 6 months after the operation.

Statistical analysis was performed using the statistical package for the social sciences, version 20. *P* value less than 0.05 was considered significant.

Postoperative pain was measured with meter-shaped visual analog scale by direct interview or by phone call at 3, 6 h, and 1 day after the operation. A visual analog scale is a method that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot be easily measured. It is mainly used in epidemiologic and clinical studies to identify the degree of severity or frequency of various symptoms [16]. Distribution of percentage of cases according to the degree of immediate postoperative pain in the current study is shown in Fig. 3.

Discussion

The introduction of surgical mesh to create a tension-free repair in inguinal hernia surgery in the 1990s was quickly used worldwide as a better surgical technique due to decreased rates of recurrence. Debate is still ongoing on the best surgical approach for this tension-free mesh repair. CGP is the most common complication after inguinal hernioplasty. An experimental study on 30 white male mice, found that cyanoacrylate glue can be used effectively as a method for closure of the abdominal wounds and can be used for mesh fixation without complications [17,18]. When we discuss our results concerning

Table 1 Distribution of cases according to the site of hernia

Variable	Right	Left	*P* value
Number of patients (%)	28 (51.9)	26 (48.1)	0.604

Table 2 Distribution of cases according to medical history

Variable	Present medical history (DM, HTN, neurological, and heart diseases)	Absent medical history	*P* value
Number of patients (%)	14 (25.9)	40 (74.1)	0.161

DM, diabetes mellitus; HTN, hypertension.

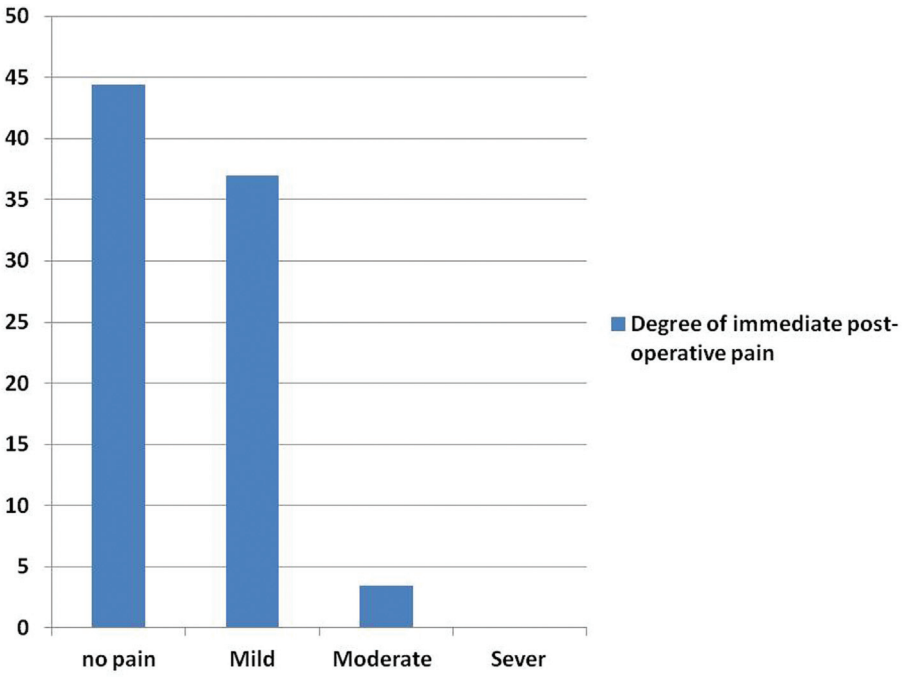
Table 3 Distribution of cases according to the time needed for mesh fixation after herniorraphy

Variable	1 min	Time needed for mesh fixation after herniorraphy				
		2 min	3 min	Less than 4 min	4 min	More than 4 min
Number of patients (%)	23 (42.6)	15 (27.8)	10 (18.5)	48 (88.9)	6 (11.1)	0 (0)

Table 4 Distribution of cases according to postoperative complications

Variable	Hematoma	Infection	Seroma	Total occurrence of early complications	Long-standing groin pain	Recurrence
Number of patients (%)	3 (5.6)	2 (3.7)	4 (7.4)	9 (16.7)	3 (5.6)	0 (0)

Figure 3



Distribution of the percentage of cases according to the degree of immediate postoperative pain.

early complications or recurrence, only nine (16.7%) cases had early postoperative complications and no recurrence. Our results were compatible to a study by Tebala *et al.* [19], which was carried out on 45 male patients (26 of them used cyanoacrylate glue fixation of the mesh) with no recurrence.

The usage of glue in mesh fixation has significantly proved its efficacy with regard to decreasing the time needed for mesh fixation in open inguinal hernia repair, as overall operative time was shorter using glue mesh fixation [GMF] (<4 min after herniorraphy in 88.9% of our cases). Helmy [20] reported a significant decrease in the operative time using GMF for unilateral inguinal hernia repair where 51.2% (22/43) of cases were handled in less than 30 min. The use of the glue decreased the operative time and the hospital stay.

As regards postoperative pain, in our study, 44.4% of cases have reported no postoperative pain, 37% reported mild degree of pain, and 18.6% have reported moderate degree of pain, which is compatible with the study of Shehata *et al.* [21], which proved that 78.9% of cases had reported no pain, 15.8% of cases reported mild degree of pain, and 5.3% of cases reported moderate degree of pain.

As regards early postoperative complications, 5.6% of cases in the current study have reported hematoma, 3.7% of cases have reported infection, and 7.4% of cases have reported postoperative seroma. However, Shehata *et al.* [21] reported that no cases had early postoperative complications after usage of cyanoacrylate for mesh fixation.As regards CGP, only 5.6% of our patients showed a complaint of long-standing groin pain after a period ranging from 3 to 6 months of the operation. However, Ladwa *et al.* [22] in the UK reported no cases with long-standing groin pain or recurrence after a period of 1 year using glue in mesh fixation.

Basically, the development of postoperative CGP in patients undergoing open inguinal hernia repair is a multifactorial phenomenon. Pain can be experienced due to nerve resection, nerve compression from sutures, foreign body reaction caused by the mesh, or tension on muscle fibers [14]. Moreover, careful identification of regional nerves and avoidance of their injury during surgery have been shown to reduce the overall incidence of CGP from 21.6 to 5.5% [7].

Variables such as foreign body sensation, groin numbness, and decreased groin compliance should have been considered because displacement or rolling up of the mesh may also cause these symptoms. In addition, a comparison is required to assess if using glue is economically viable and affordable for the population when compared with fixation using sutures.

Limitations of the study

First, this study was not a randomized controlled study; hence, a randomized prospective large study to compare between the traditional suture technique for mesh fixation and the glue fixation is necessary to conclude and recommend its use with scientific evidence. Second, the short follow up period in the present study is also a limitation; hence, another study is required with long follow-up.

Conclusion

The results and the clinical experience obtained from the patients included in our study using cyanoacrylate glue in the open inguinal hernioplasty confirmed the following:

(1) It was a simple, safe, and nontraumatic technique.
(2) It showed excellent immediate and long-term postoperative pain control in a mean follow-up period of 6 months.
(3) It aided in the reduction of the whole operative time.
(4) It had less early postoperative complications with regard to wound seroma, testicular hematoma, infection, and recurrence.

These results suggest that atraumatic mesh fixation with glue may potentially be another measure to reduce the incidence of CGP, taking into consideration that avoidance of regional nerve injury during surgery will also decrease the incidence of occurrence of pain. The results, in general, encourage the usage of glue mesh fixation in the treatment of inguinal hernioplasty.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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