

## ORIGINAL ARTICLE

# OPEN INGUINAL HERNIOPLASTY BY LICHTENSTEIN TECHNIQUE FOR MESH FIXATION: SUTURES VERSUS FIBRIN GLUE

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### Abstract

**Aim:** This was a prospective, randomized study undertaken from January 2008 to July 2009 firstly to assess post-operative pain, and secondly to verify whether or not this leads to a higher hernia recurrence rate.

**Methods:** This study covered a total of 116 patients with indirect inguinal hernias. On whom fixation of the mesh was undertaken differently, either by polypropylene sutures in 77 patients, or by fibrin glue in 39 patients.

**Results:** The two groups were equivalent for inclusion criteria and preoperative data. The complication rate was similar in the two groups. The operative time was shorter in the fibrin sealant group: 9 min. ( $p = 0.001$ ). There was no recurrence in the fibrin sealant or suture group after a minimum follow-up of 12 months.

**Conclusions:** Finally, a non-significant reduction in chronic pain was observed in the fibrin sealant group. This study confirms the effectiveness of fibrin glue in securing prosthetic meshes and reducing chronic inguinal pain.

**Keywords:** Hernia repair, mesh fixation, human sealant.

### INTRODUCTION

Groin hernia is a particularly frequent surgical disease. Moreover, surgical techniques have continued to progress. During the last 20 years, there has been considerable debate about the value of using mesh prostheses for wall reinforcement. Meta-analysis finally showed that the incidence of recurrence was lower after mesh repair.<sup>(1)</sup> These simple and rapid techniques have become very widely used and today account for 80–90% of groin hernia operations.<sup>(2)</sup>

The prosthetic material used is secured by either using a conventional suture, or with staples, in particular, in laparoscopic surgery. Despite the “tension-free” nature of these hernioplasties, sutures may cause strangulation of muscle fibres, or even a lesion or compression of the regional nerves, leading to invalidating pain or

dysesthesia.<sup>(3)</sup> One of the most frequent complications which present after abdominal wall hernia surgery is post-operative pain which, at times, is chronic and permanent and leads to poor quality of life.<sup>(4)</sup>

The incidence of these chronic complications was underestimated for a long time and is currently estimated to be between 0% and 75.5%. With the reduction or even disappearance of recurrences, this morbidity is now of primordial importance, and we therefore decided to modify the method used to anchor prostheses.<sup>(5)</sup> Fibrin glue has been used in many areas of surgical treatment in recent years because of its hemostatic and adhesive properties.<sup>(6)</sup> One example is hernia repair, where fibrin gluing has increasingly become established as an alternative method for mesh fixation. Promising initial experimental results have

shown that the strength of mesh fixation with fibrin glue is at least comparable to that using staples.<sup>(7)</sup> Increased fibroblast activity even resulted in better and faster incorporation of the mesh material.<sup>(8)</sup> A lower rate of early postoperative pain with earlier reconvalescence is reported, but also, and primarily, a reduction in chronic pain in comparison with mesh fixation using staples.<sup>(9)</sup> A significant decrease in seroma formation is described in most studies.<sup>(10)</sup>

The aim of this study was to assess post-operative pain using the tension-free technique and which brings in major variations: the fixation of the prosthesis using either suture material or fibrin glue. We also attempt to evaluate whether or not fixing the mesh with these glues leads to a higher recurrence rate.

## PATIENTS AND METHODS

This study was carried out on 116 patients between January 2008 and July 2009.

All patients were male, between the ages of 27 and 75 years. All patients were evaluated prospectively. The diagnosis was confirmed by clinical examination. Apart from the preoperative assessment required for anaesthesia, no additional examination was carried out.

All patients were operated with the same surgical technique in all cases, Lichtenstein (11), using a polypropylene mesh as prosthetic material. A total of 116 hernias were operated on. Group I: 77 operations were done using the conventional repair procedure with polypropylene sutures (prolene 2/0) for mesh fixation. Group II: 39 operations were done using fibrin glue for fixation of the mesh. All patients had been followed up for more than 12 months.

The inclusion criteria are age > 18 years, elective surgery, primary inguinal hernia and follow-up > 12 months.

The exclusion criteria are age > 80 years, emergency (obstruction, strangulation), recurrence, recent infection.

All patients were fully briefed about the procedure and informed consent was obtained.

Spinal anaesthesia was used. Antibiotic prophylaxis with Cephadrin (single dose of 2 g) was administered on induction and continuing with 1 g every 12 h post-operatively for a duration of 1 day.

Identical surgical procedures were used for the suture Group (I) and the fibrin sealant in Group (II), apart from the method used to secure the prostheses.

An inguinal incision of 5–6 cm was made to expose the external oblique aponeurosis. The ilioinguinal nerve was identified and safeguarded. The upper and lower leaves of the external oblique muscle were largely separated from the underlying tissues in order to

establish a space to allow the subsequent placing of the mesh.

The spermatic cord was then dissected and separated from the posterior wall. The cremaster muscle was incised longitudinally. Two flaps were therefore isolated and resected. The sac was separated from the cord, resected and then closed with an absorbable suture material.

In the suture group (Group I), the prosthesis of 6-11cm was fixed to the pubic tubercle, inguinal ligament and conjoint tendon by interrupted non-absorbable sutures (prolene 2/0) (Fig. 1).

In the fibrin sealant group (Group II), it was secured with fibrin glue at four points, on the deep face of the conjoint tendon. A single point was required to close the slit of the prosthesis and, thereby, encircle the spermatic cord. This point is only supported by the sides of the mesh and never by the tissues. Two milliliters of fibrin glue was then sprayed on the anterior side of the mesh (Figs. 2-4).

The aponeurosis was then closed anterior to the cord structures by an absorbable suture (vicryl 2/0). The operation was terminated by suture of the subcutaneous tissue by an absorbable suture (vicryl 2/0) and the skin by non-absorbable suture. No drainage system was used.

Patients were monitored in a recovery room for a minimum of 2 hours. Systematic analgesia as non-steroidal anti-inflammatory drugs was used.

Intake of liquid food was resumed in the evening after the operation, and a normal diet was allowed from the following day. Patient was discharged to home from day one after surgery. Post-operative assessment of both groups included local complications, such as infection of the operated hernia, seroma, haematoma, post-operative chronic pain, urinary retention and hernia recurrence during the first year.

All patients were evaluated at 30 days, 3 months, 6 months and 1 year after surgery and had answered a previously established protocol.

All patients of each group were contacted to be interviewed and examined at the point of statistical analysis of this study. The objective of the clinical examination was to detect a recurrence. For the post-operative pain sequelae, a standardized questionnaire was given out and analyzed for all patients of the two groups. The criteria defined by Cunningham et al. (12) were used to establish this questionnaire and to characterize the chronic pain as follows:

*Mild:* occasional pain or discomfort that did not limit activity, with a return to pre-hernia lifestyle.

*Moderate:* pain preventing return to normal

preoperative activities (inability to continue any sports or to lift objects without pain).

**Severe:** pain constantly or intermittently present but so severe as to impair normal activities, such as walking.

## RESULTS

All of the 116 patients operated in the two groups were males.

The age in the fibrin sealant group ranged from 33–75 years (mean:  $38 \pm 8.6$ ). The age ranged from 27–70 years (mean:  $40 \pm 7.2$ ) in the suture group.

In the suture group (77 cases), the hernia was on the right in 42 cases, on the left in 35 cases.

In the fibrin sealant group (39 cases), the hernia was on the right in 22 cases, on the left in 17 cases.

As regards the operative time, a reduction of 9 min ( $p = 0.001$ ) was observed in the cases of the fibrin sealant group. The median operative times are given in Table 1.

**Table 1. Mean operative time.**

	Fibrin sealant group	Suture group	P value
Operative time in minutes	$40 \pm 6$ Range: 25–55	$49 \pm 9$ Range: 30–70	$p = 0.001$

### **Objective data found in the assessment was as follows:**

There were no incidents whatsoever during surgery in the case of any patient. Positioning the mesh was undertaken without any difficulty in the case of both groups. Spinal anaesthesia did not cause any complication immediately post-operatively, but late following surgery some patients ( $10/116 = 8.62\%$ ) experienced headache, 7 patients in Group I and 3 patients in Group II which was resolved by non-steroidal anti-inflammatory drugs.

Secondary complications to surgery which appeared in the first month were as follows:

**Group I:** haematoma of the surgical wound in inguinal region in ( $2/77 = 2.59\%$ ) patients, which was necessary to drain. Seroma in the surgical wound in ( $3/77 = 3.89\%$ ) patients which was aspirated for a single time. Scrotal oedema in ( $6/77 = 7.79\%$ ) patients which remitted in 7 days.

**Group II:** No haematoma or seroma of the surgical wound in inguinal region was noticed in any patients. Scrotal oedema in ( $1/39 = 2.56\%$ ) patients which remitted in a short time.

The overall complication rate was 11.68% ( $9/77$ ) in the suture group vs 5.1% ( $2/39$ ) in the fibrin sealant group.

As regards pain assessment according to Cunningham's criteria, it was found that, in Group I: 7 cases were lost in follow up, 21/70 patients presented no pain whatsoever (30%), 29/70 patients (41.4%) presented mild pain, 19/70 patients (27.1%) had moderate pain. Pain remitted rapidly in all cases with analgesics (non-steroidal anti-inflammatory drugs). One patient began with chronic pain of moderate intensity one month after surgery and remained stable, although this was tolerable at 6 months after surgery.

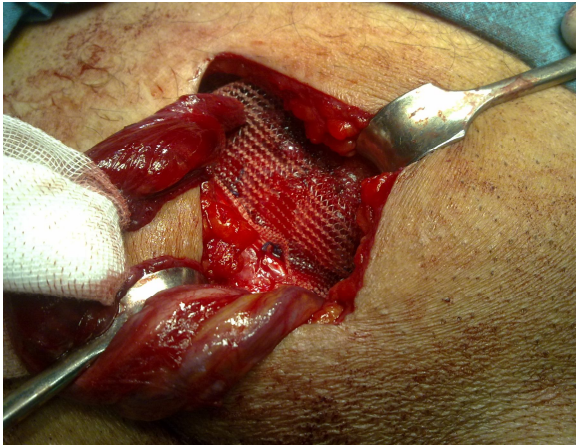
**In Group II:** One case was lost in follow up, 18/38 patients presented no pain whatsoever (47.3%), 12/38 patients (31.6%) presented mild pain, 8/38 patients (21.05%) had moderate pain. Pain remitted rapidly in all cases with analgesics (non-steroidal anti-inflammatory drugs).

One year following surgery no patients presented chronic pain.

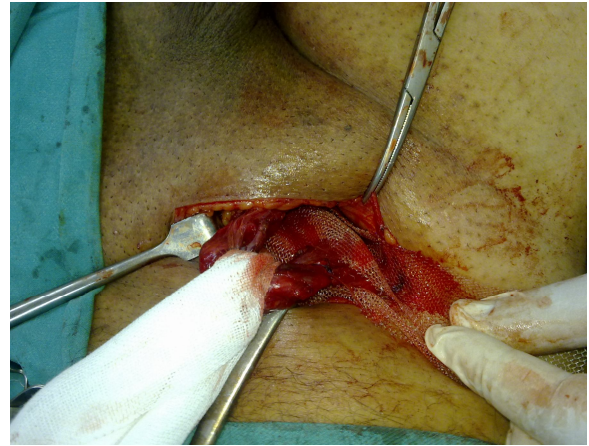
There were no recurring hernias in both groups. All patients were questioned specifically on pain and post-operative comfort at 24 h and 8 days after surgery, with clear distinction between the two groups. From these results it was found that comfort was greater in the fibrin glue group and there was less local inflammatory reaction in this area (clinical data verified through physical examination). Pain was more often present and more frequent in the suture group, although tolerable in all cases, few cases requiring higher doses of analgesia. Return to normal work was on average after 14 days.

**Table 2. Postoperative complications.**

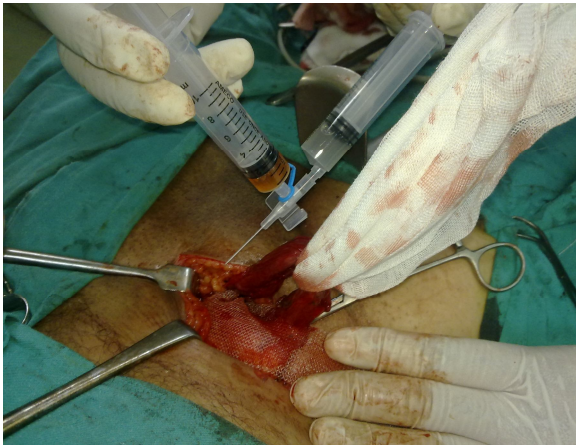
	Fibrin sealant group	Suture group	P value
Hamatoma	2/77 (2.6%)	–	0.310
Seroma	3/77 (3.9%)	–	0.212
Scrotal edema	6/77 (7.8%)	1/39 (2.6%)	0.264
Headache	7/77 (9.1%)	3/39 (7.7%)	0.800
Pain			
Mild	5/70 (7.1%)	1/38 (2.6%)	0.328
Moderate	2/70 (2.9%)	–	0.293
Complications	9/77 (11.7%)	2/39 (5.1%)	0.255



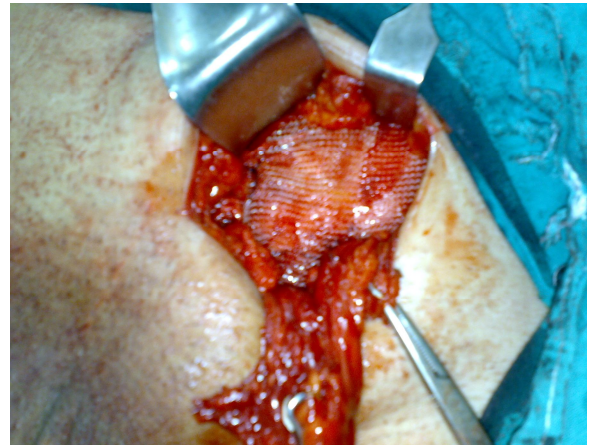
**Fig 1. Mesh fixed by sutures.**



**Fig 3. Splitting of the mesh behind the spermatic cord.**



**Fig 2. Spraying of fibrin glue on the mesh.**



**Fig 4. Mesh after fibrin glue fixation.**

## DISCUSSION

The presence of postoperative pain in the inguinal region after surgery for inguinal hernia has been increasingly referred to in the literature of medical journals. Lesions mainly involve the iliohypogastric, ilioinguinal or genito-femoral nerves and may be due to injury of the nerve, trapping in a suture, stretching or even electro-coagulation, which usually occurs during the dissection of the hernia or securing of the mesh. These lesions are all the more frequent as there are many anatomical variations in the neurological parts of the region.<sup>(13)</sup>

Also, the reaction of the periosteum at pubic tubercle level where the edge of the mesh is attached using a suture, is a source of controversy due to the frequent neuralgias located at this level.<sup>(14)</sup>

Many publications reflect this possibility<sup>(5)</sup> and for this reason achieving total disappearance of pain after hernia

surgery of the abdominal wall has become a key objective. A number of different studies which have appeared recently tackle the problem of sutures, or the possibility of mesh fixation with no stitches.<sup>(14)</sup>

The use of glues has been advocated for different surgical indications: liver resection,<sup>(15)</sup> fistulae,<sup>(16)</sup> intraoperative haemorrhages.<sup>(17)</sup>

These painful sequelae are so frequent that we sought an alternative means of securing the prostheses in order to reduce them. Katkhouda et al. was the first to demonstrate the probability of a technique of laparoscopic repair using fibrin sealant in animals with promising results.<sup>(18)</sup>

The best post-surgical tolerance, with less pain and discomfort in the region where glue has been used in keeping the mesh in place with the absence of suture, and therefore with a less inflammatory reaction and less possibility of entrapment of the iliopubic nerve

branches. Also, the absence of neuralgia at the pubic tubercle level underlines the importance of sutures in the appearance of this complication. Although the sample size was small, the results in terms of immediate and late post-operative pain were encouraging, with a reduction in both the incidence and severity of the pain. Moreover, this technique is very simple and reproducible, as shown by the significant reduction in mean operative time. These results support other studies evaluating repair by mesh fixation with fibrin sealant<sup>(19)</sup> for feasibility and technical facility. Our study goes further by demonstrating a reduction in pain sequelae. The main point for the evaluation of the treatment of inguinal hernia is the recurrence rate. There is a certain doubt as to whether glue provides sufficient attachment of the mesh and whether or not its use could lead to hernia recurrence in the long term. Although follow-up is short, no recurrence has been observed in the fibrin sealant group. It is difficult to predict the long-term efficacy of this type of repair, though it seems that the application of sealant is sufficient to secure the mesh and prevent its forceful erosion into the surrounding tissues, which may cause early recurrence. Besides, most recurrences occur during the first 3 months. After 3 months, prosthetic mesh induced fibrosis should keep the mesh in place and secure wall reinforcement.

Hel-bling's study<sup>(14)</sup> provides similar results, although the follow-up period is even shorter. Nevertheless, pure logic makes it impossible that detachment of the glue could occur after 1 year. In addition, the fibrin sealant, which is recognized for its haemostatic and healing properties, was also found to be useful for reduction of certain local complications, such as haematomas, seromas or wound sepsis.<sup>(20)</sup> In our series, haematomas and seromas were less common in the fibrin sealant group, though this trend was not significant. Total morbidity was less common in the fibrin sealant group but was not significant.

In addition, fibrin sealant is a blood derivative and, therefore, presents a potential risk of infection. To date, no case of hepatitis or HIV seropositivity has been described after the use of this type of product.<sup>(21)</sup> In our series, fibrin glue was prepared from the patient's serum with no possibility of infection.

Lastly, the excess costs due to spraying the fibrin sealant (2 ml are sufficient for a hernia repair) should be compared with the cost of sutures or staples required for conventional fixation, the reduced operative time, hospital stay and the cost of the chronic pain.

To conclude, mesh fixation with fibrin sealant in open hernia repair surgery is a simple and reproducible technique. It is accompanied by a reduction in chronic inguinal pain, with no increase in the early recurrence rate, explanatory a large-scale randomized prospective study to confirm these results.

## REFERENCES

1. EU Hernia. Trialist Collaboration Mesh compared with non-mesh methods of open groin hernia repair: systematic review of randomized controlled trials. *Br J Surg.* 2000;87:854-59.
2. Rutkow IM Demographic and socioeconomic aspects of hernia repair in the United States in 2003. *Surg Clin North Am.* 2003;83:1045-51.
3. Nienhuijs SW, Boelens OB, Strobbe LJ. Pain after anterior mesh hernia repair. *J Am Coll Surg.* 2005;200:885-9.
4. Paajanen H. Do absorbable mesh sutures cause less chronic pain than non-absorbable sutures after Lichtenstein inguinal herniorrhaphy? *Hernia.* 2002;6:117-20.
5. Poobalan AS, Bruce J, Smith WC, King PM, Krukowski ZH, Chambers WA. A review of chronic pain after inguinal herniorrhaphy. *Clin J Pain.* 2003;19:48-54.
6. Lee MG, Jones D. Applications of Fibrin sealant in surgery. *Surg Innov.* 2005;12:203-13.
7. Katkhouda N. A new technique for laparoscopic hernia repair using fibrin sealant. *Surg Technol Int.* 2004;12:120-6.
8. Ten Hallers EJ, Jansen JA, Marres HA, Rakhorst G, Verkerke GJ. Histological assessment of titanium and polypropylene fiber mesh implantation with and without fibrin tissue glue. *J Biomed Mater Res A.* 2007;80:372-80.
9. Lovisetto F, Zonta S, Rota E, Mazzilli M, Bardone M, Bottero L, Faillance G, Longoni M. Use of human fibrin glue (Tissucol) versus staples for mesh fixation in laparoscopic trans-abdominal preperitoneal hernioplasty. *Ann Surg.* 2007;245:222-31.
10. Lau H. Fibrin sealant versus mechanical stapling for mesh fixation during endoscopic extraperitoneal inguinal hernioplasty. *Ann Surg.* 2005;242:670-75.
11. Lichtenstein I, Shulman A, amid P, Montlor M tension free hernioplasty. *Am J surg.* 1989;157:188-93.
12. Cunningham J, Temple WJ, Mitchell P, Nixon JA, Preshaw RM, Hagen NA. Cooperative hernia study. Pain in the postrepair patient. *Ann Surg.* 1996;224:598-602.
13. Al-dabbagh AK. Anatomical variations of the inguinal nerves and risks of injury in 110 hernia repairs. *Surg Radiol Anat.* 2002;24:102-7.
14. Helbling C, Schlumpf R. Sutureless Lichtenstein: First results of a prospective randomized clinical trial. *Hernia.* 2003; 7(2):80-84
15. Chapman WC, Clavien PA, Fung J, Khanna A, Bonhan A. Effective control of hepatic bleeding with a novel collagen based composite combined with autologous plasma; results of a randomised controlled trial. *Arch Surg.* 2000;135:1200-5.

16. Marc S, Jose C, Richard N, Charles O, et al .Treatment of fistula-in-ano with fibrin sealant in combination with intra-adhesive antibiotics and/or surgical closure of the internal fistula opening. *Diseases of the Colon & Rectum*. 2005;48:799-808.
17. Uranus S. Indications and techniques for fibrin sealing in spleen surgery. In: Waclawiczek SG, Daum R (eds) *Fibrin sealing in surgical and nonsurgical fields. General and abdominal surgery-pediatric surgery*. Springer, Berlin. 1994:2.
18. Katkhouda N, Mavor E, Friedlander MH, Mason RJ, Kiyabu M, Grant SW, Achanta K, Kirkman EL, Narayanan K, Essani R. Use of fibrin sealant for prosthetic mesh fixation in laparoscopic extraperitoneal inguinal hernia repair. *Ann Surg*. 2001;233:18–25.
19. Canonico S, Santoriello A, Campitiello F, Fattopace A, Corte AD, Sordelli I, Benevento R. Mesh fixation with human fibrin glue (Tissucol) in open tension-free inguinal hernia repair: a preliminary report. *Hernia*. 2005;9:330–3.
20. Coderre TJ, Katz J, Vaccarino AI, Melzack R. Review article. Contribution of central neuroplasticity to pathological pain, Review of clinical and experimental evidence. *Pain*. 1993;52:259–285.
21. Joch C. The safety of fibrin sealants. *Cardiovasc Surg*. 2003;11:23–8.