A Minor Modification of Lichtenstein Repair of Primary Inguinal Hernia: Postoperative Discomfort Evaluation

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The aim of this study was to evaluate the usefulness of a modification of the Lichtenstein hernioplasty procedure by evaluating its impact on postoperative discomfort. From December 1999 to May 2006, the Lichtenstein inguinal hernioplasty was performed in 406 patients with noncomplicated unilateral inguinal hernia. During reconstruction, the mesh was fixed to the inguinal canal floor without stitching its upper margin to the internal oblique muscle. Control of postoperative pain proved to be satisfactory; 72 hours after surgery, 26.1 per cent of patients no longer felt any pain, whereas 54.4 per cent had slight pain without the need for painkillers; on Day 7, 92.8 per cent felt no pain at all. After 10 days, 86.7 per cent of those with sedentary jobs were able to return to work, whereas 79.1 per cent of those with heavier jobs resumed work in 11 to 15 days. Our modification of the original Lichtenstein procedure permitted us to obtain satisfactory results with regard to the control of postoperative chronic pain and a rapid reprisal of normal working activity.

ALTHOUGH THE IDEA of repairing inguinal hernias by reconstructing the inguinal floor with prosthetic materials goes back to the first half of the 1950s, it was only definitely established in the middle of the 1980s with the so-called "tension-free" technique proposed by Lichtenstein in 1984,[1, 2] now considered the gold standard for the management of inguinal hernia. Although recurrence rates have been reduced to a few per cent with mesh repairs, a certain number of subsequent complications may, in fact, be the result of its use and, consequently, the original procedure of Lichtenstein has undergone several modifications during the years. Lichtenstein himself proposed several changes between 1984 and 1988 with the aim of avoiding certain faults of the original technique.[3]

Chronic postherniorrhaphy pain, defined as pain lasting for more than 3 months after surgery, is without a doubt one of the most troublesome possible results of inguinal hernia repair. The reported frequency of postoperative pain varies widely. A review of 40 studies regarding chronic pain after inguinal hernia repair has reported an incidence rate ranging from 0 to 63 per cent.[4] In an updated review, the risk of causing chronic pain with clinically significant effects on daily activities was approximately 12 per cent.[5]

Despite the fact that the risk factors leading to chronic groin pain may be extremely variable, the main cause of this adverse effect is frequently nerve injury sustained during improper dissection. Furthermore, the insertion of mesh is thought to cause chronic inguinal pain, which may be attributable either to the lack of identification and resulting damage to the nerves of the inguinal canal or to the entrapment of these nerves during fixation of the mesh.[6]

For the last few years, we have performed the Lichtenstein procedure for inguinal hernia repair with the addition of the routine application of a technical modification. As a result of our experience, we maintain that this modification is extremely useful in reducing the incidence of future problems or complications caused by shrinkage of the net.

In this article, we describe this modification of the original Lichtenstein procedure, evaluating its impact on certain parameters such as the duration of postoperative pain, the period of time needed before normal working activity could be resumed, and the incidence of chronic postoperative pain.

Patients and Methods

For this study, we considered 406 patients affected by noncomplicated unilateral primary inguinal hernia

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treated using the Lichtenstein repair procedure with a minor modification. All the 406 patients were treated in a day hospital regimen and were sent home after a postoperative observation period of at least 8 hours. All patients received oral prophylactic antibiotic therapy, whereas any pain was treated with painkillers (paracetamol or diclofenac) if necessary.

Surgery was performed with the use of a local anesthetic in all cases. Approximately 15 minutes before incising, premedication consisting of 1 to 2 mg midazolam associated with 0.5 mg atropine was administered; antalgic block of the ilioinguinal, iliohypogastric, and genitofemoral nerves was performed by means of subdermal local infiltration, along the incision line, of an anesthetic mixture made up of 20 mL ropivacaine and 6 mL lidocaine and, subsequently, by means of infiltration into the anterior wall of the inguinal canal.

During surgery, in 37 cases (9.1%), it was necessary to increase analgesia by means of the intravenous administration of propofol (100 mg in 15 to 20 minutes). In no case did we find it necessary to resort to general anesthesia with orotracheal intubation.

Surgical Technique

After isolating and reducing the hernial sac, the transversalis fascia was prepared; if necessary, this was flattened by the insertion of interrupted sutures in 2-0 polyglactin. A 6 × 11-cm preshaped polypropylene mesh was then placed and fixed with three stitches in 2-0 polypropylene. The first stitch went from the mesh at approximately 1 cm from its tip and then through Cooper's ligament to settle the mesh on the pubic tubercle. The other two sutures fixed the lateral margin of the mesh to the inguinal ligament, one at the level of the internal inguinal ring and the other at an intermediary point between this and the pubic tubercle. The ends of the mesh were drawn together and closed up above the point where the spermatic cord went into the internal inguinal ring with a last suture of 2-0 polypropylene. Unlike the original Lichtenstein procedure, no suture was inserted to fix the upper margin of the mesh to the internal oblique muscle (Fig. 1).

After placement and anchorage of the mesh, continuous sutures with 2-0 polyglactin were placed in the aponeurosis of the external oblique muscle so that the elements of the spermatic cord remained between the aponeurosis and Scarpa's fascia.

A first postoperative follow-up was performed 10 days after surgery, a second after 2 months, and a final follow-up was made 6 months after the operation. All 406 patients were present at the first follow-up, at the second there were 398 (98.1%) patients, and at the third 341 (83.9%) patients were examined.

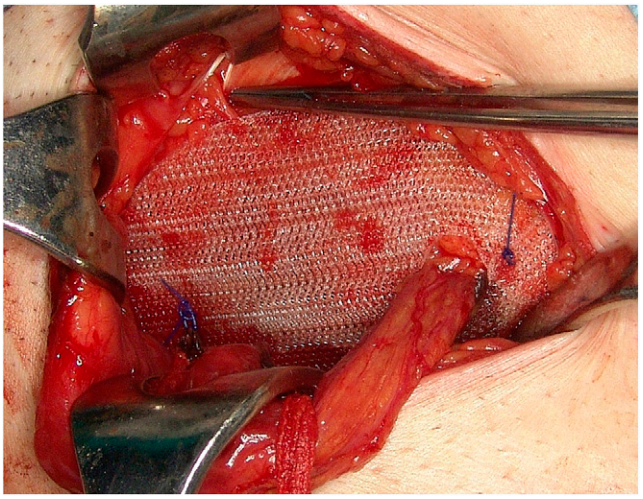

FIG. 1. Fixation of the mesh without anchorage to the internal oblique muscle; the tip of the forceps indicates the iliohypogastric nerve.

Evaluation was made not only of any peri- and postoperative complications, but also of possible postoperative discomfort. The patients were invited to answer a questionnaire in which the first end point was postoperative pain evaluation both from the point of view of intensity and of duration. The intensity of pain was evaluated using a self-report pain intensity scale. A verbal rating scale model made up of the following four levels was used: no pain, slight pain, moderate pain, and severe pain. Duration was evaluated according to whether the pain continued for 24 hours, 72 hours, 7, 15, and 30 days after surgery, and 6 months after surgery. Furthermore, each patient was asked to make a note of the quantity of painkillers taken during this period. The second end point was how much time elapsed between surgery and the patient's return to work and whether this was of a sedentary or heavier nature. This also involved a scale made up of four levels: within 10 days, between 11 and 15 days, between 16 and 30 days, and more than 30 days.

The results obtained were compared with those of a control group made up 268 patients who had previously undergone hernioplasty in our department with the use of the original Lichtenstein procedure. The group was formed by selecting from our database those patients who had provided information regarding the intensity and duration of the postoperative pain and the length of time elapsing before resuming normal working activity.

Statistical Analysis

The difference between the study group and the controls with regard to the type of inguinal hernia and patient features was assessed using the z-test for proportions. Age was compared using the z-test for two

means with unequal variances (resulting from previously performed statistically significant F-test for variances). The difference between the study and control groups with regard to increasing pain severity was assessed using the χ^2 test or Fisher exact test, as appropriate. A P value ≤ 0.05 was considered statistically significant. The association between increasing pain severity and length of follow-up was assessed using gamma and Kendall's tau-b indices. Intercooled Stata Version 9.0 (Stata Corp., College Station, TX) was used for the analysis.

Results

Of the 406 patients studied, 383 (94.3%) were males and 23 (5.7%) were females with a mean age of 52 ± 12.7 years (range, 20 to 93 years). One hundred sixty-seven patients (41.1%) were affected by concomitant diseases; 234 (57.6%) had mostly sedentary jobs, whereas 172 (42.4%) did heavy physical work (Table 1).

In 385 cases (94.9%), the inguinal hernias were primary; in 129 (31.8%) they were direct, in 209 (51.5%) they were indirect inguinal hernias, and in 47 (11.6%) cases they were pantaloon hernias. In four patients (1%), the hernia was no longer easily reducible within the abdominal cavity. In 21 patients (5.1%), a recurrent inguinal hernia was involved (Table 2).

The mean operative time was of 65 ± 13.8 minutes (range, 30 to 120 minutes). Three hundred seventy-two patients (91.6%) were sent home after an observation period of 8 hours, 32 (7.8%) after 24 hours, and in only two cases was it necessary to keep the patients under observation for more than 24 hours after surgery.

All the patients were re-examined 10 days after the operation with medication of the incision and removal of the sutures; a second follow-up was performed 2 months after surgery; a last follow-up was made 6 months after the operation.

With regard to complications, in one case (0.2%), the incision became infected, seven cases (1.7%) developed hematomas, three cases (0.7%) seromas, and in one case (0.2%) the mesh was rejected 5 months after surgery. Regarding postoperative pain in the patients belonging to the study group, during the first 24 hours, 296 patients (72.9%) reported moderate pain and 98 (24.2%) slight pain; only 12 (2.9%) felt severe pain, which was controlled with the administration of oral painkillers. At 72 hours after surgery, 106 patients (26.1%) no longer felt any pain, 221 (54.4%) reported slight pain and 74 (18.2%) moderate pain; only five (1.2%) patients still felt severe pain. At 7, 15, and 30 days after surgery, almost all the patients were without any pain at all and none of them reported severe pain. At 7 days, only 3.2 per cent still felt moderate pain requiring the use of painkillers. Only three patients (0.7%) reported slight pain persistent 6 months after the operation. Three hundred seven (75.4%) patients took two analgesic tablets during the first 24 hours, 81 (19.9%) took one or two tablets during the first 72 hours, 16 (3.9%) took painkillers for the first 7 postoperative days, and only two patients (0.5%) needed to take analgesics from time to time during the first 15 days.

Comparing these results with those of the patients of the control group, a significant difference ($P < 0.0001$) regarding the intensity of pain within the first 15 days can be observed, whereas no significant differences were found between the two groups regarding the presence of pain at 30 days and 6 months after the operation (Fig. 2).

At each follow-up, the number of patients with intense pain gradually decreased both in the study group ($p$gamma = 0.005; ptau-b = 0.008) and in the control cases ($p$gamma = 0.009; ptau-b = 0.008). With regard to the patients' return to work, for those with mostly sedentary jobs, 86.7 per cent in the study group

TABLE 1. *Patient Features*

	Study Group No. (%)	Control Group No. (%)	P
Males	383 (94.3%)	245 (91.4%)	NS
Females	23 (5.7%)	23 (8.6%)	NS
Mean age (years)	52 ± 12.7 (range. 20–93)	54 ± 11.2 (range. 18–87)	0.032
Concomitant diseases			
High blood pressure	68 (16.7%)	32 (11.9%)	NS
Ischemic cardiopathy	32 (7.9%)	16 (5.9%)	NS
Atrial fibrillation	17 (4.2%)	15 (5.6%)	NS
Diabetes mellitus	35 (8.6%)	19 (7.1%)	NS
Chronic bronchopathy	12 (2.3%)	9 (3.3%)	NS
Other	3 (0.7%)	1 (0.3%)	NS
None	239 (58.9%)	176 (65.7%)	NS
Type of job			
Sedentary	234 (57.6%)	166 (61.9%)	NS
Heavy	172 (42.4%)	102 (38.1%)	NS

NS, nonsignificant.

and 79.2 per cent in the control group ($P = 0.0005$) went back within 10 days after surgery. For the patients with heavier jobs, the difference between the two groups was not statistically significant (6.4% in the study group and 2.9% in the controls) for those patients resuming work within 10 days after surgery, whereas there was a significant difference for the patients who resumed from between 11 and 15 days after surgery, 79.1 per cent in the study group *versus* 32.3 per cent in the control group ($P < 0.0001$) (Table 3).

TABLE 2. *Type of Inguinal Hernia*

Hernia	Study Group No. (%)	Control Group No. (%)	*P*
Direct	129 (31.8%)	87 (32.4%)	NS
Indirect	209 (51.5%)	141 (52.6%)	NS
Combined (indirect/direct)	47 (11.6%)	26 (9.7%)	NS
Recurrent	21 (5.11%)	14 (5.2%)	NS

NS, nonsignificant.

The recurrence rate was less than 1 per cent in both groups: three cases (0.73%) and two cases (0.74%) in the study and control groups, respectively.

Discussion

The Lichtenstein procedure has been indicated by the American College of Surgeons as the gold standard for the repair of inguinal hernia.[7] Since 1984, the technique has been somewhat modified to produce

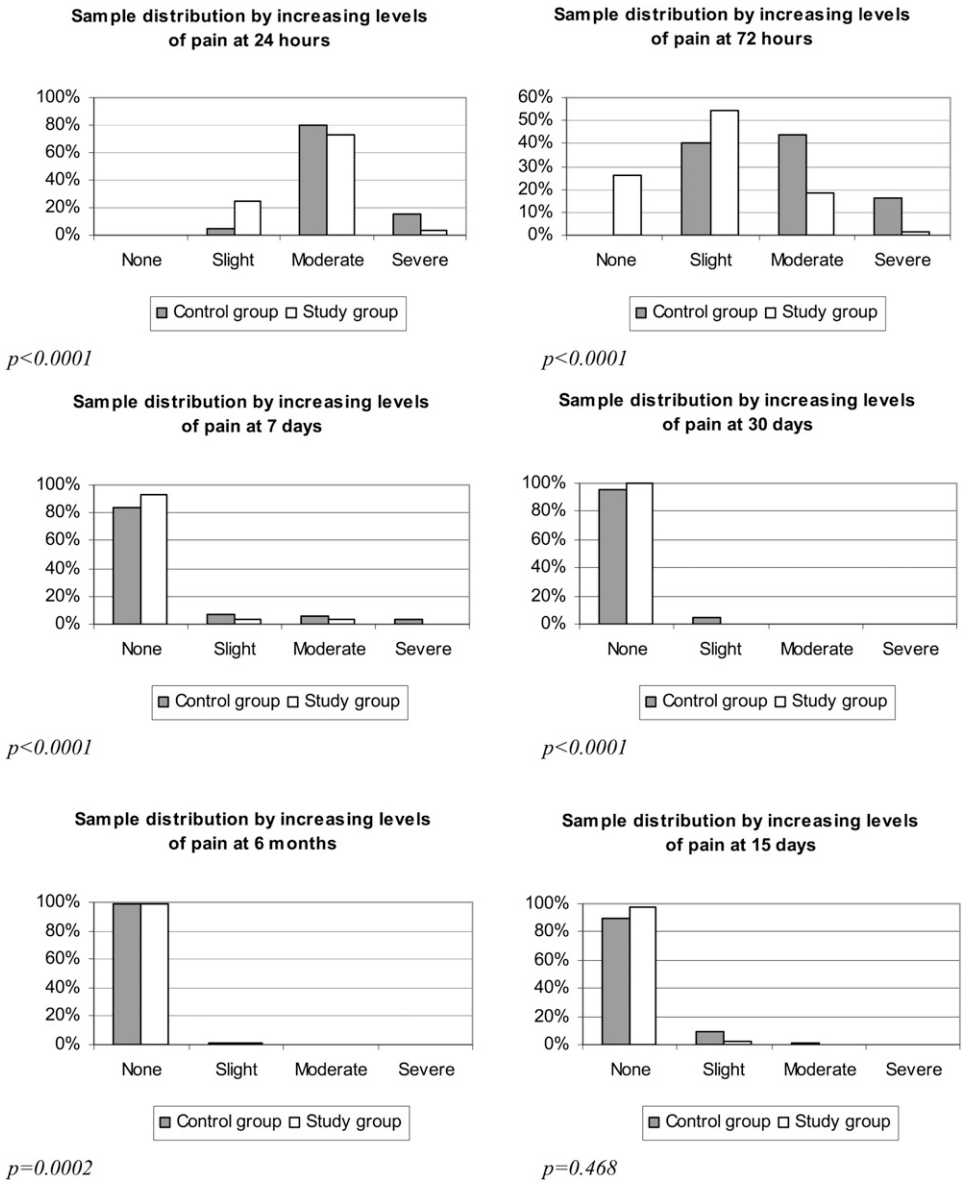

FIG. 2. Intensity and duration of postoperative pain.

TABLE 3. *Time Elapsing before Patients Resumed Work*

Time	Sedentary Jobs			Heavy Jobs		
	Study Group	Control Group	*P*	Study Group	Control Group	*P*
Less than 10 days	203 (86.7%)	121 (72.9%)	0.0005	11 (6.4%)	3 (2.9%)	0.2094
11–15 days	29 (12.4%)	43 (25.9%)	0.0005	136 (79.1%)	33 (32.3%)	<0.0001
16–30 days	2 (0.8%)	2 (1.2%)	0.7288	23 (13.4%)	61 (59.8%)	<0.0001
Greater than 30 days	0	0		2 (1.1%)	5 (4.9%)	0.0579
Total	234 (100%)	166 (100%)		172 (100%)	102 (100%)	

a more tension-free procedure. The original method involved the complete fixation of the mesh onto the floor of the inguinal canal with the use of nonabsorbable sutures inserted not only into Cooper's ligament, but also into the inguinal ligament and the internal oblique muscle.[1] Although it is imperative to make sure that the mesh is securely fixed to avoid the formation of a meshoma, the original technique gave rise to several problems. One of these, identified by the original authors of the procedure, involved the shrinkage of the mesh, which implicated approximately 20 per cent of its original length; this led to tension on the tissues in all directions and produced a less tension-free procedure. Lichtenstein himself proposed a modification of his original technique between 1984 and 1988, suggesting that the mesh should be fixed without stretching it but leaving a slight cupola to avoid contraction, which would pull on the tissues in all directions.[8]

Nevertheless, although using mesh for the repair of inguinal hernia offers several advantages such as simplicity and low incidence of recurrence,[2] it has itself been a cause of postsurgical pain, because it increases scar tissue formation and nerve entrapment.[9–10]

The true incidence of postherniorrhaphy groin pain has not yet been fully elucidated, probably because most surgeons have been more concerned with the recurrence rate than with this seemingly insignificant symptom. Poobalan et al.[4] in their review found an incidence rate ranging from 0 to 63 per cent. Franneby et al.[10] demonstrated that after 24 to 36 months of follow-up, approximately 30 per cent of patients undergoing inguinal herniorrhaphy reported pain or discomfort and nearly 6 per cent reported high-intensity pain resulting in the inability to perform daily living activities.

Although several risk factors leading to chronic postoperative pain have been identified, for example, postoperative hematoma, wound infection, and composition of the mesh, the most frequent cause appears to be entrapment of the inguinal canal nerves, especially the iliohypogastric nerve, which is the regional nerve at the highest risk during tension-free repair because it may be trapped by the overlapping mesh in the scar tissue forming between this and the muscle plane along which the nerve runs[11] Alfieri et al.[12] maintain that the most preventive step to reduce the incidence of postoperative groin pain is careful dissection and preservation of the ilioinguinal, iliohypogastric, and genitofemoral nerves. When all three nerves were identified and preserved, no cases of chronic pain were identified at the 6-month follow-up. This was in stark contrast to the 40 per cent of patients who reported moderate to severe pain when all three nerves were divided.

In our modification of the Lichtenstein procedure, we fix the mesh to Cooper's ligament and apart from this to the inguinal ligament only, thus avoiding the fixation of its upper margin to the internal oblique muscle. In this way, not only is it possible to avoid the formation of a meshoma, but there is also an absence of tension, because the mesh is able to shrink in one direction only. Furthermore, we maintain that if the upper margin of the mesh is not fixed to the internal oblique muscle, its shrinkage will not bring about traction of the internal oblique muscle with the resulting reduction of the risk of entrapment of the nerves of the inguinal canal and considerably less chronic postoperative pain.

Applying this variation of the original procedure, we found that 54.4 per cent of our patients felt only slight pain at 72 hours after surgery and had no need for painkillers. Furthermore, 92.7 per cent of the patients had no pain at all 7 days after surgery. Even more important, however, is the fact that only 0.5 per cent of the patients reported slight persistent pain after 30 postoperative days and that only three (0.7%) patients reported slight pain persistent 6 months after the operation. Comparing these results with those of a group of patients undergoing the original Lichtenstein procedure, a significant difference ($P < 0.0001$) can be observed regarding both the intensity and the duration of pain within the first 15 days after surgery. In this control group of patients, in fact, the intensity of pain was more severe and the pain lasted longer compared with the patients in the study group. No significant differences were found between the two groups of patients regarding the presence of pain at 30 days and 6 months after the operation.

Return to work was also fairly rapid, occurring for patients with mostly sedentary jobs within 10 days in

86.7 per cent in the study group *versus* 72.9 per cent in the control group ($P = 0.0005$) and for those with heavier jobs within 15 days in 79.1 per cent in the study group *versus* 32.3 per cent in the control group ($P < 0.0001$).

In conclusion, the Lichtenstein hernioplasty is an extremely efficient and sure technique for the management of inguinal hernia both for the few overall complications related to mesh implantation and for the extremely low recurrence rates evaluated in approximately 0.5 per cent of the cases.[13] The abdominal approach is also to be considered only moderately invasive not only because it involves locoregional anesthetic, which proves to be efficient and well tolerated by the patient, but also taking into account the rapidity of the surgical procedure. Moreover, the Lichtenstein open tension-free repair appears to be superior to laparoscopic repair, because the latter results in a higher recurrence rate, is associated with operative mortality, and presents only the insignificant advantage of only 1 day before the return to normal physical activities and questionably less pain for 8 days.[14]

After applying this minor modification to the Lichtenstein technique for several years, we maintain that it is less invasive and offers certain advantages compared with the original procedure previously used by us. We therefore decided that instead of performing a comparative study of the two methods, we would offer an observational study involving the results of our modification, which is extremely easy to apply and, in our opinion, offers a further contribution toward the various improvements of the original Lichtenstein procedure proposed throughout the years, moreover without any increase in the recurrence rate. The control of postoperative pain is, in fact, an extremely important factor leading to the reduction of patient discomfort and a more rapid return to normal working activity.

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