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Surgical Options in Lumbar Hernia: Laparoscopic Versus Open Repair. A Long-Term Prospective Study

Alfredo Moreno-Egea, MD[1], Andres C. Alcaraz, MD[1], and Marian C. Cuervo, MD[1]

Abstract

Objective. To determine the safety and effectiveness of laparoscopic lumbar hernia repair. *Design*. Prospective clinical study. *Setting*. Abdominal wall unit, university hospital. *Patients*. Between January 1995 and December 2008, data from 55 consecutive patients who had undergone laparoscopic (n = 35) or open (n = 20) lumbar hernia repair. *Main Outcome Measures*. The primary endpoint was recurrence; secondary endpoints were patient outcomes (morbidity, pain, and return to normal activity). *Results*. Mean operating time (P = .01), hospital stay, return to normal activity, analgesic consumption, and pain at 1 month (P < .001) were significantly less in the laparoscopic group. Complications were similar in the 2 groups (37% vs 40%, respectively; P = .50). Traumatic hernias increased local complications versus incisional lumbar hernias (71.4% vs 29%; P = .007). Consumption of analgesics (6.8 ± 6.5 vs 18.1 ± 9.1; P < .001) and pain during the first month (no pain: 90% vs 54.3%; P = .015) were significantly less with a lightweight versus medium-weight mesh. The risk factors associated with recurrences development were localization (P = .01) and size (P = .008). Recurrence rates were 2.9% in the laparoscopic group and 15% in the open group (P = .13). *Conclusions*. Outcomes did not differ with respect to morbidity and recurrence rate after long-term follow-up; however, this study suggested that laparoscopic approach for lumbar hernia is safe, effective, and more efficient than open repair and can be considered the procedure of choice. Open surgery may be considered the best option in the diffuse hernias with size larger than 15 cm.

Keywords

lumbar hernia, laparoscopy, open surgery, morbidity, recurrence, lightweight mesh

Introduction

Lumbar hernias are uncommon clinical defects of posterolateral abdominal wall. The lack of collective experience of any one surgeon prevents us from drawing valid conclusions to standardize the management of these patients. The following technical problems have been reported: the difficulty in defining the external edges of the fascial defect because of the location, the lack of adequate fascia and the inherent weakness of the surrounding tissue, the bony structure of the boundaries, concomitant paralysis of the muscles, and so on.[1-3] The large number of techniques published in the literature reflects a lack of consensus, which limits us from making informed decisions. The laparoscopic approach has been proposed as an alternative with advantages for the patient. But it is very difficult to design a good study of an uncommon disease. The creation of specialized units in the treatment of hernias allows a large number of patients to be brought under the same multidisciplinary team, enabling the application of diagnostic protocols and standard treatment. That has been our case, where by working together with urologists, orthopedic surgeons, and radiologists over a 15-year period, we have gathered a great deal of experience in the treatment of a process traditionally considered as uncommon.

We performed a prospective consecutive clinical study to compare 2 techniques—laparoscopy and open repair—used in the treatment of lumbar hernia.

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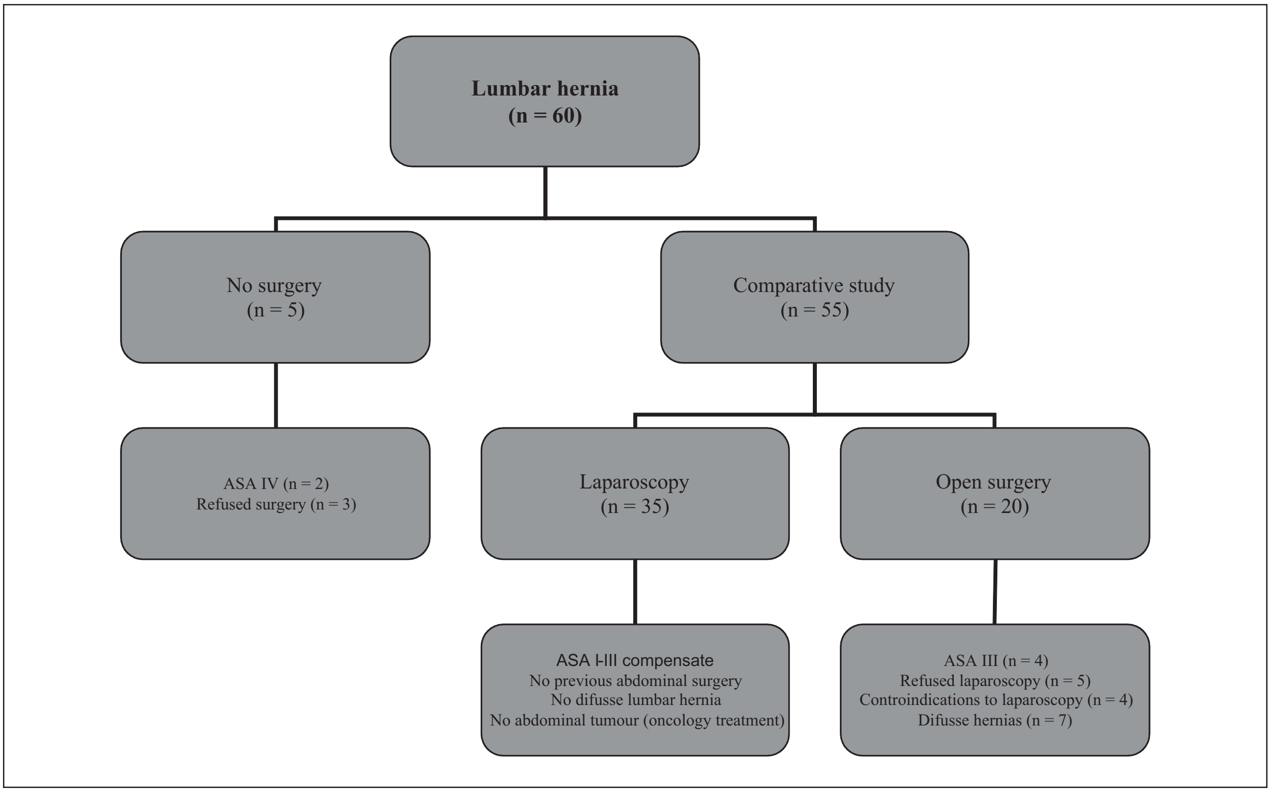

Figure 1. Study design[a]
[a]ASA, American Society of Anesthesiologists; contraindications to laparoscopy indicates previous abdominal surgery with mesh.

Methods

Study Design

This was a prospective, nonrandomized, longitudinal, analytical, clinical study of 55 patients diagnosed with lumbar hernia between January 1995 and December 2008. Diagnosis was made using clinical and computed tomography (CT) methods. This evaluation was always requested to assess the extent of the defect, state of the posterior muscles, muscular atrophy, the contents of the sac, and to define the hernia boundaries. The lumbar region was defined as laterodorsal of the anterior axillary line (L4).[4] All the patients were assessed in an Abdominal Wall Unit, and once duly informed of the process, those who gave their consent were included in the protocol study. The type of operation the patient underwent was determined by surgeon preference with the basic principle of one unit, one surgeon (AM-E), and they were divided into 2 groups: (*a*) laparoscopic approach (n = 35) and (*b*) open repair (n = 20). See Figure 1.

Exclusion criteria were patients with other hernias (defined by GREPA classification as M or L1-L3),[4] the presence of psychiatric illness or other circumstances that might compromise the patient's cooperation, and those who refused to give informed consent. All the follow-up parameters were tabulated prospectively in a database and analyzed by an independent data manager (ACA). The investigation plan was submitted and approved by the ethics committee.

Surgical Technique

Laparoscopic approach. A standardized surgical technique was used by a single senior surgeon specialized in laparoscopic hernia repair (AM-E). The patient was placed in a lateral decubitus position with the table flexed, opening the space between the rib cage and the iliac crest. Repair was performed under general anesthesia and pneumoperitoneum was created with a Veress needle placed subcostally on the midclavicular line. The position of the 3 trocars (two 5 mm and one 10 mm) depended on the location and the size of the hernia. The colon was mobilized by opening the peritoneal reflection along the white line of Toldt and because of gravity the colon was able to retract to the midline. Mobilization continued posterior to the psoas muscle. The retroperitoneal fat was reduced, and the borders of the defect were cleared before dissection was extended to the iliac crest inferiorly and over the diaphragm superiorly. After the fascial defect size was measured internally with a metric ruler, a composite mesh large enough to overlap 5 cm onto the normal fascia was inserted via the 10-mm trocar and extended close to the defect in the preperitoneal space. The mesh was referenced with 2 guide sutures on the medial side or closer to the trocars (p1 and p2), and another suture near the center of the lower shaft (C point). A Gore suture passer instrument (Gore-Tex, Flagstaff, AZ) was used to puncture the abdominal wall at the 2 predetermined sites and then used to grasp the threads and pull them out through the abdominal wall. Once the mesh had been placed over the defect, it was fixed with helical staples (ProTack, Tyco, Covidien, Norwalk, CT). The setting started at the bottom (C point), then alternated sides, and finished at the top (p1 and p2). The mesh was fixed superiorly over the 10th rib with at least 5-cm overlap to the diaphragm, inferiorly over the iliac crest periosteum, and posteriorly over the musculus quadrates lumborum and erector spinae fasci, and the musculus transverses abdominis anteriorly. To avoid entrapment, it was necessary to identify the iliohypogastric, ilioinguinal, and genitofemoral nerves. The mesh was covered by the previously dissected peritoneum and clamped to the wall to prevent it contacting the intestinal loops. Finally, the cavity was reviewed, all trocars were removed under direct visual guidance, the threads were cut ensuring that they remain under the skin, and the abdomen was deflated.

Open prosthetic repair. The operation was performed with general or regional anesthesia, as determined by the anesthetist. The scar was resected and 2 wide flaps of skin and subcutaneous tissue well exceeding the hernia defect were dissected with an electrocautery. The herniary defect sac was dissected and its margins identified. A polypropylene mesh was placed in the preperitoneal space, overlapping the defect by more than 5 cm on all sides and fixed with nonreabsorbable "U" sutures, just below the latissimus dorsi, erector spinae and internal oblique muscles, the 12th rib and the periostium of the iliac crest. Once the mesh had been placed, the fibers of the latissimus dorsi and external oblique muscles were reapproximated to cover the mesh by loose absorbable suture, and the skin was closed. In the recurrent cases, a double prosthetic repair was performed. A mesh was placed in the preperitoneal space, covering the entire dissected space. The muscles forming the defect boundaries were approximated loosely over the mesh without tension. A second lightweight polypropylene mesh measuring 30 × 30 cm was placed supra-aponeurotically, in the subcutaneous space, to cover the previous repair and sutured in place with just 4 to 6 sutures (A second mesh was placed onlay, fixed with 6-8 sutures; Timesh, PFM, Cologne, Germany). A drain was placed in the subcutaneous tissue (depending on the amount of dissected tissue and resulting dead space) and removed when the debit was 50 mL/d or less. The cutaneous flaps and skin were closed carefully to avoid dead spaces—subcateneous layer with absorbable continuous suture and the cutaneous layer with wound clips.[5,6]

Mesh

During the development of study, 2 different meshes were used for the laparoscopic technique, depending on the operating surgeon's preference and mesh availability: a medium weight and a lightweight mesh:

1. *Parietex composite* is a double-layer medium-weight mesh: one layer, a hexagonal structure, 3-dimensionalmultifiberpolypropylene(64g/m^2), 1.5-mm thick with a pore size >700 mm, and the other layer a hydrophilous reabsorbable non-stick membrane of collagen (Parietex composite, Sofradim, Villefranche sur Saone, France).
2. *Timesh* is a lightweight mesh produced by a titanium coating over polypropylene (35 g/m^2). It is 0.30-mm thick with a pore size > 1 mm and has a ball burst resistance 47 N/cm.

Follow-up

Outpatient follow-up was done in a specific consulting room at 1, 3, 6, and 12 months, and yearly thereafter, by means of physical exploration. The primary endpoint was the recurrence, defined on physical examination and confirmed by CT. Secondary endpoints were as follows: demographic data, intra-operative parameters and post-operative clinical data. The size of the hernia was defined as the intra-operative size of the fascial defect in centimeters (diameter) and cm^2 (area): (*a*) diameter or length was defined as the greatest vertical distance between the most cranial and the most caudal margin of the hernia defect and (*b*) area which was measured by combining length and width in a formula for an oval (area = $\pi \times a \times b$ cm^2); width was defined as the greatest horizontal distance between the lateral margins of the hernia defect on both sides. The study outcome measures included (*a*) operating time (minutes) calculated from the first skin incision to closure, (*b*) hospital stay (days) determined by independent physicians, (*c*) need for oral analgesia (days), (4) visual analogue scale pain score measured 1, 6, and 12 months after surgery (ranged from 0 = *no pain* to 5 = *unbearable pain*), and (*e*) return to normal activity (days) was defined the time needed to be able to perform household activities, and drive or walk painlessly. Patients' follow-up was maintained postoperatively for a median of 72 months (range 24-180 months). All the data were collected prospectively on a computer by an independent observer. (Median follow-up was 66 and 72 months for the laparoscopic and open groups, respectively; range = 24-180 months). No patients were lost to follow-up.

Statistical Analysis

The quantitative variables were expressed as means ± standard deviation and the qualitative variables as percentages. Categorical variables were compared using the χ^2 or Fisher exact test when expected values were low. Normally distributed continuous variables were compared using *t* test or Mann–Whitney test, and continuous variables that were not normally distributed were compared between cohorts using Wilcoxon rank sum tests. The relationship between the defect size and recurrence at 3 years was analyzed by the receiver operating characteristic curve using various categories for defect size, with values of sensitivity, specificity, 95% confidence interval (CI), and predictive values (+PV or −PV). Kaplan–Meier survival curves with log-rank analysis were created for each group of defect size and local complication for hernia recurrence. All data were processed using the Statistical Package for the Social Sciences software package for Windows (SPSS Inc., v15.0, Chicago, IL) and MedCalR 11.3.0.0 (MedCalc Software bvba, Mariakerke, Belgium).

Results

Demographic data are presented in Table 1. All the laparoscopic patients were completed by laparoscopic surgery without conversion to open surgery. Patients of laparoscopic group were significantly more obese (P = .03) and with hernias of smaller size than the open group (P = .01). The intra-operative morbidity was 14.3%: 4 cases of bleeding—2 due to a lesion of the omentum requiring hemostasis with a clamp, and other 2 due to a vascular lesion during the mesh fixation, causing a small hematoma in the posterior mesh/wall interphase, neither with repercussions in the postoperative period. All diffuse lumbar hernias were operated on by open surgery. In this group, there were no intra-operative complications. Postoperative morbidity was similar in both groups: laparoscopic approach 37%, open surgery 40% (P = .50). We did not observe infections or rejections of the mesh. In open surgery, the major complications were seromas (40%), and these patients were treated on an outpatient basis.

During the follow-up, we detected 1 recurrence in the laparoscopic group and 3 recurrences in the open repair group (P = .13). They were all confirmed by CT scan at 12 months. Recurrence in the laparoscopic group was an obese patient (body mass index = 34.5 kg/m^2) with incisional hernia: defect size 20 × 12 cm and muscular atrophy. The 3 recurrences in the open surgery group were diffuse incisional hernias, with defect size larger than 18 cm. The cause of recurrence, in all cases, was inadequate mesh fixation. Five patients were not operated on because of high anesthetic risk, and none was hospitalized for reasons related to the lumbar hernia in a follow-up period of more than 3 years (38-118 months).

Clinical Characteristics and Outcome According to Surgical Approach

The analysis of variables based on the surgical approach (laparoscopic vs open surgery) showed no differences in the age, gender, comorbidity, etiology, hernia content, morbidity, or recurrences. However, the groups showed significant differences in body mass index (P = .03), classification (superior space, inferior space, and diffuse; P <.001), defect size (P = .01), operating time (P = .01), hospital stay (P < .001), return to normal activity (P < .001), analgesic consumption (P < .001), and pain at 1 and 6 months (P < .001 and P = .01, respectively; Table 1).

Etiologic Univariate Analysis: Traumatic Versus Incisional

The analysis of variables based on the etiology of lumbar hernia in the laparoscopic group (traumatic vs incisional hernia) only showed differences in local morbidity (85.7% vs 29.2%, P = .007). There were no significant differences between traumatic or incisional hernias in terms of comorbidity, defect size (12.8 ± 4.7 vs 11.9 ± 4.3 cm, P = .72), hospital stay (2.8 ± 1.2 vs 2.5 ± 0.8 days, P = .73), operating time (79.3 ± 20.5 vs 71.2 ± 36 minutes, P = .30), intra-operative morbidity (14.3% vs 16%, P = 1.0), time of analgesia (7.8 ± 7.3 vs 7.3 ± 6.6 days, P = .71), visual analogue scale pain score (0 = *no pain*, 42.9% vs 76%, P = .47), and recurrence (0% vs 4%, P = 1). Traumatic hernias increased local complications (71.4%) versus incisional lumbar hernias (29%).

Mesh Study: Parietex (Medium-Weight mesh) Versus Timesh (Lightweight Mesh)

The epidemiological characteristics of patients in both groups were similar. The medium-weight mesh was used in 76% of incisional lumbar hernias and 28% of traumatic lumbar hernias, whereas the lightweight mesh was used in 71% of the traumatic hernias and 24% of the incisional hernias. Statistical analysis between the 2 meshes shows no difference in surgical time, morbility, hospital stay, pain at sixth month, or recurrence. However, there was a statistical difference in consumption of analgesics (in number, 18.1 ± 9.1 vs 6.8 ± 6.5, P < .001; and days, 11.9 ± 7.6 vs 7.6 ± 8.7, P = .03) and pain during the first month (P = .01; Table 2).

Table 1. Characteristics and Postoperative Results[a]

	Laparoscopy (n = 35)	Open (n = 20)	*P*
Age, years	61.6 ± 11.6	64.2 ± 8.6	.52
Gender			.17
Male	17 (48.6)	6 (30)	
Female	18 (51.4)	14 (70)	
BMI, kg/m^2	31.2 ± 4.4	28.2 ± 3.7	.03
Comorbidity			
Diabetes	2 (5.7)	2 (10)	.61
COPD	5 (14.3)	4 (20)	.70
Etiology			.59
Spontaneous	3 (8.6)	0	
Surgery	25 (71.4)	15 (75)	
Trauma	7 (20)	5 (25)	
Localization			<.001
Superior	16 (45.7)	4 (20)	
Inferior	19 (54.3)	9 (45)	
Diffuse	0	7 (35)	
Defect			.29
Single	32 (91.4)	20 (100)	
Multiple	3 (8.6)	0	
Size of hernia, cm	11.7 ± 4.4	14.5 ± 2.8	.01
Hernia contents			.10
Colon	17 (48.6)	14 (70)	
Small bowel	12 (34.3)	6 (30)	
Preperitnoneal fat	6 (17.1)	0	
Operating time, min	71 ± 32.5	84 ± 14.5	.01
Intra-operative morbidity			.14
Omental bleeding	2 (5.7)	0	
Parietal bleeding	2 (5.7)	0	
Splenic injury	1 (2.8)	0	
Hospital stay	2.5 ± 0.9	5.1 ± 1.8	<.001
Postoperative morbidity			.50
Hematoma	4 (11.4)	0	
Seroma	7 (20)	8 (40)	
Transitory pain	2 (5.7)	0	
Analgesic consumption, days	6.8 ± 6.5	15.9 ± 7.7	<.001
Pain, at 1 month, VAS			<.001
0	11 (31.4)	0	
1-2	21 (60)	5 (21.6)	
3-4	3 (8.5)	11 (55)	
5	0	4 (16.6)	
Pain at 6 month (VAS 0)	29 (82.8)	16 (80)	.01
Pain at 1 year (VAS 0)	31 (88.6)	18 (90)	.08
Return to normal activity, days	14 ± 6.3	27 ± 5.8	<.001
Recurrence	1 (2.9)	3 (15)	.13
Median follow-up (range)	66 (38-170)	72 (24-180)	

Abbreviations: BMI, body mass index; COPD, chronic obstructive pulmonary disease; VAS, visual analogue scale; NS, nonsignificant, $P > .05$, with 95% confidence interval.

[a]Values are expressed as mean ± SD for continuous variables. The distributions of dichotomous data are given in absolute values with percentages in parentheses.

Table 2. Mesh Study (in Laparoscopic Group)[a]

	Parietex (n = 22)	Timesh (n = 13)	*P*
Age, years	62.3 ± 9.9	62.9 ± 11.9	.73
Gender			.35
Male	12 (54.5)	5 (38.5)	
Female	10 (45.5)	8 (61.5)	
BMI, kg/m^2	30.4 ± 4.4	29.7 ± 4.3	.49
Comorbidity			
Diabetes	1 (4.5)	1 (7.7)	1.00
COPD	4 (18.2)	1 (7.7)	.63
Etiology			.02
Spontaneous	1 (4.5)	2 (15.4)	
Surgery	19 (86.3)	6 (46.2)	
Trauma	2 (9.1)	5 (38.5)	
Localization			.14
Superior	8 (36.4)	8 (61.5)	
Inferior	14 (63.6)	5 (38.5)	
Diffuse	—	—	
Defect			1.00
Single	20 (90.9)	12 (92.3)	
Multiple	2 (9.1)	1 (7.7)	
Size of hernia, cm	13.2 ± 3.5	11.7 ± 4.9	.62
Operating time, min	72.8 ± 31.1	80.7 ± 21.3	.21
Intra-operative morbidity	5 (22.7)	0 (0.0)	.13
Hospital stay, days	4 ± 2.2	2.9 ± 1.1	.09
Postoperative morbidity			.48
Hematoma	3 (8.6)	1 (7.7)	
Seroma	5 (22.7)	2 (15.4)	
Transitory pain	2 (9.1)	0 (0.0)	
Analgesic consumption, days	11.9 ± 7.6	7.6 ± 8.7	.03
Number of analgesics	18.1 ± 9.1	6.8 ± 6.5	<.001
Pain, at 1 month, VAS			.01
0	19 (54.3)	18 (90)	
1	6 (17.1)	0 (0.0)	
2	6 (17.1)	1 (5.0)	
3	3 (8.6)	1 (5.0)	
4	1 (2.8)	0 (0.0)	
5	0	0 (0.0)	
Pain at 6 month (VAS 0)	29 (82.9)	18 (90)	.14
Pain at 1 year (VAS 0)	31 (88.6)	16 (80)	.32
Recurrence	1 (4.5)	0 (0.0)	1.00
Median follow-up (range)	72 (42-180)	53 (24-138)	

Abbreviations: BMI, body mass index; COPD, chronic obstructive pulmonary disease; VAS, visual analogue scale (0-5); NS, nonsignificant, *P* > .05, with 95% confidence interval.

[a]Values are expressed as mean ± SD for continuous variables. The distributions of dichotomous data are given in absolute values with percentages in parentheses.

Risk Factors for Recurrence

The univariate analysis of recurrence showed that the risk factors associated with its development were localization (*P* = .01) and defect size (*P* = .008). Diffuse lumbar hernias had a recurrence rate of 42.9%. Local morbidity was also significantly associated with recurrence (*P* = .003). All patients with recurrence had local morbidity (Figure 2). The relationship between defect size and recurrences was analyzed with the creation of receiver operating characteristic curves, showing an area under the curve of 0.882 (95% CI = 0.793-0.972). The prediction of recurrence using a diameter of 15 cm as a cutoff point showed a sensitivity of 100% (95% CI = 39.8-100.0), with a specificity of 78.4% (95% CI = 64.7-88.7), +PV 100% (95% CI = 98.7-100.0) and −PV 26.7% (95% CI = 0.9-52.4). See Figures 3 and 4 and Table 3.

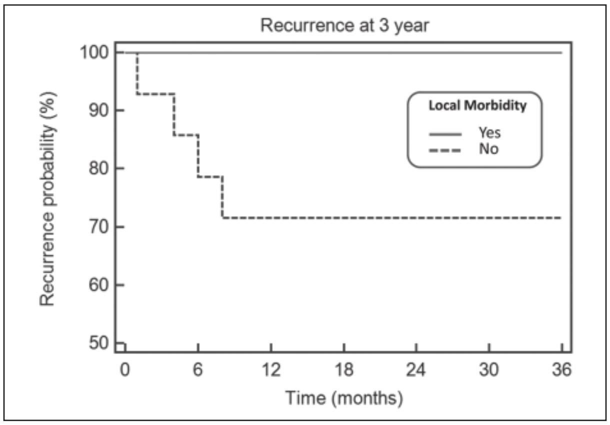

Figure 2. Survival rates for patients with local morbidity

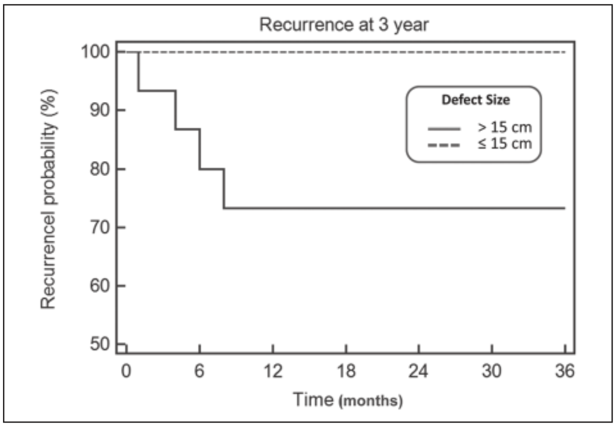

Figure 4. Kaplan–Meier survival curves for hernia recurrence/defect size

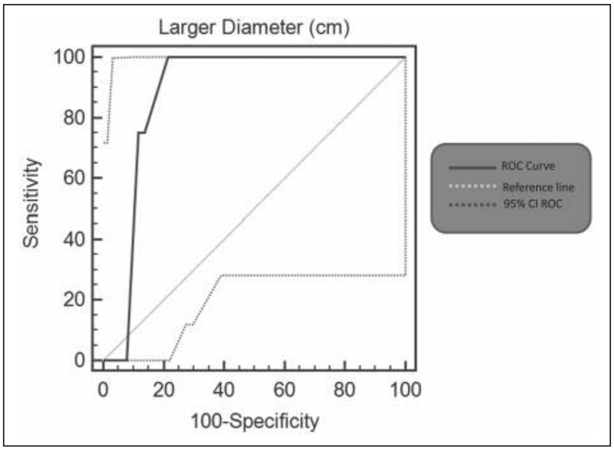

Figure 3. Receiver operator characteristic (ROC) curve of defect size as a predictor of development of recurrence at 3 years (with the Hanley and McNeil method)

Discussion

The relative rarity of lumbar hernia and the lack of collective experience of only one surgeon are all contributing factors for the lack of a standard repair technique for lumbar hernias,[7-10] and so the debate of open versus laparoscopic repair of lumbar hernias is ongoing. Our special status as a legally constituted multidisciplinary unit with a focus on this pathology means that we have now performed lumbar hernia surgery on maximum number of patients and also have the most number of publications in this area (Table 4).

When Is Surgery Indicated?

The natural history of lumbar hernias is a progressive increase in size, back pain, and sometimes bowel obstruction.[11-13] Therefore, most authors believe that it should always be repaired, except in high-risk patients. Because surgical correction is always more difficult in advanced cases, surgery should be indicated as early as possible, after improving the original condition of the patient. Suspicion of lumbar hernia should always be confirmed with a CT scan before proposing surgery, though in the literature intraoperative diagnosis is not uncommon.[14-16] If the existence of a lumbar fascial rupture is confirmed, then its indication is justified. Bolkier et al,[17] Staermann et al,[18] and Palanivelu et al[19] accept a cosmetic indication in cases of denervation muscle atrophy. However, currently no data in the literature justifies this behavior. Like other authors, we have found that patients with high risk or who have refused surgery had no problems with their hernia for a long follow-up.[20]

Etiology and Surgical Option

From an anatomical point of view, we regard the primary lumbar hernias as a separate entity. These hernias are small, have well-defined borders, are without visceral content, and have no alteration of the surrounding tissue. In these cases, open preperitoneal surgery is an easy option, with no extensive tissue dissection and with a low risk of morbidity.[21] Similarly, for a surgeon who has experience with the preperitoneal laparoscopic approach, patients without comorbidity and those with small hernias are good candidates for this technique.[22-25] In this etiological group, the choice of technique should depend on surgeon's experience. Our results indicate that the etiology of lumbar hernia does not affect prognosis and only the local morbidity affects it, whereas traumatic hernias are associated with increased local complications. The patients with postoperative morbidity should be evaluated by CT up to a year afterward because of their greater probability of recurrence.

Open Surgery

The history of open surgery is shown in Table 5.[26-47] Currently, most authors in the literature accept the

Table 3. Univariate Analysis of Risk Factors for Recurrence

Patients	Recurrence (n = 4)	No Recurrence (n = 51)	*P*
Age, years	61 ± 4.7	62.7 ± 10.9	.67
Gender			1.00
Male	2 (50.0)	21 (41.2)	
Female	2 (50.0)	30 (58.8)	
Etiology			.48
Primary	0 (0.0)	3 (5.9)	
Surgery	3 (75.0)	36 (70.1)	
Trauma	1 (25.0)	12 (23.5)	
BMI, kg/m^2	30.7 ± 3.7	30.1 ± 4.4	.56
Comorbidity			
Diabetes	1 (25.0)	3 (5.9)	.26
COPD	1 (25.0)	8 (15.7)	.25
Localization of defect			.01
Inferior space	0 (0.0)	28 (54.9)	
Superior space	1 (25.0)	18 (35.3)	
Diffuse	3 (75.0)	4 (9.8)	
Defect size, cm	17.5 ± 1.5	12.3 ± 4.1	.008
Hospital stay, days	6.2 ± 3.8	3.3 ± 1.4	.12
Operating time, min	83.5 ± 25.5	75.1 ± 28.3	.65
Intra-operative morbidity	0 (0.0)	5 (9.8)	1.00

Abbreviations: BMI, body mass index; COPD, chronic obstructive pulmonary disease; VAS, visual analogue scale (0-5); NS, nonsignificant, *P* > .05, with 95% confidence interval.

[a]Values are expressed as mean ± SD for continuous variables. The distributions of dichotomous data are given in absolute values with percentages in parentheses.

Table 4. Studies for Acquired Lumbar Hernia (n ≥ 5 Patients)[a]

	Arca et al (1998)[51]	Zhou et al (2004)[21]	Carbonell et al (2005)[66]	Tobias-Machado et al (2005)[58]	Palanivelu et al (2008)[19]	Cavallaro et al (2009)[2]	Edwards et al (2009)[8]	Yavuz et al (2009)[9]	Moreno-Egea et al (2011)
n	7	11	10	7	11	13	27	7	60
Median age, years	—	62.0	50.0	52.0	51.3		52.9	48.7	63.0
Gender, female/male	—	3/9	4/6	4/3	4/7		16/11	5/2	33/27
Etiology									
Spontaneous	2	11	—	—	—	9	—	—	3 (5.0)
Surgery	5	—	7	7	11	4	27	7	45 (75.0)
Trauma	—	—	3	—	—	—	—	—	12 (20.0)
Inflammatory	—	—	—	—	—	—	—	—	—
Site									
Superior	1	10	—	—	—	5	—	—	23 (38.3)
Inferior	1	—	—	—	—	4	—	—	31 (51.6)
Diffuse	5	1	10	7	2	4	—	—	6 (10.0)
Localization									
Right	—	5	2	3	6	5	12	2	31 (51.6)
Left	—	2	8	4	5	6	15	5	29 (48.3)
Bilateral	2	4	—	—	—	2	—	—	—
Clinical									
Mass/pain	7	10	5	7	11	13	27	7	60
Obstruction	—	1	5	—	—	—	—	—	—
Treatment									
Plasty	—	8	—	—	—	—	—	—	—
Mesh	—	2	10	—	—	13	—	—	20 (33.3)
Laparoscopy	7	—	—	7	11	—	27	7	35 (58.3)
No surgery	—	1	—	—	—	—	—	—	5 (8.3)

[a]Data are expressed as absolute values with percentages in parentheses.

Table 5. Literature Review: Open Surgery

1888, Owen[26]	Inverted sac, catgut repair muscles
1892, Warbasse[27]	Imbricating the transversalis fascia and covering the defect with a flap turned up from the fascia lata and gluteus maximus
1907, Dowd[28]	Flap of gluteus maximus
1917, Rishmiller[29]	Flap of latissimus dorsi
1923, Ravdin[30]	Free fascia graft (taken from the fascia lata)
1948, Watson[31]	Overlap flaps of the transversalis fascia
1954, Swartz[32]	Free fascia lata strips (3)
1950, Thorek[33]	Meshplasty: Tantalio
1955, Koontz[34]	Flaps of fascia lata and lumbar fascia + tantalio mesh
1960, Pyrtek and Kelly[35]	Meshlasty: Marlex
1963, Hafner et al[36]	Meshplasty: Marlex
1971, Orcutt[37]	Imbricated fascia of the internal oblique, serratus and quadratus lumborum
1978, Swartz[38]	Running strip of fascia lata
1980, Ponka[39]	Malla solapada entre reparación muscular
1983, Alexandre and Bouillot[40]	Tension-free mesh
1986, Lichtenstein[41]	Extraperitoneal "binder" mesh
1991, Bolkier et al[17]	Plication of the normal fascia with interrupted suture
1995, Sutherland and Gerow[42]	Layered sándwich technique (by mobilized muscle flap)
1997, Staerman et al[18]	Running strip of autogenous skin graft as a retention suture
2002, Lossanoff and Kjossev[43]	Plug repair with several sutures
2004, Patten et al[67]	Bone anchor fixation of the mesh to the iliac crest
2008, Armstrong et al[44]	Ventralex patch repair
2010, Solaini et al[45]	Polypropylene dart mesh repair
2010, Witherspoon et al[46]	Open sutureless repair with using a "memory ring" patch
2010, Di Carlo et al[47]	Dowd technique and prosthetic mesh
2011, Bathla et al[7]	Combined laparoscopic and open preperitoneal repair
2011, Garg et al[10]	Sutureless meshplasty

tension-free hernia repair with preperitoneal patch mesh as the best open technique. The advantage of this surgical option is that it can close the musculofascial layer covering the mesh. On this plane, you can put another mesh depending on the defect type and status of adjacent tissues. This option, as our results demonstrated, can be useful in cases of recurrence and when there is strong muscle atrophy. Our recurrences have been resolved with this option, in a relatively simple and safe process (Figure 5).

Laparoscopic Surgery

The history of the laparoscopic approach is shown in Table 6.[48-61] This surgical option still has controversial issues, especially related to the mesh type, the need to overlap, and the fixation method. There are no randomized clinical trials contrasting the open and laparoscopic approaches involving lumbar hernias to conclude which procedure is the method of choice. The literature supports the conclusion that laparoscopic repair is safe and feasible. There are no significant complications, it avoids the need for wide dissection of the lumbar region through a large incision, it allows for the exact localization of the anatomical defect with an excellent anatomical view, thus avoiding injury to structures in proximity to the hernia during repair, as well as offering the advantages of the laparoscopic approach.[50-61] This study confirms that laparoscopic approach offers advantages for the patient: less hospital stay, an earlier return to normal activity, and less analgesic consumption, and less pain at 1 and 6 months (Figure 6).

What Mesh?

In the literature there is no agreement on which mesh should be used. The surgery is developed in the preperitoneal space, so if the peritoneum is integrated, a polypropylene mesh can be used. But often there is excess space and the abdominal cavity is exposed and not protected, so a bilaminar mesh seems a better choice. Today, the lightweight mesh can ensure proper integration with better results for the patient.[62-65] Our study seems to support this fact, as it also decreases postoperative pain.

What Fixation Technique?

There are many ways to fix the mesh to the preperitoneal space: sutures, tackers, or staples; transmural sutures; bone anchor fixation, and so on. All these have demonstrated

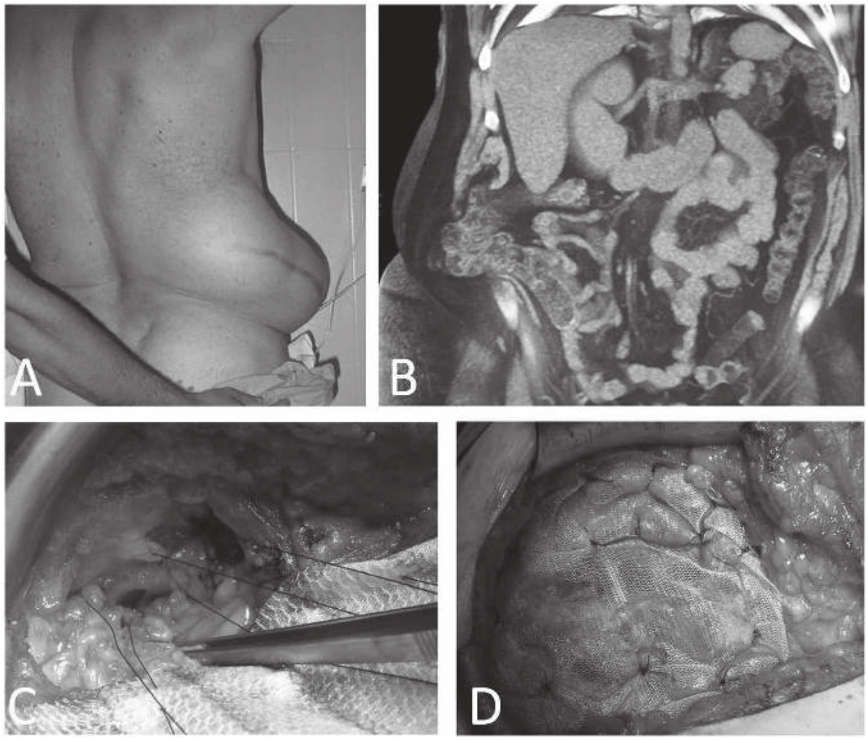

Figure 5. Lumbar hernia—open surgery (A) physical exam, (B) computed tomography study, (C) extraperitoneal mesh repair, and (D) onlay mesh repair

Table 6. Literature Review: Laparoscopic Lumbar Hernia Repair

Year, Author/s (n)	Etiology	Size	Technique	Mesh	Overlap	Fixation
1996, Burick and Parascandola[48]	Trauma	—	TAP	PPL	4	T
1997, Heniford et al[49]	Spontaneous	4 × 3	TAP	PTFE	4	S (3 cm)
1997, Bickel et al[50]	Spontaneous	3 × 3	TAP	PPL	4	T
1998, Arca et al[51] (7)	Incisional	5 × 8	TAP	PTFE	4	C (3 cm), drill bit
1999, Woodward et al[22]	Incisional	—	TEP	PPL	—	C, bone screws
2001, Shekarriz et al[52] (3)	Incisional	5 × 9.5	TAP	PPL	3	T
2001, Steinfeld et al[53]	Incisional	—	TAP	PPL	—	T
2002, Moreno-Egea and Aguayo[54]	Trauma	6 × 10	TAP	Composite	5	T
2002, Postema and Bonjer[23]	Spontaneous	—	TEP	PPL	—	T
2003, Meinke[24]	Incisional	4 × 4	TEP	PTFE	4	C (2 cm)
2003, Habib[25]	Spontaneous	3 × 4	TEP	PPL	5	T
2004, Grauls et al[55]	Spontaneous	3 × 5	TAP	PPL	—	T
2004, Salameh and Salloum[56]	Incisional	10 × 17	TAP	PTFE	3	C (5 cm)
2005, Ipek et al[57]	Spontaneous	8 × 10	TAP	PTFE	3	C (5 cm), drill bit
2005, Tobias-Machado et al[58] (7)	Incisional	8 × 12	TAP	PPL	—	T
2006, Madan et al[59] (2)	Incisional	—	TAP	PTFE	3	C (1 cm)
2007, Iannitti and Biffl[60]	Trauma	4 × 4	TAP	Composix	—	T
2008, Palanivelu et al[19] (11)	Incisional	6 × 8	TAP	Double[a]	5	S
2009, Edwards et al[8] (27)	Incisional	6 × 13	TAP	PTFE	5	C
2009, Yavuz et al[9] (7)	Incisional	5 × 8	IP	PPL	4	C (1 cm)
2010, Kawashita et al[61]	Incisional	5 × 12	TAP	Composix	—	C

Abbreviations: TAPP, transabdominal preperitoneal; TEP, extraperitoneal; PPL, polypropylene; PTFE, polytetrafluoroethylene; Fixation T, tacker; S, sutures; C, combined T + S (at *x* cm intervals); drill: used to create iliac hole through which the sutures can be passed.
[a]Double mesh repair: PPL equal to the defect and composite.

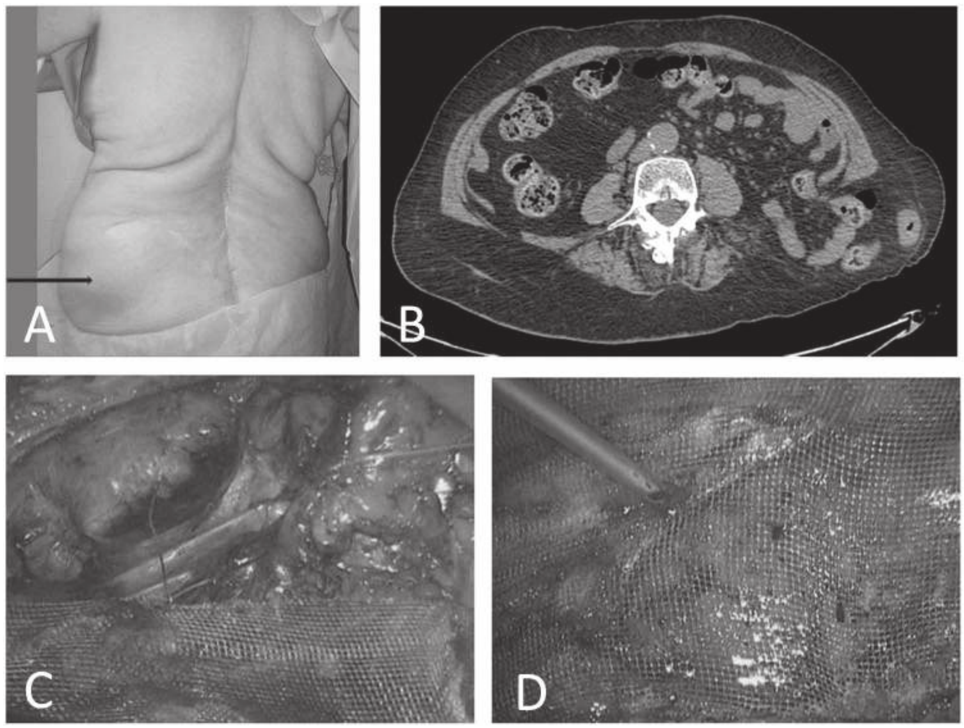

Figure 6. Lumbar hernia—laparoscopic surgery: (A) physical exam, (B) computed tomography study, (C) laparoscopy technique, and (D) mesh repair and fixation with synthetic tissular adhesive

their effectiveness in the literature based on an absence of recurrence. Carbonell et al[66] used bone anchor fixation technique, but their cases are recurrent, incarcerated, or traumatic lumbar hernias.[67] In most cases, routine use of sutures anchored to the iliac crest or transcostal sutures is not recommended. These options can cause more clinical problems than benefits.[68,69] In literature, there are 7 publications using helicoidal fixation only; of these, 2 of the series were with 3 and 7 patients.[51,57] All the published cases have been incisional hernias, with sizes between 6 and 15 cm, with the mean follow-up of 1 year, and which have not reported any recurrence. These results, and our experience, support the safety of tacker fixation in the lumbar hernia, as has been shown for other abdominal wall hernias.[70-72] The problem of mesh fixation should be considered today as "the problem of individualized treatment." What is really important is the correct adjustment of the type of fixation to the patient and hernia type.

Recurrences

The results of treatment are difficult to analyze in terms of the limited experience of one surgeon and the limited follow-up in the majority of cases. Recurrences have been published with all surgical options. Di Carlo et al,[47] in 2007, published a recurrent hernia in 3 occasions. Madan et al,[59] in 2006, have published another recurrent case in a traumatic lumbar hernia after laparoscopic surgery was converted to open surgery. In our series, the only predictors of recurrence have been the location and defect size. All the recurrences were in patients with diffuse hernias, with size larger than 16 cm, and associated with muscle atrophy. All these examples should help us guide on the importance of the correct evaluation of each patient, the proper choice of surgical technique, individualized selection of mesh fixation, and the need to centralize treatment of this disease in centers with experience where the patient can be offered the best possible outcome. A working algorithm is shown in Figure 7.

The main limitation of our study is its own design. The efficacy of a treatment should be tested by randomized controlled trial. But one must bear in mind that it is more difficult to conduct randomized controlled trials in the field of surgery than in the medical field. Moreover, the low prevalence of this condition can make it very difficult to have adequate experience with the same surgical technique. Until more reliable studies are conducted, we can draw the following conclusions:

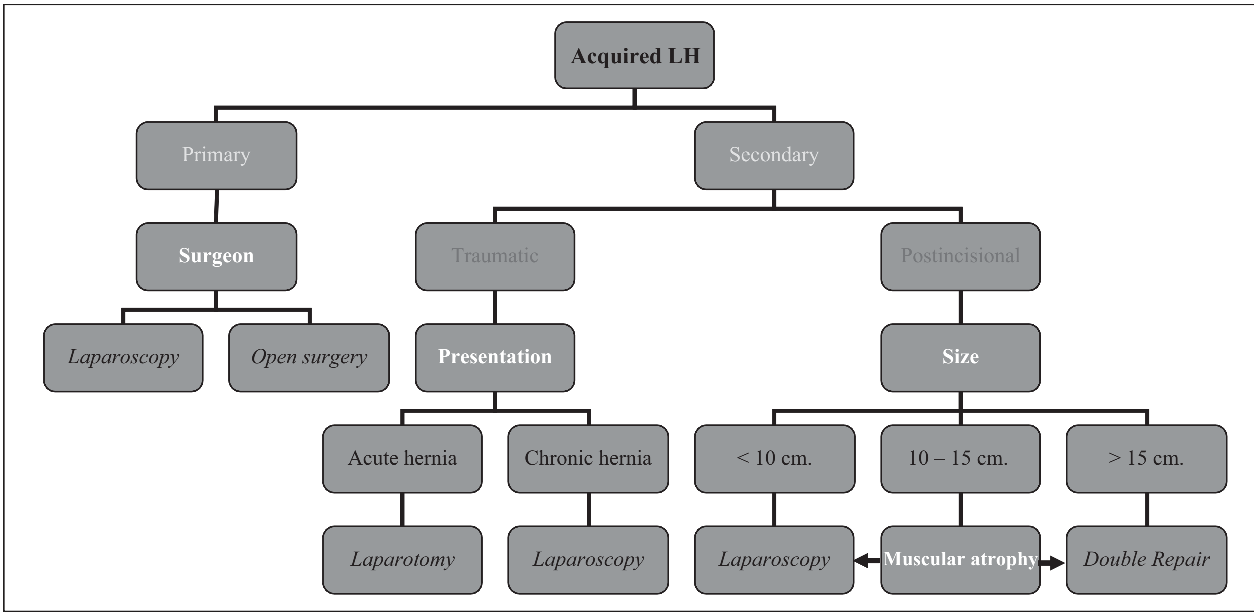

Figure 7. Algorithm for treatment of lumbar hernias (LHs)

1. The laparoscopic approach is associated with less operating time, shorter hospital stays, an earlier return to normal activity, lower analgesic consumption, and less pain at 1 and 6 months, with equivalent recurrence rates, when compared with open lumbar hernia repair.
2. Open surgery may be considered the best option in the diffuse hernias with defects larger than 15 cm. Traumatic hernias do not differ in their prognosis of incision and are only associated with a greater number of cases of local morbidity.
3. The lightweight mesh does not increase the recurrence rate in lumbar hernia repair, but it does seem to improve the quality of life for the patient postoperatively.
4. Risk factors associated with recurrence are the size and location of the hernia.

Declaration of Conflicting Interests

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