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ORIGINAL ARTICLE

Could long-term follow-up modify the outcomes after laparoscopic TAPP? A 5-year retrospective cohort study

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Abstract

Purpose Laparoscopic inguinal hernia repair (LIHR) has demonstrated multiple benefits. However, long-term results regarding recurrence and quality of life (QoL) are still on debate. We aimed to analyze postoperative outcomes with long-term follow-up after LIHR.

Methods A consecutive series from December 2012 to May 2017 of laparoscopic TAPP was included. A minimum of 6 months of follow-up was required for inclusion. The sample was divided into two groups, G1: patients with recurrence and G2: patients without recurrence. Patient's characteristics, operative variables and postoperative outcomes were analyzed. A QoL survey (Eura-HS QoL) was performed in the pre- and postoperative period.

Results A total of 717 laparoscopic TAPP were performed in 443 patients. On univariate analysis, smoking, previous recurrence, mesh size smaller than 12 × 15 cm and surgical teams with less than 30 cases/year showed an increased recurrence rate ($p < 0.05$). But only smoking and less experienced teams were statistically significant on multivariate analysis ($p < 0.01$). After a 2-year follow-up, recurrence rate was 1.5%, while it increased to 2.6% ($n = 19$) at 5-year follow-up. Sixty percent of patients answered QoL survey. Average preoperative scores of pain, activities restriction and aesthetic dissatisfaction improved significantly after 6 months of follow-up in patients without recurrence.

Conclusions After LIHR, quality of life shows a significant improvement in all parameters. Extending follow-up beyond 2 years after laparoscopic TAPP allows a more accurate assessment of recurrence rate. Smoking and inexperienced teams were significant risk factors for its development.

Keywords Laparoscopic inguinal hernia · Recurrence · Risk factors · Quality of life

Introduction

Inguinal hernioplasty is one of the most frequent procedures in general surgery. Since its introduction in the 90s, laparoscopic approach has gained great popularity and became the treatment of choice in centres of reference. Within its attributes, the minimally invasive approach has shown less postoperative (POP) pain, faster recovery, early return to work and better quality of life (QoL) [1]. Among the different variants, transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) are the most frequently used in the daily practice. Despite the differences between both techniques, the choice to perform one or another depends on surgeon's preference [2–5].

It is well known that LIHR has demonstrated to be safe and efficient [6, 7]. However, long-term results are scarce and controversial. In addition, recurrence rate has been reported from a range of 1–10% [8, 9]. Several factors have been described as potential contributors to the durability of the hernioplasty such as: patient's characteristics, surgical technique, surgeon's learning curve and the type of defect [10, 11]. Another possible explanation is that the length of follow-up varies widely among different studies [9, 12, 13], although the cutoff point for an optimal follow-up has not been elucidated.

Another key aspect of surgical long-term results is the impact on quality of life (QoL) [14–16]. Postoperative pain

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is one of the most common cause of work absence and reduction of physical activity. In addition, the literature shows an incidence of postoperative groin pain that ranges from 11 to 29% after LIHR [17, 18]. This highlights the need of QoL assessment with long-term follow-up to evaluate the durability of the repair and to detect variables that would improve outcomes as well.

In the present study, we aim to identify risk factors for recurrence after LIHR with long-term follow-up and to evaluate its impact on patient's QoL.

Materials and methods

After obtaining Institutional Review Board approval, clinical records of patients who underwent inguinal hernioplasty between December 2012 and May 2017 were revised. Only TAPP laparoscopic surgeries with a minimum of 6 months of follow-up were included. Surgeon's experience was classified as low or high depending on the number of LIHR per year, with a cutoff value of 30 per year.

Surgical technique

Briefly, a 10-mm port at the umbilicus and 5 mm ports in each flank were placed. Peritoneum was incised to access the preperitoneal space. Hernia sac was reduced and the lower epigastric vessels and elements of the spermatic cord or round ligament were identified. Mesh was placed in all cases for reinforcement and was fixed to the Cooper's ligament, transverse abdominis and rectus abdominis muscles with resorbable tacks. The size and composition of the prostheses were decided according to surgeon's criteria. Peritoneum flaps were closed with a running suture. Finally, a 'figure-of-eight' stitch was performed to close the fascial defect at the umbilicus.

Patient analysis

The sample was divided into two groups. Patients who developed recurrence during follow-up were in Group 1 (G1), while those with no recurrence were in Group 2 (G2). Patients' characteristics, operative variables and POP outcomes were analyzed. Follow-up was performed at the clinics on POP day 10, 30, and 6 months, and then annually. Hernia recurrence was diagnosed with physical examination alone, and ultrasound was performed in cases of inconclusive clinical assessment.

The Eura-HS QoL survey [19] was chosen to assess the QoL after surgery. This questionnaire evaluates three aspects of QoL: pain at the surgical site, restriction of activities and cosmetic discomfort. Each of them includes a subset of items that were analyzed separately in a scale from 1 to 10 and then summed up to get a global scale for pain (maximum 30 points), activities restriction (maximum 40 points) and cosmetic discomfort (maximum 20 points). The survey was given to all patients immediately before the operation and at the 6-month follow-up visit. It was repeated whenever a recurrence was detected during follow-up, and the latter one was considered for comparative analysis.

Statistical analysis

Statistical analysis was calculated with IBMSPSS v.20 (IBM, Armonk, New York, USA). Student's *t* test and Chi square test were used to identify relationship between outcomes and individual variables. A logistic regression model was applied to detect potential confounders in the multivariate analysis. Student's *t* test for dependent variables was used to determine changes in QoL survey's scores before and after surgery. A p value < 0.05 was considered significant.

Results

A total of 717 LIHR were performed in 443 patients. The median POP follow-up was 30 months (range 6–52 months). Nineteen recurrences (2.6%) were detected in this period, and these constituted Group 1 (G1). The remaining 698 repairs, in which no recurrences were detected, formed Group 2 (G2).

Risk factors for hernia recurrence

Patient's characteristics are summarized in Table 1. The mean age was 55 years in G1 and 59 years in G2, with a wide predominance (90%) of males. Average body mass index (BMI) was also similar (G1: 25.9 kg/cm^2 vs. G2: 26.3 kg/cm^2, p = NS). A higher proportion of smokers (40%) was found in G1 compared to G2 (18%), $p = 0.01$. In G1, 31% of the surgeries were previously repaired hernias, while this proportion was significantly lower in G2 (12%), $p = 0.02$.

Regarding operative variables, operative time did not show differences between groups (G1: 105 min. vs. G2: 117 min, p = NS). A larger hernia defect was observed in G1, although it was not statistically significant (G1: 4.3 cm vs. G2: 3.9 cm, p = NS). Different mesh sizes were used, with an average of 146 cm^2 in G1 and 162 cm^2 in G2. A higher proportion of meshes smaller than 12×15 cm were placed in G1 (G1: 84% vs. G2: 58%, $p < 0.05$). The most frequently used material was standard polypropylene (85%), followed by lightweight meshes. When examining the influence of surgeon's experience, it was observed that 37% of hernioplasties in G1 were made by those with less than 30 repairs per year, while this proportion was lower in G2 (G1: 37% vs.

Table 1 Demographics and intraoperative variables

Variable	G1 Recurrence group ($n=19$)	G2 Non-recurrence group ($n=698$)	p
Age	55 (27–82)	58 (20–91)	ns
Gender (M:F)	17/2	384/40	ns
BMI (kg/m^2)	25.9 ± 3.4	26.3 ± 3.4	ns
ASA I-II	19 (100%)	408 (100%)	ns
Smokers	8 (40%)	74 (18%)	**0.01**
Recurrence repair	6 (31%)	82 (12%)	**0.02**
Operative time (min)	105	117	ns
Defect size (cm)	4.3	3.9	ns
Mesh			
Mesh < 12 x 15	16 (84%)	176 (58%)	**0.03**
Lightweight mesh	8 (44%)	155 (38%)	ns
Surgeon experience			
< 30 surgeries/year	7 (37%)	76 (11%)	**0.03**

Univariate analysis showed that active smokers, previous recurrence, meshes less than 12x15 cm and unexperienced surgeons were risk factors associated to hernia recurrence

Bold values indicate better results compared to other filtering methods

M male, *F* female, *BMI* body mass index, *ASA* American Society of Anesthesiologists

Table 2 Multivariate analysis

	G1 ($n=19$)	G2 ($n=698$)	OR	95% CI	p
Smokers	8	74	**3.7**	**1.4–9.7**	**<0.01**
Mesh < 12 × 15	16	176	1.8	0.5–6.5	0.3
Recurrence repair	6	82	1.9	0.7–5.6	0.09
< 30 surgeries/year	7	76	**3.9**	**1.4–10.4**	**<0.01**

Active smokers and unexperienced surgeons were significantly associated to hernia recurrence on multivariate analysis

Bold values indicate better results compared to other filtering methods

G2: 11%, $p<0.01$ (see Table 1). Multivariate analysis (Table 2) showed that smoking and surgeon's experience were the only two independent factors associated with hernia recurrence ($p<0.01$).

Global recurrence rate was 2.6%, with a total of 19 hernioplasties detected over a follow-up period of 5 years. Distribution along time of these recurrences can be observed in Fig. 1. At second POP year, only 11 recurrences were detected, which would represent a 1.5% recurrence rate. This would have been only the 58% of the total recurrences detected when extending follow-up to 5 years.

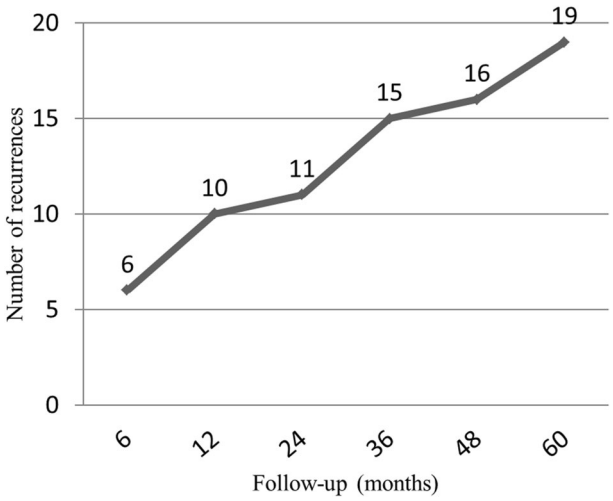

Fig. 1 Distribution of hernia recurrence along time

Table 3 QoL in patients with recurrence (G1)

Variable	Preoperative	Postoperative	p
Pain	10.3	5.3	0.07
In rest	2.7	1.2	0.08
During activities	4.3	1.9	**0.03**
During last week	3.3	2.2	0.34
Restriction of activities	13.9	9.3	**0.04**
Daily activities	1.5	1.8	0.51
Outside the house	3.9	2.3	0.19
During sports	4.1	2.6	0.11
During heavy labour	5.9	4.4	**0.03**
Cosmetic discomfort	3.9	4.5	0.55
Shape of the abdomen	1.3	2.1	0.29
Site of the hernia	2.6	2.4	0.61

All QoL parameters improve after surgery in patients with hernia recurrence, although only restriction of activities reached statistical significance

Bold values indicate better results compared to other filtering methods

QoL quality of life

Quality of life

The Eura-HS QoL survey was completed preoperatively and postoperatively by 265 patients (60%). In recurrence group (G1), 100% (19 patients) filled both forms (Table 3). Pain score showed improvement after hernioplasty, although it did not reach significance (preoperative: 10.3 vs. postoperative: 5.3, $p=0.07$). Activities restriction score improved significantly after surgery (preoperative: 13.3 vs. postoperative: 9.3, $p=0.04$). Cosmetic discomfort worsened after surgery, although it was not statistically significant (3.9 vs. 4.5, respectively, $p=0.55$). In the non-recurrence group (G2),

59% of patients filled out the survey (Table 4). All evaluated variables of QoL showed a significant improvement after LIHR in this group. Pre- and postoperative scores were as follows: pain: 7.8 vs. 2.4 ($p < 0.01$); restriction activities 6.2 vs. 2.3 ($p < 0.01$); and cosmetic discomfort: 2.3 vs. 1.6 ($p = 0.01$).

Discussion

Since its introduction, LIHR has been accepted worldwide, being laparoscopic TAPP with mesh reinforcement the most frequently used technique. Compared with the open approach, TAPP repair offers the benefits of minimally invasive surgery reducing surgical site events with similar recurrence rate [9, 20]. However, literature is limited regarding long-term results and a minimal cutoff point for postoperative follow-up after LIHR has not been proposed yet. In this study, we found that extending postoperative follow-up from 2 to 5 years led to a 40% increment in the recurrence rate (1.5% vs. 2.6%). Smoking and surgeon's experience were independent risk factors for hernia recurrence, as was observed on multivariate analysis. In addition, patient's quality of life at 6 months after surgery improved significantly, except for those who had recurrences.

To obtain a low recurrence rate is one of the main goals after inguinal hernia repair. However, results are heterogeneous with recurrence rates ranging from 1 to 10% [8, 9] and a variable mean postoperative follow-up [9, 12, 13]. It is assumed that a two-year period could seem sufficient to assess this outcome, since most recurrences are detected during that time [21]. In this study, we found a cumulative recurrence rate of 2.6% after 5-year follow-up, with an increment of 40% of detection compared to 2 years (1.5%). A similar observation was obtained in a multicenter study by Eklund et al. [22] with a cumulative recurrence rate of 3.5% after 5 years, whereas at 2 years it was only 2%. Thus, setting up a long-term follow-up with scheduled visits or even by phone-call [23] could provide a more accurate assessment of hernioplasty.

It has already been established that surgeon's experience on hernia repair has a direct impact on recurrence rate [12, 24, 25]. We found that a higher expertise on laparoscopic approach was significantly related to a lower recurrence rate. An adequate number of cases are needed to obtain better results, but the minimal cutoff point has not been clarified yet. It has been proposed that up to 250 cases are necessary to reach an adequate learning curve [26]. In concordance, Feliu-Pala et al. observed a reduction in recurrence rate after 100 cases [27]. We considered a cutoff point of 30 LIHR per year, since this is the average number of cases reached by most trainees in our institution. These differences in the learning curves might be explained by the complexity of the hernia and the experience of the trainer. Overall, surgeon's experience in laparoscopic hernia surgery is a very important issue when analyzing postoperative outcomes. It is well known that laparoscopic hernia repairs are generally performed by general surgeons who are not specialized in hernia field leading to heterogenous results. This encourages the need for, on one hand, training in institutions with comprehensive hernia approach which could offer an adequate learning curve and, on the other hand, promoting specialized areas in hernia field for most institutions. As a result of this specialization one would expect better outcomes in the treatment of hernia.

Tobacco smoking is another variable that influences results in hernia repair [28]. In this series, active smokers were more likely to develop a recurrence compared to non-smokers, and this was confirmed on multivariate analysis. It is well known that nicotine affects microcirculation impairing wound healing process [29, 30]. It could be possible that the main damage occurs within the first weeks after surgery, which is a critical period of neovascularization and scar formation. Assuming that the peripheral tissue is reduced in vasculature and that the active smoker would be perpetuating the harmful effect on the wound, this could lead to a poor-quality scar tissue and predisposing to future hernioplasty failures.

Quality of life is a relevant issue after inguinal hernia repair, as postoperative groin pain has been reported to be as high as 29% [17, 18]. It is assumed that laparoscopic approach would improve postoperative events allowing a faster recovery and early return to daily activities; however, few studies assess QoL improvement with an

Table 4 QoL in patients without recurrence (G2)

Variable	Preoperative	Postoperative	*p*
Pain	7.8	2.4	**< 0.01**
In rest	1.4	0.5	**< 0.01**
During activities	3.7	1.1	**< 0.01**
During last week	2.6	0.7	**< 0.01**
Restriction of activities	6.7	2.3	**< 0.01**
Daily activities	0.9	0.5	**< 0.01**
Outside the house	2.1	0.7	**< 0.01**
During sports	1.7	0.6	**< 0.01**
During heavy labour	2.9	1.1	**< 0.01**
Cosmetic discomfort	2.3	1.6	**0.01**
Shape of the abdomen	1.2	0.9	0.13
Site of the hernia	1.3	0.7	**< 0.01**

All QoL parameters showed a significant improvement after surgery in patients without hernia recurrence

Bold values indicate better results compared to other filtering methods

QoL quality of life

objective scale. We chose the Eura-HS survey because it evaluates three elemental components of QoL before and after surgery. In our study, a significant improvement in all evaluated parameters was observed in patients without recurrence (G2). On the other hand, patients who had a recurrence also showed an improvement on pain at the site of the hernia and activities restriction, but only the latter was statistically significant. This lack of significance could be explained by the small sample size. Cosmetic discomfort, however, seems to have worsened after surgery, although it was not statistically significant. Based on these results, we can say that laparoscopic inguinal hernia repair improves pain at the site of the hernia, restriction of activities and cosmetic discomfort, but these results might be worse in patients that develop hernia recurrence. Similar findings were observed in the study by Jalil and colleagues [14], in which patients with recurrences had low QoL scores.

This study has limitations, being its retrospective design the most relevant. Second, the sample size between groups is discordant. However, extending postoperative follow-up after TAPP repairs probably show more confident outcomes regarding recurrence and risk factors that will play a role in a failure of the repair. We believe this study would be an important contribution in hernia field. In the future, a prospective assessment of QoL would be a positive way to determine patient's evolution in a more objective way. In addition, a long-term follow-up plan should be scheduled with the patient beforehand to diminish drop-outs.

Conclusion

Quality of life shows a significant improvement in all parameters after LIHR. Extending follow-up beyond 2 years after laparoscopic TAPP allows an adequate assessment of recurrence rate. Smoking and inexperienced teams were significant risk factors for its development.

Compliance with ethical standards

Conflict of interest Drs. Peña, Dreifuss, Schlottmann and Sadava have no conflicts of interest or financial ties to disclosure.

Ethical approval The Hospital Alemán of Buenos Aires Institutional Review Board reviewed and approved this study.

Human and animal rights The study including human participants has been performed in concordance with ethical standards of the Declaration of Helsinki and its later amendments.

Informed consent For this study, formal consent was not required.

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