Current issue list available at AnnMedRes

Annals of Medical Research

journal page: www.annalsmedres.org

Comparison of open and laparoscopic inguinal hernia surgery based on chronic pain, paraesthesia and recurrence with six months follow-up

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ARTICLE INFO

Keywords:
Inguinal hernia repair
Laparoscopic hernia surgery
Paraesthesia
Chronic pain
Recurrence

Received: Aug 02, 2023
Accepted: Sep 04, 2023
Available Online: 27.09.2023

DOI:
10.5455/annalsmedres.2023.08.173

Abstract

Aim: To assess the preoperative and operative findings and postoperative early and late complications in patients who were operated on electively and to compare the factors affecting these results through open and laparoscopic hernia techniques.

Materials and Methods: In this retrospective study, the patients were initially divided into two groups as open inguinal hernia repair (OIHR) and laparoscopic inguinal hernia repair (LIHR); then the LIHR group was divided into two subgroups as transabdominal preperitoneal (TAPP) and total extraperitoneal (TEP) groin hernia repair with respect to the operation techniques. Preoperative, operative, and early and sixth-month late-period complications of the patients were statistically analyzed.

Results: In a total of 241 patients included in the study, 170 patients were included in the OIHR group, and 71 patients were included in the LIHR group (TAPP=20, TEP=51). No statistically significant difference was noted between the OIHR and LIHR groups and between the TAPP and TEP subgroups in terms of chronic pain, paraesthesia, and recurrence.

Conclusion: We believe that there is no difference in long-term results between open and laparoscopic elective inguinal hernia surgery.

Introduction

Inguinal hernia is a condition that can affect individuals of all age groups, which occurs due to a defect or weakness in the tissues surrounding the inguinal canal in the abdominal wall [1,2]. This condition requires urgent surgical intervention in some cases and elective operation in most cases [3]. In the historical process, many successful open techniques have been observed, such as Bassini, Shouldice, Lichtenstein, and darn repair, and nowadays there is an increasing trend towards laparoscopic approach in repairing the described inguinal hernia. Especially in modern surgical practice, transabdominal preperitoneal (TAPP) and total extraperitoneal (TEP) groin hernia repairs are well-defined and implemented laparoscopic methods [4]. Moreover, robotic hernia repair has also entered clinical practice due to the increasing trend toward minimally invasive surgery, however, it remains controversial in terms of cost-effectiveness [5]. It is known that patients who undergo both open and laparoscopic inguinal hernia surgery may experience complications in both the early and late postoperative periods. Postoperative chronic pain, paraesthaesia, mesh reaction, and recurrence are particularly reported in the literature [6,7]. Medical treatment or additional surgical interventions may be required following these existing complications [6]. In this study, we assessed preoperative and operative findings in patients who underwent elective surgery. After analyzing postoperative early and late complications and their results, our objective was to examine the effective factors on these results by comparing open and laparoscopic hernia techniques.

Materials and Methods

Study design

The Ethics Committee approval was obtained from the University of Health Sciences Gulhane Training and Research Hospital Clinical Research Ethics Committee (no: 2022/39, date: 11.05.2022). All study procedures were performed in accordance with local ethical standards and with the 1964 Helsinki Declaration and its amendments.

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Patients over the age of 18 who were operated consecutively with an indication for elective inguinal hernia repair surgery from January 2020 to January 2022 in a single tertiary hospital were included in this retrospective study after receiving ethical approval from the local committee. Emergency cases, patients who were operated for other surgical reasons addition to inguinal hernia repair, patients who were operated for bilateral inguinal repair or inguinal hernia recurrence or not used mesh, patients who had connective tissue diseases, patients with missing hospital records and postoperative follow-up as well as patients under the age of 18 were excluded from the study. Demographic and clinical data of the patients such as age, gender, smoking habits, comorbidities such as diabetes mellitus, chronic obstructive pulmonary disease, hypertension, chronic heart failure, chronic thyroid, renal, neurological and vascular diseases, Body-mass index (BMI), American Society of Anesthesiologists (ASA) scores, hernia side, hernia type, operation type, presence of early-local complications such as seroma, hematoma, dehissens, and surgical site infection/abscess were analyzed. At the end of the sixth month, recurrence, re-operation, paraesthesia at the operation site, chronic pain status, and Visual Analogue Scale (VAS) scores were also analyzed.

Routine intravenous antibiotic prophylaxis of one gram of cefazolin was applied to the patients. Antibiotherapy was chosen with consultation of Infectious Diseases in patients with allergy anamnesis.

Following the patients were initially divided into two groups as open inguinal hernia repair (OIHR) and laparoscopic inguinal hernia repair (LIHR), the LIHR group was further divided into two subgroups with respect to the operation techniques, namely, TAPP and TEP. Only the Lichtenstein procedure, in which mesh is used, was applied as an open technique. Polypropylene mesh was used in the cases. No drain was used in routine practice. However, drains were used in cases when the need developed according to the surgeon's decision. Different approaches were used in local-early complications. Seroma-hematoma cases were followed-up closely, pressure wound dressing and drainage were applied if necessary. Oral antibiotics and drainage were preferred for surgical site infections-abscesses. Debridement and wound suturation techniques were also applied for dehiscence cases. Recurrent cases were reoperated. Cases with chronic pain and paraesthesia were taken under long-term medical treatment with Algology and Neurology clinics for multidisciplinary approaches after imaging and laboratory examinations such as magnetic resonance imaging (MRI) and electromyelography.

Statistical analysis

The statistical analyses were performed using the SPSS version 22.0 program. Continuous variables were expressed as mean and standard deviation when normally distributed, and as median (minimum-maximum) when abnormally distributed. Categorical variables were expressed as numbers and percentages. After examining the distribution of the variables, the numerical variables that showed a normal distribution were analyzed between the two groups using the "Student T test," and those that showed an abnormal distribution were analyzed using the "Mann Whitney U test." The comparison of categorical data was performed using "chi-square analysis" and "Fisher's exact test." For hypothesis testing, as the H0 hypothesis (null), there is no difference in postoperative results between open and laparoscopic techniques in inguinal hernia surgery and as the H1 hypothesis (alternative), there are differences in postoperative outcomes between open and laparoscopic techniques in inguinal hernia surgery. A p-value of less than 0.05 was considered as statistically significant in the statistical analyses.

Results

The mean age of the 241 patients included in the study was 55.3 ± 15.8 years (ranging from 19 to 91 years old). 97.5% of the patients were male. 170/241 patients were included

Table 1. Descriptive features of the patients.

Feature (n = 241)	Number (Percentage)
Age*	55.3 ± 15.8
Gender	
Female	6 (2.5)
Male	235 (97.5)
Height (centimeter)**	172 (155-197)
Weight (kilograms)**	77 (50-114)
BMI (kg/m^2)*	26.0 ± 2.9
Smoking	56 (23.2)
Presence of comorbidity	101 (41.9)
DM	31 (12.9)
DM + additional comorbidity	26 (10.8)
Location of the hernia	
Right Side	142 (58.9)
Left Side	99 (41.1)
ASA	
I	53 (22.0)
II	167 (69.3)
III	21 (8.7)
Hernia type	
Direct Hernia	64 (26.6)
Indirect Hernia	135 (56.0)
Pantaloon Hernia	42 (17.4)
Surgery type	
Open	170 (70.5)
Laparoscopic	71 (29.5)
TAPP	20 (28.2)
TEP	51 (71.8)
Postoperative complications	
Presence of chronic pain	36 (14.9)
VAS score* in those with pain	3.1 ± 1.5
Paraesthesia	28 (11.6)
Presence of early complications	17 (7.1)
Surgical site infection/abscess	8 (3.3)
Hematoma/Seroma	7 (2.9)
Dehiscence	2 (0.9)
Recurrence	7 (2.9)

*Mean ± Standard deviation. **Median (minimum-maximum). ASA: American Society of Anesthesiologists; BMI: body mass index; TAPP: transabdominal preperitoneal; TEP: total extraperitoneal; VAS: visual analog scale; DM: diabetes mellitus.

Table 2. Comparison of the descriptive and clinical features of the OIHR and LIHR groups.

	OIHR (n = 170)	LIHR (n = 71)	p value
	Number (percentage)	Number (percentage)	
Age*	57.3 ± 15.9	50.7 ± 14.5	**0.003**†
Gender			0.673††
Female	5 (2.9)	1 (1.4)	
Male	165 (97.1)	70 (98.6)	
BMI (kg/m^2)*	26.2 ± 2.8	25.2 ± 2.8	0.014†
Smoking	38 (22.4)	18 (25.4)	0.615‡
Presence of comorbidity	84 (49.4)	17 (23.9)	**0.001**‡
DM	26 (15.3)	5 (7.0)	0.081‡
DM + additional comorbidity	22 (12.9)	4 (5.6)	0.096‡
Location of the hernia			0.598‡
Right Side	102 (60.0)	40 (56.3)	
Left Side	68 (40.0)	31 (43.7)	
ASA			**0.008**‡
I	36 (21.2)	17 (23.9)	
II	113 (66.5)	54 (76.1)	
III	21 (12.4)	0	
Hernia type			**0.014**‡
Direct Hernia	51 (30.0)	13 (18.3)	
Indirect Hernia	85 (50.0)	50 (70.4)	
Pantaloon Hernia	34 (20.0)	8 (11.3)	
Postoperative complications			
Presence of chronic pain	25 (14.7)	11 (15.5)	0.876††
VAS score* in those with pain	3.0 ± 1.4	3.4 ± 1.7	0.470†
Paraesthesia	22 (12.9)	6 (8.5)	0.321††
Presence of early complications	11 (6.5)	6 (8.5)	0.584‡
Surgical site infection/abscess	3 (1.8)	4 (5.6)	0.200††
Hematoma/Seroma	6 (3.5)	2 (2.8)	0.565††
Dehiscence	2 (1.2)	0	0.497††
Recurrence	5 (2.9)	2 (2.8)	0.660††

*Mean ± Standard deviation. †Student t-test. ††Fisher's exact test. ‡Chi-square test. ASA: American Society of Anesthesiologists; BMI: body mass index; TAPP: transabdominal preperitoneal; TEP: total extraperitoneal, VAS: visual analog scale, DM: diabetes mellitus.

in the OIHR group, and 71/241 patients were included in the LIHR group (TAPP=20, TEP=51). Out of the 241 patients included in the study, 36 had chronic pain, 28 had paraesthesia, and 17 had early postoperative complications (surgical site infection/abscess=8, hematoma/seroma=7, dehiscence=2) (Table 1).

When the OIHR and LIHR groups were compared in terms of descriptive and clinical characteristics, the patients in the OIHR group were older (57.3 ± 15.9 vs. 50.7 ± 14.5, p=0.003). Comorbidity was more common in the OIHR group (49.4% vs. 23.9%, p<0.001). Between the OIHR and LIHR groups, there was a significant difference in terms of BMI (p=0.014), ASA score (p= 0.008), and hernia type (p=0.014). Nevertheless, in terms of early postoperative complications, no difference was observed between the two groups. Of the 17 patients with early postoperative complications, 11 were in the OIHR group and 6 were in the LIHR group. Recurrence was observed in 5 patients in the OIHR group and in 2 patients in the LIHR group (Table 2).

No significant difference was observed between the TAPP and TEP subgroups from the point of descriptive features, clinical features, and postoperative complications. In the TAPP and TEP subgroups, early postoperative complications were noted in 3 patients each. While no recurrence was observed in the TAPP subgroup, it was observed in 2 patients in the TEP subgroup (Table 3).

When the patients were compared with respect to the presence of early complications (n=17), only the VAS score (6.3 ± 0.5 vs 2.8 ± 1.2, p<0.001) was noted to be higher in those with early complications, however, in terms of other descriptive and clinical features, no significant difference was noted (Table 4).

When patients were compared upon the presence of chronic pain (n=36), those with chronic pain had a higher rate of smoking (38.9% vs 20.5%, p=0.016), paraesthesia (22.2% vs 9.8%, p=0.045), and recurrence (11.1% vs 1.5%, p=0.011) (Table 5).

Table 3. Comparison of descriptive and clinical features of TAPP and TEP subgroups.

	TAPP (n = 20)	TEP (n = 51)	p value
	Number (percentage)	Number (percentage)	
Age*	49.5 ± 16.0	51.1 ± 14.0	0.675†
Gender			0.718‡
Female	0	1 (2.0)	
Male	20 (100)	50 (98.0)	
BMI (kg/m^2)*	24.4 ± 3.3	25.6 ± 2.5	0.105†
Smoking	4 (20.0)	14 (27.5)	0.516‡
Presence of comorbidity	5 (25.0)	12 (23.5)	0.561††
DM	1 (5.0)	4 (7.8)	0.564††
DM + additional comorbidity	1 (5.0)	3 (5.9)	0.686††
Location of the hernia			0.500‡
Right Side	10 (50.0)	30 (58.8)	
Left Side	10 (50.0)	21 (41.2)	
ASA			0.540††
I	6 (30.0)	11 (21.6)	
II	14 (70.0)	40 (78.4)	
III	0	0	
Hernia type			0.483‡
Direct Hernia	5 (25.0)	8 (15.7)	
Indirect Hernia	12 (60)	38 (74.5)	
Pantaloon Hernia	3 (15.0)	5 (9.8)	
Postoperative complications			
Presence of chronic pain	3 (15.0)	8 (15.7)	0.628††
VAS score* in those with pain	3.6 ± 2.0	3.3 ± 1.7	0.820†
Paraesthesia	1 (5.0)	5 (9.8)	0.668††
Presence of early complications	3 (15.0)	3 (5.9)	0.340††
Surgical site infection/abscess	2 (10.0)	2 (3.9)	0.314††
Hematoma/Seroma	1 (5.0)	1 (2.0)	0.487††
Dehiscence	0	0	-
Recurrence	0	2 (3.9)	0.513††

*Mean ± Standard deviation. †Student t-test. ††Fisher's exact test. ‡Chi-square test. ASA: American Society of Anesthesiologists; BMI: body mass index; TAPP: transabdominal preperitoneal; TEP: total extraperitoneal, VAS: visual analog scale, DM: diabetes mellitus.

Table 4. Comparison of descriptive and clinical features with respect to the presence of early postoperative complications.

Feature	Early complication (+) (n = 17)	Early complication (-) (n = 224)	p value
	Number (percentage)	Number (percentage)	
Age*	56.0 ± 16.0	55.3 ± 15.8	0.858†
Gender			0.358‡
Female	1 (5.9)	5 (2.2)	
Male	16 (94.1)	219 (97.8)	
BMI (kg/m^2)*	26.7 ± 3.6	25.9 ± 2.8	0.280†
Smoking	5 (29.4)	51 (22.8)	0.554††
Presence of comorbidity	8 (47.1)	93 (41.5)	0.655‡
DM	1 (5.9)	30 (13.4)	0.705††
DM + additional comorbidity	0	26 (11.6)	0.229††
Location of the hernia			0.603‡
Right Side	9 (52.9)	133 (59.4)	
Left Side	8 (47.1)	91 (40.6)	
ASA			0.548‡
I	2 (11.8)	51 (22.8)	
II	13 (76.5)	154 (68.8)	
III	2 (11.8)	19 (8.5)	
Hernia type			0.724‡
Direct Hernia	4 (23.5)	60 (26.8)	
Indirect Hernia	11 (64.7)	124 (55.4)	
Pantaloon Hernia	2 (11.8)	40 (17.9)	
Postoperative complications			
Presence of chronic pain	3 (17.6)	33 (14.7)	0.725††
VAS score* in those with pain	6.3 ± 0.5	2.8 ± 1.2	**0.001**†
Paraesthesia	4 (23.5)	24 (10.7)	0.119††
Recurrence	0	7 (3.1)	0.595††

*Mean ± Standard deviation. †Student t-test. ††Fisher's exact test. ‡Chi-square test. ASA: American Society of Anesthesiologists; BMI: body mass index; TAPP: transabdominal preperitoneal; TEP: total extraperitoneal, VAS: visual analog scale, DM: diabetes mellitus.

Discussion

Inguinal hernia surgery is a well-defined procedure, and historically, many different procedures have been successfully implemented to this type of surgery using open techniques. Laparoscopic inguinal hernia surgery has become increasingly prevalent in clinical practice due to the rapid improvement in minimally invasive surgical techniques in the past two decades. Above all, early return to daily activities, aesthetic concerns, and the dynamics of modern life bring surgeons and patients closer to the preference for laparoscopic inguinal hernia surgery [8,9].

In particular, due to the trend towards preventing recurrence in hernia surgery and advancements in biomedical technology, the use of mesh has become a clear part of algorithms in open surgery, as well as it is a standard practice in minimally invasive surgery. Nevertheless, there is a need for good surgical technique and mastery of anatomy due to risk factors such as mesh migration, mesh reaction, or recurrence of the hernia, which can complicate reoperation [10]. In this study, only the patients who underwent surgery using mesh were included in both the open and laparoscopic technique groups.

Pang et al.'s [11] systematic review and meta-analysis concluded that the laparoscopic approach had advantages in older patients over the open approach, such as shorter length of hospital stay, lower wound infection, and lower chronic pain. However, it was noted that as age increased, there was a greater tendency towards the open approach in this study.

As the ASA score ascends, there is an increased risk for patients throughout the perioperative and postoperative periods, in both emergency and elective cases. It is a necessity to closely monitor the patient groups, especially in the presence of major comorbidities [12]. Despite the literature indicates that there is a tendency towards open surgery in patients with high ASA scores and major comorbidities due to habits and familiarity with perioperative processes, the advantages of laparoscopic surgery are also highlighted in experienced centers with sufficient technical capabilities [13]. A tendency towards open surgery was detected in the presence of a high ASA score and comorbidities in this study.

Table 5. Comparison of the descriptive and clinical features with respect to the presence of chronic pain.

Feature	Chronic pain (+) (n = 36)	Chronic pain (-) (n = 205)	p value
	Number (percentage)	Number (percentage)	
Age*	51.3 ± 17.1	56.1 ± 15.5	0.096†
Gender			0.625††
Female	1 (2.8)	5 (2.4)	
Male	35 (97.2)	200 (97.6)	
BMI (kg/m^2)*	26.4 ± 2.8	25.9 ± 2.9	0.285†
Smoking	14 (38.9)	42 (20.5)	**0.016**‡
Presence of comorbidity	13 (36.1)	88 (42.9)	0.445‡
DM	2 (5.6)	29 (14.1)	0.187††
DM + additional comorbidity	2 (5.6)	24 (11.7)	0.387††
Location of the hernia			0.656‡
Right Side	20 (55.6)	122 (59.5)	
Left Side	16 (44.4)	83 (40.5)	
ASA			0.205‡
I	11 (30.6)	42 (20.5)	
II	24 (66.7)	143 (69.8)	
III	1 (2.8)	20 (9.8)	
Hernia type			0.091‡
Direct Hernia	7 (19.4)	57 (27.8)	
Indirect Hernia	26 (72.2)	109 (53.2)	
Pantaloon Hernia	3 (8.3)	39 (19.0)	
Postoperative complications			
Paraesthesia	8 (22.2)	20 (9.8)	**0.045**††
Presence of early complications	3 (8.3)	14 (6.8)	0.725††
Surgical site infection/abscess	2 (5.6)	5 (2.4)	0.281††
Hematoma/Seroma	0	8 (3.9)	0.610††
Dehiscence	1 (2.8)	1 (0.5)	0.277††
Recurrence	4 (11.1)	3 (1.5)	**0.011**††

*Mean ± Standard deviation. †Student t-test. ††Fisher's exact test. ‡Chi-square test. ASA: American Society of Anesthesiologists; BMI: body mass index; TAPP: transabdominal preperitoneal; TEP: total extraperitoneal, VAS: visual analog scale, DM: diabetes mellitus.

The hernia type can also be identified through imaging techniques. However, during the surgery, it can be determined definitively [6]. In this study, despite a significant difference was noted between the OIHR and LIHR groups in terms of hernia type, it was not evaluated as an increased tendency in operative preference based on hernia type but rather as a perioperative sub-diagnosis. In addition, no significant difference was noted in the laparoscopic technique subgroups.

Froylich et al. [14] reported in their study, which consisted of 7346 patients, that there was no significant difference between open and laparoscopic techniques in terms of early complications in obese patients. In addition, they emphasized the need for further research to evaluate long-term complications. In the study of Willoughby et al. [15], it was reported that the laparoscopic approach could be considered only in the overweight (25.0-29.9 kg/m^2) patient population in terms of complications since the development of deep surgical site infection was less common, however, it was emphasized that there was no statistical difference from the point of treatment and results. In this study, it was determined that there was no significant difference in BMI between the groups in terms of early complications. Furthermore, despite the means of both the OIHR and LIHR groups were detected to be overweight with respect to BMI, a higher BMI mean was detected in the OIHR group in comparison to the LIHR group.

In the study of Oliveira et al. [16], chronic pain was stated to be the most common long-term complication after inguinal hernia surgery. The International Association for the Study of Pain (IASP) describes chronic pain and discomfort lasting for more than 3 months following inguinal hernia surgery as inguinodynia in medical terminology. In the literature, the condition of chronic pain, which is reported to be around 10-12%, might especially lead to consequences such as limited mobility and progressive deterioration in quality of life [16]. In this study, the chronic pain condition was noted in 14.9% of the patients. However, VAS score means were detected to be 3.1 ± 1.5.

In the review by Haladu et al. [17], chronic inguinal pain has been reported to have a lower incidence in laparoscopic cases. The review by Bullen et al. [18] on the results of primary unilateral inguinal hernia repair has also revealed a significant decrease in both acute and chronic pain in favor of the laparoscopic group. However, in this study, no significant differences were observed in both the presence of chronic pain and the mean VAS scores.

In the meta-analysis conducted by Aiolfi et al. [19] which included 51,037 patients, no significant differences were detected in early postoperative findings when open and laparoscopic surgeries were compared. It has been stated that there may be differences in long-term findings based upon the patient and the surgeon's experience with minimally invasive laparoscopic techniques. In the study by Rodha et al. [20], it was reported that the TAPP technique had better results in terms of postoperative pain compared to the TEP technique. In this study, no significant difference was noted in early postoperative complications between both the OIHR vs. LIHR groups and TAPP vs. TEP groups. In addition to that, no difference was determined between the TAPP and TEP groups in terms of chronic pain and VAS scores.

In the literature, recurrence after hernia surgery is highly studied, and its incidence is reported to be between 0.5-15% [21]. In the studies conducted, there is no significant difference noted in recurrence between laparoscopic and open surgery, and there is also no difference observed in subgroups of laparoscopic techniques [17,18,20]. Recurrence was observed in 2.9% of the patients in this study. No significant difference was detected between OIHR vs. LIHR and TAPP vs. TEP groups. In addition, recurrence was significantly higher in the group of patients who had chronic pain.

The literature states that in inguinal hernia surgery, neural injury may result in long-term paraesthesia at the surgical site, particularly following selective or non-selective neurectomy. It is believed that, as with all surgeries, there may be an increased risk of paraesthesia in the operative site following the inguinal hernia surgery, especially in patient groups diagnosed with diabetic neuropathy and peripheral neuropathy. In the literature, it is stated that it may be presented particularly with chronic pain, but clear information about its incidence, differences between open and laparoscopic techniques, and differences between laparoscopic techniques have not been suggested [22,23]. In this study, paraesthesia was detected in 11.6% of patients in the surgical area. In addition, despite no significant difference was found between the groups, the presence of paraesthesia was statistically significant in the patient group with chronic pain.

This study had some limitations. The main limitations of this study can be listed as its retrospective design, the assessment of patients' results only for the first six months of the long term, and the lack of imaging techniques such as ultrasonography in the control evaluations. Additionally, the small size of the patient population and the fact that the surgeries were not performed by a single surgeon are also limitations. Also, the patients' preferences for open and laparoscopic surgery were not included in the study design and may have affected our results.

Conclusion

While chronic pain, paraesthesia, and recurrence are considered as valuable indicators of surgical success in terms of long-term patient comfort and quality of life in open and laparoscopic hernia surgeries, no significant differences were observed between both open and laparoscopic and TAPP and TEP surgeries in the long term. As for patients suffering chronic pain, accompanying paraesthesia has been evaluated independently of the surgical technique used. Nonetheless, there is a need for prospective, randomized-controlled studies, reviews, and meta-analyses with larger patient series on these subjects.

Ethical approval

This study was approved by the University of Health Sciences Gulhane Training and Research Hospital Clinical Research Ethics Committee (Date: 11.05.2022, Decision No: 2022/39).

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