

Early wound-related complications and influential factors after Lichtenstein inguinal hernia repair: Lessons learned

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Abstract

Aim: The main purpose of this study was to research short-term wound-related results and complications of tension-free hernia repair, especially in the postoperative period during the length of stay in the hospital (LOS).

Materials and Methods: This study had a retrospective design. Study data was collected via the 29 Mayıs State Hospital registry system. Between May 30, 2016, and May 30, 2019, a total of 1128 cases were screened. Patients were identified who were operated for tension-free inguinal hernioplasty. In total, 652 patients were included in this study. Patients with inconsistent diagnostic data, no documentation of seatbelt use, or missing outcomes were excluded. For descriptive statistical analyses, the mean and standard deviation were used for continuous variables, and percentage and frequency values were used for dichotomous variables. The statistical tests were chosen according to the Kolmogorov Smirnov test. After univariate analysis, the final statistical results were done with multiple binary logistic regressions. A 5% level was chosen as significant for *p*-values. Data were analysed with SPSS™ for Windows 18 (SPSS, Chicago, IL). Patient demographics, hernia side, hospital LOS, body mass index (BMI) and postoperative complications were abstracted for each patient.

Results: The total number of patients is 652 [males: 619 (94.9%) vs. females: 33 (5.1%)]. The mean age of both males and females was 56.83 ± 14.3 years and 57.33 ± 11.4 years (*p* = .84), respectively. For both males and females, the mean BMI was 24.09 ± 6.54 kg/m² (24.12 ± 6.51 kg/m² vs. 23.32 ± 7.07 kg/m²). The mean duration of LOS was detected as 2.45 ± 1.02 days. In the LOS period, prominently, BMI (30 kg/m²) and incarcerated-strangulated hernias were found highly significant for seroma, in statistical analysis with multiple binary logistic regression analysis [AOR: 4.3 (1.3, 13.8) (*p* ≤ .05)] and [AOR: 12.1 (4.9, 29.5) (*p* ≤ .05)], respectively.

Conclusion: For patients who have a BMI above 30 kg/m² and especially for strangulated or incarcerated hernias, the seroma complication may be a candidate.

Keywords: Lichtenstein; wound related; postoperative early complications.

INTRODUCTION

The concept of tension-free hernia repair, which was proposed in 1989 by Lichtenstein, has become a standard procedure for inguinal hernia repair with time (1). Different types of mesh, such as polypropylene, Marlex, Vypro II, TiMesh and Prolene can be used for this procedure (2,3). Infection, pain, adhesions, seroma, intestinal obstruction or recurrences are the major complications of inguinal hernia repair (4,5). Infertility complications may rarely occur in male patients. The main indicators in the diagnosis of infertility are testis volume, testicular resistive index, serum testosterone, serum gonadotropins [follicle stimulating hormone and luteinizing hormone]

and semen quality (volume, concentration, mobility, α-glucosidase activity and morphology). It has been reported in the literature that inguinal hernia repair with mesh may cause infertility by affecting the spermatid structure (6). In this study, we aim to share the short-term results of tension-free hernia repair.

MATERIAL and METHODS

This study was conducted between May 30, 2016, and May 30, 2019, at 29 Mayıs State Hospital-Ankara, General Surgery Clinic. A total of 1128 tension-free hernioplasty operations were retrospectively screened, and the available data of 652 patients were included in

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this study. This study was approved as a retrospective clinical research study by the TUEK Research Committee of the institution Etlik Zübeyde Hanım Women Diseases Education and Research Hospital. (10th meeting number) (The date: 06.18.2019). Patients who were missing or whose data were unclear were not included in the study.

Methods

There was no concomitant disease in any age group. Patients were evaluated according to age, gender, anatomical location and type of hernia, postoperative period, length of hospital stay (LOS), and complications. Patients were informed about the importance of follow-ups and possible complications (recurrence, testicular atrophy, etc.), and were called for appointments for examinations. In addition, all patients were informed that their operative information could be used for scientific studies.

Surgical Procedure

Patients were taken into surgery after the patients' problems were remedied or controlled. Cefazolin sodium 1 gr was administered intravenously to all patients preoperatively. A skin incision was made between the anterior superior iliac spine and the pubic tubercle in parallel with Langer's lines. Old incision scars were removed in cases of recurrence. Subsequently, the subcutaneous adipose tissue and superficial fascia were passed, and the aponeurosis fibres of the abdominal external oblique muscle were opened. The medial side of the aponeurosis was released to the rectus abdominis muscle and the lateral margin to the inguinal ligament and iliopubic tract. The round ligament in women coincides with the spermatic cord in men, and extends to the pubic symphysis and is suspended in the anatomic avascular plane. Care was taken not to injure the external spermatic vessels and the genital nerve while the cord was being dissected. In addition, the cord was not over-dissected due to infections in recurrent hernia cases to minimise the risk of testicular complications. The cord was released from the surrounding tissues until the internal ring has been reached. The cremaster muscle sheets were transversely cut at the level of the internal ring, avoiding clamping the nerves. The indirect hernia sac was released from the section of the sac's neck. For the digital examination of the femoral ring, the sac was opened, and the presence of the femoral hernia was investigated. High ligation and excision were performed for indirect hernias. In cases of direct hernias, the sac was freed, and support sutures were placed with 2/0 multifilament sutures on the posterior wall of the inguinal canal. The medial and inferior margins of the rectangular shape, about 8 x 16 cm in size, were cut with rounded ends. As Lichtenstein suggested, the cord was retracted upwards. In the rounded corner of the patch, the first suture was placed on the aponeurotic tissue on the pubic bone, 1.5–2 cm above the pubic bone with 2/0 prolene suture, and the inferior edge of the patch was sutured to the lacunar and inguinal ligament with the continuous suture technique.

In order to pass the cord elements at the lateral end of the patch at the level of the inner ring, a keyhole-like slit was made. This was done so that the 2/3 wide part will be at the top and the 1/3 narrow part will be at the bottom. The large upper part of the tail was removed with a haemostat and placed over the narrow portion by crossing the tails. By crossing the tails, a structure similar to the normal transversalis fascia hanger was formed, which also resembles the normal structure of the internal ring. The two free ends of the tail were held together by a suture. The excess of the patch on the lateral margin was cut to 3-4 cm beyond the internal ring, and the patch was inserted under the external oblique aponeurosis. The upper fixation of the patch was performed on the internal oblique muscle and/or aponeurosis. Several 2/0 prolene sutures were used individually for this procedure. Care was given not to injure the iliohypogastric nerve during the procedure. The subcutaneous closure was performed over the external oblique cord using absorbable suture material. Mattress skin sutures were then placed, and the operation was terminated.

Statistical Analysis

During descriptive statistical analyses, the mean and standard deviation were used for continuous variables, and percentage and frequency values were used for dichotomous variables. The Chi-square (χ^2) test and Fisher's exact test were used to compare group proportions. Null hypotheses were rejected at the 0.05 or 5% level of significance. Student's t-test or the Mann-Whitney U test were used for continuous variables. Regarding continuous variables, for both univariate statistical tests and correlation analysis, statistical tests were chosen according to the Kolmogorov Smirnov test results. For the assessment of variables that were significant in univariate analysis results, multiple binary logistic regressions were used for the final statistical tests. Data were analysed with SPSS™ for Windows 18 (SPSS, Chicago, IL).

RESULTS

In this study, between May 30, 2016, and May 30, 2019, 652 patients with inguinal hernia were included on whom tension-free hernioplasty repair was performed. Of these, 619 patients (94.9%) were males, and 33 (5.1%) were females. The mean age of all the patients was 56.86±14.2 years. The mean age of both males and females was 56.83±14.3 years and 57.33±11.4 years ($p=0.84$), respectively. For both males and females, the mean BMI was 24.09 ± 6.54 kg/m² (24.12±6.51 kg/m² vs. 23.32±7.07 kg/m²) ($p=0.53$). Demographic characteristics of patients are shown in Table 1. The distribution of the repaired hernias was as follows: 286 (43.9%) were left side, 316 (48.5%) were right side and 50 (7.7%) were bilateral inguinal hernias. Of these cases, 77 (11.8%) of them were admitted under emergency conditions with strangulation or incarceration. The distribution of hernias is shown in Table 2. The mean duration of hospital stay detected was 2.45±1.02 days, and the complications we encountered

Table 1. Demographic characteristics

Variables	M	F	Mean ±Std.Dv	p ≤ 0.05
Age (year)	56.83±14.3	57.33±11.4	56.86± 14.2	0.84
*BMI(kg/m ²)	24.12±6.51	23.32± 7.07	24.09±6.54	0.53

* Male :M , Female :M
 * BMI (Body Mass Index) was calculated with the following formula in all operated patients;
 * BMI = Weight (kg)/Height (m²) Obese cases BMI index is 30 kg/m² or more

Table 2. The distribution of the hernias as inguinal areas

Hernia Side	Count (n)	Percentage (%)
Right	316	48.5
Left	286	43.9
Bilateral	50	7.7
Total	652	%100

*Hernia side R Right side , Hernia side L : Left side, Bilateral : Together with both left and right side hernias

Table 3. Postoperative complications

Complications	Count (n)	Percentage (%)
Infection	3	0.5
Hematoma	5	0.8
Seroma	26	4
Testicular swelling	16	2.5

after surgery are summarised in Table 3. Three cases (0.5%) had wound infection, 5 (0.8%) cases had wound haematoma, and 26 (4%) cases had seroma. According to the hospital registry system, no cases in the investigation were detected with ductus deferens incision, bladder injury, major artery and vein incision. No postoperative mortality has been observed.

Respectively, the diagnosis of the incarcerated or strangulated hernias and BMI were statistically significant in terms of seroma (Table 4). In multiple binary logistic regression analyses, we detected that both BMI (30 kg/m²) and incarcerated-strangulated hernias showed a strong significance for seroma cases. They were found as [AOR: 4.3 (1.3, 13.8) (p ≤ .05)] and [AOR: 12.1 (4.9, 29.5) (p ≤ .05)], respectively. According to these parameters, 30 (4.6%) cases were detected as obese, whereas 77 (11.8%) cases were strangulated and incarcerated.

There was not any morbidly obese patient. A binary logistic regression identified BMI and strangulated-incarcerated hernias as the most important independent predictors for seroma occurrence [AOR: 4.3 (1.3, 13.8) (p ≤ .05)] and [AOR: 12.1 (4.9,29.5) (p ≤ .05)] (Table 5).

Table 4. The univariate analysis results, for seroma

	Seroma(+)	Seroma(-)	Total case of signs-n(%)	p ≤ 0.05
Gender(M vs. F)	24(92.3%) vs 2(7.7%)	595(95%) vs 31(5%)	26 (100%)	0.38
BMI(≥ 30KG/M2)	6(20%)	24(80%)	30(100%)	0.001*
Strangulation or incarceration	17(22.1%)	60(77.9%)	77(100%)	0.001*
Wound infection	1(33.3%)	2(66.6%)	3(100%)	0.12
Hematoma	0(0%)	5(100%)	5(100%)	1.00
LOS(≥ 3 day)	3(1.7%)	172(98.3%)	175(100%)	0.07**
Testicular swelling	2(12.5%)	14(87.5%)	14 (100%)	0.13
Applied anesthesia	23(88.5%)vs 3(11.5%)	568(90.7%)vs. 58(9.3%)	652 (100%)	0.727

*Variables are significant for p ≤ .05, **Variable is significant for p ≤ 0.1
 *High BMI (+): Body mass index is more over 30 kg/m² , High BMI (-): Body mass index is less over 30 kg/m²

Table 5. Binary multiple logistic regression results

	Seroma(+)	Seroma(-)	AOR[Exp(B)](95% CI)	p ≤ 0.05
BMI(≥ 30KG/M2)	6(20%)	24(80%)	4.3 (1.3,13.8)*	0.02*
Strangulation or incarceration	17(22.1%)	60(77.9%)	12.1(4.9, 29.5)*	0.001*
LOS(≥ 3 day)	3(1.7%)	172(98.3%)	0.4(0.1,1.3)	0.13

*AOR : Adjusted odds ratio , 95%CI: Confidence interval, *Statistically significant results for %95 confidence interval.

DISCUSSION

Although the use of mesh in inguinal hernias is not a novel technique, different results have been obtained in different studies in the literature. Lichtenstein et al. stated that they found only four recurrences, in more than 3000 cases, in their study. They indicated that these recurrences were caused by technical error; three of them were due to the inadequate coating of the pubic tubercle area, and one of them was due to insufficient width of the graft. They did not observe any recurrences during the follow-up period (6–36 months) (7). Parviz et al. suggested that the between inguinal hernia repair recurrence and the technical error reason for using too narrow a patch caused the repair to be under tension. In addition, they had recommended a wider patch that was fixed in place with an appropriate degree of laxity (8). On the other hand, Friis and Lindahl reported that the recurrence rate is reduced to one-third after tension-free herniotomies as compared with conventional herniotomies without an increase in the complication rate in their study (9). Usually, recurrences seen in the first year after surgery are due to technical errors and subsequent recurrences are due to the persistence of weakening in the fascia. In addition to the factors that increase intraabdominal pressure in recurrent hernias, collagen metabolism disorders should be considered (10). In our study, we could not detect any recurrence case in the hospital registry system, during the 18 months. When hernia recurrence is excluded, complication rates vary between 2%–11.8%, and local infections, seroma and haematoma occur (11,12). It has been stated that the BMI is a traditional way of evaluating, especially for body shaping surgery and may have a predictive value for surgical complications (13). Ghnnam et al. found that increased BMI significantly increased operative time, hospital stay, drainage duration and drainage amount, and also it increased minor and major local complications although statistically insignificant. On the other hand, they had stated that had difficulty trying to compare the current literature due to the different definitions used for minor and major complications (14). A frequent complication of hernia repair is seroma formation. Seroma is usually found in small wounds in the liquefaction of necrotic fat tissue. Friis and Lindahl [9] observed seroma formation in four (3.9%) cases in a 102-case study of tension-free hernioplasty with prolene mesh. In particular, we also observed statistical significance in the univariate analysis for BMI (≥ 30 kg/m²) 6 vs. 24 (20%) ($p = .001$), for development of a seroma (Table IV). Emile et al. stated in their study that with a good clinical evaluation of the World Society of Emergency Surgery clinical road map, synthetic mesh repair of incarcerated or strangulated ventral hernias has lower recurrence rates than suture repair (15,16). However, they reported that synthetic mesh repair in incarcerated and strangulated ventral hernias had reached a rate of seroma formation comparable to surgical site infections, even in operations performed following the established guidelines (15). We have seen that the risk of seroma increases strongly in the case

of strangulated and incarcerated hernia among hernia operations using mesh. We found that strangulated or incarcerated hernias had a strong statistical significance, in terms of seroma development, in univariate analysis 17 vs. 60 (22.1%) ($p = .0001$) (Table IV). In the final statistical analysis with multiple binary logistic regressions, strangulated or incarcerated hernias increased the risk for the development of the seroma 12.1 fold (Table V). In addition, a BMI over 30 kg/m² increased the risk of developing seroma 4.3 fold in multiple binary logistic regressions. Ghnnam et al. showed that seroma is related to BMI in their study (14). In another study, Sodergren and Swift found the seroma rate as 14.5% for laparoscopic ventral hernia repair operations, and they especially emphasised that seroma depended on dead space in the remnant hernia sac (17). The bladder is frequently found in the hernia sac as a component of inguinal hernias. Usually, a small part becomes herniated and does not produce clinical signs. Although the bladder is frequently reported to penetrate the hernia sac, the injury is very rare (18). We did not observe such a complication in our cases. The prolonged return to work leads to financial losses based on individuals and countries. Returning to active working life in four weeks in uncomplicated cases following hernia operations is generally accepted as normal. Rider et al. (19) stated that despite the differences in the workgroups in patients, early return to work did not change the result in terms of hernia relapse. In their study, Kark et al. (20) found that 49.6% of patients returned to work in a week or less, and 61% returned to work in 2 weeks or less. The mean postoperative hospital stay in our study was also found as 2.45 ± 1.02 days. The incidence of wound infection after hernia repair is 1.1%–4.9%. Staphylococcal infections involving the skin and subcutaneous tissues were common. Their route of transmission is generally with skin defects and gaps in asepsis. In cases with strangulation and obstruction due to incarceration, severe infections caused by intestinal flora may develop. When the braided suture material is used, the bacteria that settle between the braids may cause granuloma, and with their drainage, they can result in chronic sinuses (21). Moloney emphasised the superiority of nylon monofilament against braided nylon and saw less infection. In cases who developed an infection with nylon monofilament, shorter recovery periods have been described (22). Lichtenstein and other researchers reported the infection rate as 0.3% in herniorrhaphy with prolene mesh (23,24). Kark et al. (20) reported infection in 15 cases (1.5%) in their series with 1098 cases published in 1995. In our study, wound infection was observed in three (0.5%) cases. Open wound care and appropriate antibiotherapy were performed in patients with infection. All cases responded to this treatment. In 1991, Kama reported a 1.56% rate of haematoma at the wound site (21), while in the Kingsnorth study, this rate was 5% in the mesh group and the Shouldice group, it was 7%. Friis and Lindahl (9) reported the rate of haematoma at the site of operation as 3.9% in cases who underwent tension-free hernioplasty. In our study, we encountered haematoma in 5 (0.8%) cases. No reopening of any

wounds was required. Kark et al. (20) found testicular tenderness and swelling in 19 (1.9%) patients in a series of 1098 cases of tension-free hernioplasty. We also detected swollen testicles and tenderness in 16 (2.5%) cases. The swelling was moderate. They easily regressed with scrotal elevation and anti-inflammatory treatment. Rutkow and Robbins (25) performed the mesh-plug repair method under epidural anaesthesia, and used a complete anaesthetic block; they also stated that patients left the operating room in a shorter time. Lichtenstein reported that they performed non-tension mesh repair under local anaesthesia (26,27). However, it is stated that there is no significant difference between local, spinal and general anaesthesia in inguinal hernia repair (28). In our study, epidural or spinal anaesthesia was performed in 591 (90.6%) cases, whereas general anaesthesia was used in 61 (9.4%) cases to perform the other side.

We believe that every time hernias are repaired, we should be mindful of the requirement for meticulous maintenance especially in patients who have a BMI above 30 kg/m² and strangulated or incarcerated hernias, for development of the seroma complication.

Limitation

As operations on patients were performed by different surgeons, in addition to the retrospective design of the study, some data could not be obtained, such as return to work. Factors such as this may be considered a limitation.

Competing interests: The authors declare that they have no competing interest.

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