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ORIGINAL ARTICLE

Safety and efficacy of Tension Free Mesh Repair of Bilateral Inguinal Hernia on The Testicular Functions

Wessam Mohamed Amr, Wael Salah Eddin Mansy, Hazem Nour Abdellatif, Mahmoud Abdel Ghany Abdel Rahman

Department of general surgery- Faculty of Medicine- Zagazig University- Egypt

Corresponding author:

Mahmoud Abdel Ghany Abdel Rahman

Email:

midoelmasry_2015@yahoo.com

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ABSTRACT

Background: Lichtenstein repair is the standard surgical method of inguinal hernia. The impact of the mesh repair on the testis and incidence of infertility after the mesh repair is still a subject of discussion. The aim of this study was to evaluate the testicular functions after tension free mesh repair of bilateral inguinal hernia.

Subjects and methods: In the period between October 2018 and April 2019 in the General Surgery Department of Zagazig University and Al Ahrar teaching Hospitals, 18 male patients with bilateral inguinal hernia ranging between 20 and 40 years were subjected to Lichtenstein tension free mesh repair. All the patients have been evaluated pre & 6 months postoperatively to assess the testicular functions after the repair.

Results: No significant differences have been noted between the pre & postoperative fertility parameters which include the testicular volume and perfusion measured by scrotal Doppler ultrasound, semen quality which determine spermatogenesis and hormonal assessment which evaluate the endocrinological status.

Conclusions: Lichtenstein tension free mesh repair is an effective procedure for the repair of bilateral inguinal hernia when an experienced surgeon in laparoscopic repair isn't present. It is a safe method with less complication rates regarding recurrence, pain.

Also, it can be used in the young adults using a synthetic mesh without any fear for the future fertility of those patients.

Keywords: Inguinal hernia, Lichtenstein repair, scrotal ultrasonography, semen analysis, hormonal assessment.



INTRODUCTION

Groin hernias are very common. They represent approximately 75% of all abdominal wall hernias. The lifetime risk of inguinal hernia is 27% in men and 3% in women.¹Worldwide, inguinal hernia repair is the most commonly performed surgeries. Therefore, the complicated anatomy of the groin together with the different repair techniques is usually reviewed or understood.²

The use of prosthetic materials such as the polypropylene mesh for inguinal hernia reduces markedly the recurrence rates, postoperative hospital stays, discomfort and pain.³

The Lichtenstein repair is an effective approach for inguinal hernia repair using a synthetic mesh, with low recurrence rates. Lichtenstein applied his pioneer tension free mesh approach for inguinal hernia in 1986. This approach has then become the standard of choice due to its easy application and as it produces a repair without tension with better long-term outcomes.⁴Damage to the testis with

either atrophy or dysfunction, is the most harmful complications of inguinal hernia repair. Patients with bilateral inguinal hernia undergoing repair, patients with history of ipsilateral or contralateral surgery for hernia, hydrocele or varicocele are risk factors of such complication.^{5,6}This work aims to evaluate the effects of tension free mesh repair of bilateral inguinal hernia on the testicular functions and to determine if the use of synthetic mesh for inguinal hernia repair in young adults is safe or not.

PATIENTS AND METHODS

The study was approved by the Ethical Committee of the Faculty of Medicine, Zagazig University, informed consent was obtained. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans. This prospective cohort study included a total of 18 male patients in the period between October 2018 and April 2019 presented clinically by reducible bilateral inguinal hernia with mean age of 25 ± 6.35

years (range 20-40 years). Some patients needed ultrasound examination to confirm the diagnosis. Patients have been generally evaluated preoperatively by full history taking, complete general investigations, CXR and abdominal U/S. Also, the testicular functions of the patients were evaluated the day before surgery and 6 months postoperatively by Scrotal Ultrasonography to assess testicular volume (the testicular volume (V) is calculated as a rotational ellipsoid: $V = L \times W \times H \times 0.526$ where L is the length, W is the width and H is the height), CDUS to evaluate testicular perfusion by measuring peak systolic velocity (PSV), end diastolic velocity (EDV) and resistive index (RI). Also, semen analysis (CASA) was done to all patients after 72h of sexual abstinence to detect concentration and rate of progressive motility of sperms and hormonal assessment of FSH, LH and Testosterone was done to all patients preoperatively and 6 months postoperatively. All the patients have been operated with Lichtenstein tension free mesh repair for both sides.

Inclusion criteria: Male patients diagnosed with bilateral reducible inguinal hernia, aged between 20 and 40 years. **Exclusion criteria:** Patients with history of ipsilateral or contralateral hernia surgery, patients with testicular surgery for varicocele, hydrocele or undescended testes, comorbidities as impotence, diseases of the prostate, heart disease, and renal failure.

Surgical technique: (Figure 1)

- Skin incision: About 5 cm long incision extending laterally from the pubic tubercle within Langer's lines is done. The external oblique aponeurosis is then incised through the superficial ring and its inferior edge is then dissected from the cord while its superior flap is freed out of the anterior rectus sheath on the medial side, while its lateral side is freed from the internal oblique muscle.
- Dissection and mobilization of the cord: The spermatic cord with its covering is separated from the inguinal floor and pubic bone for a about 2 cm behind the pubic tubercle. When lifting the cord, the ilio-inguinal nerve, external spermatic vessels and the genital nerve are included within the cord. The cremasteric sheath is then incised longitudinally.
- Management of hernia sac: Indirect hernia sac is dissected out of the cord to a level at the sac's neck. Then, the sac is opened at the fundus followed by transfixation and ligation at the neck followed by transection of the sac. Complete non-sliding scrotal hernia sacs are transected and the distal section is left in situ with incision of its anterior layer to avoid postoperative hydrocele formation. The sac of direct hernia is invaginated to inside with absorbable sutures.

- Placement and fixation of the mesh: A sheet of 6 x 11 cm of monofilament polypropylene mesh is used. After plication of the posterior wall of inguinal canal without tension, the mesh is fixed with nonabsorbable polypropylene sutures to the surrounding tissues without inducing tension on them.
- During the repair, fine meticulous dissection and mobilization of the cord has been done. The hernia sacs were dissected gently and dealt with. Proper identification of the cord structures and preservation of the vas deferens and spermatic vessels have been done. All these measures help to preserve the testicular vascularity and perfusion.
- Closure of the wound in layers with sterile dressing of the wound.

The patients were given postoperative antibiotics and started oral fluids in the day of surgery within variable duration. The postoperative pain was controlled by oral and parenteral analgesics. All the participants have been discharged on the second surgical day. Duration of hospital admission, complications occurred postoperatively have been registered. They were told to use oral analgesics and to avoid heavy lifting or excess activity and sports for at least 6 weeks postoperatively.

Statistical analysis: Data were then imported into Statistical Package of the Services Solutions Social Sciences (SPSS version 23.0) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean \pm SD, the following tests were used to test differences for significance, difference and association of qualitative variable by Chi square test (χ^2). Differences between quantitative independent groups by t test or Wilcoxon signed rank test. P value was set at < 0.05 for significant results & < 0.001 for high significant result.

RESULTS

In the study period (between October 2018 and April 2019), 18 patients with reducible bilateral inguinal hernias were included and treated with Lichtenstein tension free mesh repair. The mean age of the population was 25 ± 6.35 (range 20-40). The mean BMI of the study population was 27.18 ± 2.42 (range 23.10 - 31.90), with mean operative time 85.3 ± 4.45 . (Table 1) Regarding the medical history and special habits of the population sample, three patients (16.67%) have hypertension (HTN), two patients (11.11%) have diabetes mellitus (DM), while five patients (27.78%) were smokers of different degrees. The procedure was performed successfully for all patients except a single patient who was complicated intra-operatively with bladder injury that was repaired soon in two layers together with a urinary catheter and two patients

complicated with intraoperative bleeding that was controlled. One patient was clinically diagnosed with a recurrent hernia and underwent an additional operation. Two patients required an additional visit to the outpatient clinic due to pain. Ultrasonography showed postoperative hematomas in two patients and a postoperative seroma in other 5 patients. Infection at the site of wound was noticed in three patients. Testicular oedema was found in six patients and subsided gradually. The pain subsided with conservative treatment. No readmissions after discharge from the hospital were reported. In total, 18 patients (100%) completed the follow-up period of 6 months. (Figure 2). The mean right testicular volume preoperatively was 16.59 ± 4.09 , while the mean postoperative volume was 16.84 ± 3.98 . The mean left testicular volume preoperatively was 16.04 ± 4.12 , while the mean postoperative volume was 15.80 ± 3.53 (Table 2). Analysis of the mean volume of the right and left testes pre & 6 months post-operatively showed no significant differences (p. value = 0.254 and 0.277 respectively). The testicular perfusion is assessed by measuring the resistive index (RI) of the testicular arteries which is determined by both peak systolic velocity (PSV) and end diastolic velocity (EDV). The

testicular artery was identified by US while the probe on the scrotum measuring parameters of perfusion. The preoperative and 6-months postoperative values of the RI were measured (Table 3). Analysis of the pre- and postoperative values of the resistive index (RI) of the left and right testicular arteries showed no significant differences (p. value is 0.236 & 0.878 respectively). No statistically significant differences in semen volume, concentration, motility, VCM, or pH after LR of bilateral inguinal hernia were found. Semen analysis can be used as a parameter for seminal tract patency or obstruction. No significant differences in semen volume, concentration, motility, or pH were found after TEP hernia repair. (Table 4). Comparison of blood hormone values revealed higher LH levels postoperatively with a mean value of 4.77 IU/L compared to 4.44 IU/L preoperatively. However, this difference isn't clinically significant as both values were within the normal range of LH (1.3–13.0 IU/L) (p. value = 0.02*). There were no significant differences in FSH or testosterone levels when comparing the pre & postoperative mean values of these hormones (p. value = 0.84 and 0.87 respectively) (Table 5).

Table 1: Demographic data of the population sample.

Demographic data	Values
Age	20 – 40 (25 ± 6.35)
BMI	23.1 – 31.9 (27.18 ± 2.42)
Operative time	85.3 ± 4.45

Table 2: Pre and postoperative mean testicular volume.

	Preoperative mean value \pm SD	Postoperative mean value \pm SD	P. value
Lt. testicular volume	16.04 ± 4.12	15.80 ± 3.53	0.277
Rt. testicular volume	16.59 ± 4.09	16.84 ± 3.98	0.254

Table 3: The mean value of the Lt. & Rt. RI pre and postoperative with the p. values

	Preoperative mean value \pm SD	Postoperative mean value \pm SD	p. value
Lt. arterial RI	0.85 ± 0.15	0.82 ± 0.19	0.236
Rt. arterial RI	0.83 ± 0.16	0.83 ± 0.14	0.878

Table 4: Pre and postoperative semen quality.

	Preoperative	Postoperative	p. value
Volume (mL)	3.0 (2.0–3.5)	3.0 (1.7–4.0)	0.74
Concentration (10^6 cells/mL)	49.0 (22.3–90.3)	39.0 (11.8–82.3)	0.21
Motility (% progression)	41.5 (24.5–58.0)	42.0 (26.3–59.3)	0.86
VCM (10^6)	51.5 (20.0–133.0)	28.5 (14.3–121.3)	0.29
pH (mol/L)	7.7 (7.5–8.0)	7.7 (7.5–7.7)	0.87

Table 5: The pre & postoperative mean hormonal values with the p. values.

	Preoperative mean value ± SD	Postoperative mean value ± SD	p. value
LH	4.44 ± 0.80	4.77 ± 0.66	0.02*
FSH	5.16 ± 1.11	5.13 ± 0.78	0.84
Testosterone	15.33 ± 3.89	15.42 ± 3.98	0.87

* Significant difference

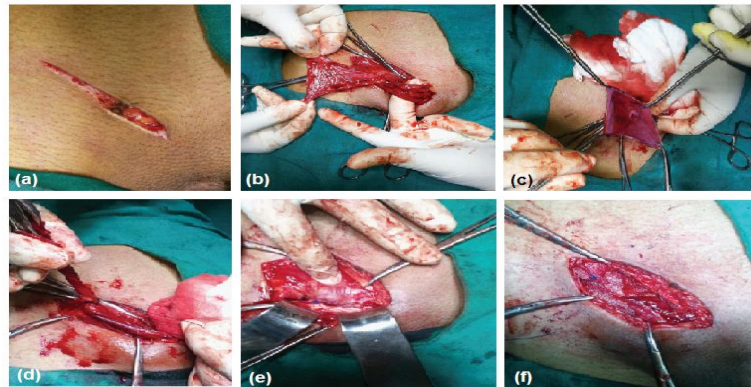


Fig. 1: Steps of Lichtenstein repair.

a. Skin incision. b. Dissection of the cord and sac. c. Opening of the sac. d. Transfixation and ligation of the sac. e. Repair of the posterior wall. f. Placement of the mesh.

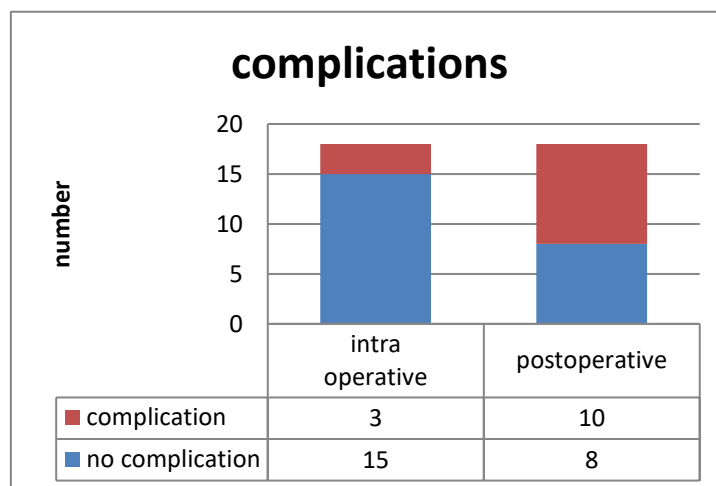


Figure 2: Intra and post-operative complications.

DISCUSSION

Inguinal hernia repair is the most commonly performed elective surgeries. Therefore, the complicated anatomy of the groin together with the different repair techniques is usually reviewed or understood.^{1,2}The use of prosthetic materials such as the polypropylene mesh for hernia repair reduces significantly the risks of recurrence, duration of stay postoperatively, discomfort and pain. However, in most cases, the prosthesis adheres to the spermatic cord structures. The disadvantages of this technique include wound complications, technical errors in hernia repair, contraction of the mesh, and problems associated with the cord components, such as hydrocele, varicocele, ischemic orchitis, atrophy of the testis and eventually infertility.³Damage to the testis with

either atrophy or dysfunction, is the most harmful complications of inguinal hernia repair. Despite, it is a rare sequale as the studies reported that atrophy of the testis occurred in or less than 2% of male population after the repair of inguinal hernia. Direct iatrogenic injury or mesh-induced fibrosis may affect the spermatic cord structures resulting in impairment of the testicular function and fertility.^{5,6}In some reports, inguinal hernia may result in impairment of the testicular perfusion by the intermittent mechanical compression on the vessels supplying the testis or the spermatic vessels in the inguinal canal.^{5,6,7,8}Male patients who are listed to undergo mesh repair for bilateral inguinal hernia or repair of hernia on one side with preoperative impairment of the other testis are considered at a great risk to develop disorders of

fertility. The objective of our study is to assess the effects of Lichtenstein repair (LR) for bilateral inguinal hernia on the male fertility by analyzing testicular perfusion and volume, semen analysis, and endocrinological status pre and 6 months postoperatively. The European Hernia Society (EHS) stated that the laparoscopic repair is the standard in the repair of bilateral inguinal hernia. However, the EHS recommended the use of the Lichtenstein repair (LR) for primary bilateral inguinal hernias if a surgeon experienced in laparoscopy or sufficient resources are not available for laparoscopic repair.⁹ This prospective study included 18 male patients clinically diagnosed with reducible bilateral inguinal hernia presented to the general surgery department at Zagazig University and Al Ahrar teaching hospitals between October 2018 and April 2019 and treated with Lichtenstein repair. All the patients were evaluated the day before surgery and 6 months postoperatively by scrotal ultrasonography (US) and colored Doppler ultrasonography (CDUS) on both testicles to determine both testicular volumes and to assess the testicular perfusion, semen analysis to measure the semen concentration and rate of progressive motility of the sperms and hormonal assessment by measuring the blood levels of LH, FSH and Testosterone hormones.

In our study, we did not find any significant difference between the pre & 6 months postoperative results of the RI of testicular artery and testicular volume which are important indicators of testicular function.

Dilek⁷, in his study on the effect of both laparoscopic repair and LR on the testicular volume and RI of testicular artery, reported that there is no effect of the repair on the testes regarding the RI and testicular volume. His data collected showed no significant difference between the results of pre and postoperative values of those parameters.³ Also, another study supports his result that mesh repair of inguinal hernia caused only a transitional change in testicular perfusion without a long-term adverse effect on the microcirculation of the testis.¹⁰ In their study on a canine model, Peiper et al. noticed that thrombosis in the spermatic veins has occurred in one third of cases. The use of mesh repair may produce a decrease in the blood flow, temperature of the testis and subsequently affect rate of spermatogenesis negatively. So, they put strict recommendations about the indications of the prosthetic mesh utility during the repair.¹¹ In our study, no statistically significant differences in semen volume, concentration, motility, or pH after LR of bilateral inguinal hernia were found. In other study performed to study the impact of mesh and its

position on the blood flow to the testicles and spermatogenesis in populations with groin hernias, the author reported that there is no significant difference between the pre and postoperative values of spermiogram including count and motility.¹² **Sucullu et al.**,¹³ showed in his study that there is significant increase in the RI postoperatively, but this increase in the RI did not affect the testicular volume and spermiogram in postoperative results. In our study, there were higher blood levels of LH in the postoperative follow up. LH is also called as the interstitial cell-stimulating hormone in males which stimulates the production of testosterone by Leydig cells.⁸ High levels of LH may indicate testicular dysfunction as a result of decreased testosterone secretion. In this case, secretion of GnRH from the hypothalamus and secretion of LH and FSH from the pituitary gland would be stimulated to increase spermatogenesis. But, in our study FSH was not increased and LH was not significantly elevated as its value was still in the normal range of LH (1.3–13.0 IU/L). So, we did not regard the isolated higher LH levels as clinically significant. Also, our findings on the hormonal assessment to the patients were similar to the results of other studies that investigated hormonal levels after laparoscopic repair and found no statistical differences in fertility parameters in the 6 months postoperative period.^{8,14}

Conclusions: Lichtenstein tension free mesh repair is an effective procedure for the repair of bilateral inguinal hernia when a surgeon not experienced with laparoscopic repair is present. It is a safe method with less complication rates regarding recurrence, pain and testicular impairment. It can be used in the young adults using a synthetic mesh without any fear for the future fertility of those patients.

Conflict of Interest: There is no conflict of interest.

Financial Disclosures: Nil.

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