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Original Article

Evaluation of Testicular Function after Laparoscopic and Open Mesh Repair of Inguinal Hernia

Mehmet Mustafa Altıntaş, Selçuk Kaya

Department of General Surgery, Kartal Dr. Lütfi Kirdar City Hospital, İstanbul, Turkey

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Correspondence: Selçuk Kaya, Kartal Dr. Lütfi Kırdar Şehir Hastanesi, Genel Cerrahi Anabilim Dalı, İstanbul, Turkey
E-mail: selcukkaya_36@hotmail.com

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ABSTRACT

Objective: The aim of this study was to compare the effects on testicular volume (TV) and spermatic cord blood flow of Lichtenstein hernia repair using tension-free synthetic mesh and laparoscopic totally extraperitoneal (TEP) repair.

Methods: A total of 96 sexually active male patients aged 20–40 years who presented at a general surgery outpatient clinic between January 2018 and June 2019 and were diagnosed with inguinal hernia were included in the study. The patients were randomized into 2 groups. Of the group, 48 patients underwent Lichtenstein hernioplasty (Group I) and 48 patients had TEP repair (Group II). Inguinal Doppler ultrasound was performed 1 year after surgery to evaluate the operated side and to assess the intact testicular volume and spermatic cord arterial blood flow. The peak systolic velocity (Vmax), end diastolic velocity (Vmin), resistive index (RI), and pulsatility index (PI) were measured.

Results: A statistically significant difference was found in the Vmin, RI, PI, and TV values in the Lichtenstein repair side (Group I) in comparison with the non-operated side (p=0.03, 0.01, 0.01, 0.01, respectively). In the comparison of the TEP repair side (Group II) with the non-operated side, no statistically significant difference was observed in the TV or spermatic cord arterial blood flow values. While there was no significant difference between Vmax, Vmin, and TV values between the Lichtenstein and TEP groups, a statistically significant difference was seen in the RI and PI values (p=0.02, 0.01, respectively).

Conclusion: In this evaluation of the effects of surgical treatment of inguinal hernia, TEP repair provided better preservation of testicular function compared with the Lichtenstein technique.

INTRODUCTION

Globally, inguinal hernia repair remains one of the most common surgical procedures in general surgery clinics. Male patients have a 27% risk of developing an inguinal hernia during their lifetime, while the risk is 3% for females.[1,2]

The development of synthetic meshes led to a preference for tension-free mesh repair methods rather than tissue-based repair techniques. Traditional methods, such as the Bassini, McVay, and Shouldice techniques, have now largely been replaced with the Lichtenstein method, which uses an anterior approach and synthetic mesh to repair the hernia. Laparoscopic transabdominal preperitoneal and totally extraperitoneal (TEP) repair techniques have also been introduced.

While some evidence suggests that reduced recurrence may be an advantage of tension-free hernia repair, complications of fibrosis, ischemic orchitis, testicular atrophy, and prolonged pain and sexual dysfunction have become important issues of discussion.[3,4] The incidence of ischemic orchitis and testicular atrophy after tension-free inguinal hernia repair using open synthetic mesh has been reported as 0.1% to 2% in the literature.[3,4] However, there are few studies comparing the effects of open and laparoscopic tension-free hernia repair using synthetic mesh on testicular volume (TV) and testicular blood flow.

The objective of this study was to compare the effects of both techniques on TV and spermatic cord blood flow in patients who underwent a Lichtenstein repair or a TEP repair.

MATERIALS AND METHODS

A total of 96 sexually active male patients aged 20-40 who were diagnosed with an inguinal hernia and treated between January 2018 and June 2019 were included in the

study. Two groups were randomized: 48 patients had a Lichtenstein hernioplasty (Group I) and 48 patients had a TEP repair (Group II). All of the patients had type II and III-A inguinal hernias according to the Nyhus hernia classification.[5] Patients with a bilateral or femoral inguinal hernia, pathology detected in an inguinal examination, sexual dysfunction, previous inguinal hernia surgery, diabetes mellitus, cardiac or vascular pathology that could have negative effects on testicular blood flow, and patients with an American Society of Anesthesiology physical status classification of 3 or 4 were excluded from the study. The procedure and potential complications were explained to all of the patients, and informed consent was provided. Approval for this research was granted by the Kartal Dr. Lutfi Kirdar City Hospital Clinical Research Ethics Committee on October 14, 2020 (no: 2020/514/187/2).

All of the study patients were operated on under general anesthesia and discharged on the first postoperative day. Control examinations, including inguinal and scrotal ultrasound (US) imaging with a color Doppler US device (Xario; Canon Medical Systems Corp., Otawara, Tochigi, Japan) with a 7-11 mHZ electronic linear probe was performed 1 year after the surgical procedure. The surgical site and TV and spermatic cord arterial blood flow values were measured. Arterial blood flow measurement included the peak systolic velocity (Vmax), end diastolic velocity (Vmin), resistive index (RI) and pulsatility index (PI).

Table 1. Distribution of patients who underwent surgical hernia repair

	n	%
Side		
Right	52	54.2
Left	44	45.8
Hernia type		
Indirect	52	54.2
Direct	32	33.3
Indirect + Direct	12	12.5
Operation type		
Lichtenstein	48	50
Totally extraperitoneal	48	50

Statistical analysis

Descriptive statistics (mean, SD) were used to analyze and present the data. Student's t-test was used to compare normally distributed data between groups. Results were considered significant at $p<0.05$.

RESULTS

The median age of the patients enrolled in the study was 34 years (range: 20–40 years). Of the group, 52 (54.2%) patients had a right inguinal hernia, and 44 (45.8%) had a left inguinal hernia. The preoperative evaluation results indicated that 52 (54.2%) patients had an indirect inguinal hernia, 32 (33.3%) patients had a direct inguinal hernia, and 12 patients had a mixed hernia (Table 1).

All of the procedures were uneventful, and no hematoma, infection, or other complication developed in any of the patients during the preoperative or postoperative periods. There were no signs of recurrence or mesh reaction.

A statistically significant difference was found in the Vmin, RI, PI, and TV values in the comparison of the Lichtenstein repair side (Group I) and the non-operated side ($p=0.03$, 0.01, 0.01, 0.01, respectively). The comparison of the TEP repair side (Group II) and the non-operated side revealed no statistically significant difference in TV and spermatic cord arterial blood flow values. While there was no significant difference in the Vmax, Vmin, or TV values between the Lichtenstein and TEP groups, a statistically significant difference was observed in the RI and PI values ($p=0.02$, 0.01, respectively) (Table 2).

DISCUSSION

There are numerous techniques for inguinal hernia repair, from tissue-based repair to open mesh repair and laparoscopic repair. Following the introduction of a tension-free hernia repair technique by Lichtenstein in 1989, this type of repair became the standard treatment.[6] The use of synthetic mesh has been reported to substantially reduce the risk of hernia recurrence and appears to reduce the chance of persisting pain.[7] An open or laparoscopic surgical procedure with mesh has become the most common method to treat inguinal hernia.[8,9] A literature search in-

Table 2. Comparison of testicular volume and spermatic cord blood flow in Lichtenstein (Group I) and TEP (Group II) patients

	Vmax (cm/sec)	Vmin (cm/sec)	RI	PI	TV (cm)
Group I	17.32±7.42	3.75±2.29	0.78±0.092	1.91±0.34	16.45±3.71
Group II	16.93±5.2	4.77±1.77	0.69±0.05	1.62±0.36	13.47±3.54
Intact side	16.76±2.24	6.21±2.22	0.64±0.07	1.55±0.29	19.82±2.17
Group I and II*	0.91	0.38	0.02	0.01	0.07
Group I and Intact side*	0.84	0.03	0.01	0.01	0.01
Group II and Intact side*	0.93	0.08	0.52	0.92	4.46

*p: Student's t-test; $p<0.05$. PI: Pulsatility index; RI: Resistive index; TEP: Totally extraperitoneal; TV: Testicular volume; Vmax: Systolic peak current rate; Vmin: End diastolic velocity.

dicated that open or laparoscopic techniques performed with mesh have the best results and the lowest recurrence rate.[6] The question of superiority of either of the techniques remains a topic of discussion.

The rate of recurrent hernia formation is reportedly lower after a mesh application, but fibrosis can develop as a result of the direct contact of the patch with the vessels passing through the inguinal canal. Therefore, ischemic orchitis, testicular atrophy, long-lasting pain, and sexual dysfunction have become important issues.[3,4]

Arterial blood flow in the testicles may be affected due to mechanical pressure created by the mesh and edema can develop in the early postoperative period. Some researchers support the idea that testicular blood flow should be evaluated soon after the procedure. In contrast, some studies have concluded that testicular blood flow should instead be evaluated in the late postoperative period because fibrosis continues for 2 years. Ersin et al.[10] evaluated testicular blood flow at the postoperative first week, Bulus et al.[11] at the third postoperative month, and Zieren et al.[3] at 6 and 12 months postoperatively. In our study, an evaluation was performed 1 year after surgery.

The use of anatomical mesh preserves vascularization to the testicle. Dissection should be performed very carefully and care must be taken to protect sexual function. Testicular atrophy may develop as a result of vascular injuries.[10,11] The frequency of testicular atrophy has been reported to be 0.5% to 5%, and this is a complication that can have significant consequences.[12,13]

In the first studies to measure testicular blood flow in cases of open and laparoscopic hernia surgery using mesh, mesh contraction did not appear to change blood flow or perfusion.[3,14] However, subsequent studies have shown that hernia surgery can alter testicular blood flow.[15–17] These studies have generally examined the effects of prosthetic materials on testicular function and showed that the use of mesh may result in tissue inflammation that can lead to vascular obstruction. Aydede et al.[17] demonstrated the negative effect of oak-induced chronic inflammation on testicular blood flow in anterior and posterior approaches.

Our study included patients who underwent a Lichtenstein repair using tension-free synthetic mesh or a TEP repair. The parameters used to assess testicular function were TV and spermatic cord arterial blood flow measurements. Doppler US can provide valuable information about blood circulation in the testicular and scrotal structures. Testicular ischemia can be identified with Doppler US imaging demonstrating decreased blood flow at the end of diastole and an increase in the RI.[18,19]

Singh et al.[20] reported that there was a significant deterioration in both TV and RI in cases of open mesh repair compared with laparoscopic inguinal hernia repair. Junge et al.[21] found a significant decrease in testicular function in a Lichtenstein repair group when compared with a laparoscopic repair group.

In our study, there was a statistical difference in the TV, spermatic cord arterial blood flow; Vmin, RI, and PI values between the Lichtenstein surgical side and the healthy side. Haslak et al.[22] also found that there was a decrease in borderline testicular blood flow in patients who underwent a Lichtenstein repair. However, we observed no statistically significant difference in the TV and spermatic cord arterial blood flow between the TEP repair side and the intact side. This finding was consistent with the literature.[20] In our comparison of Lichtenstein hernia repair and TEP repair, we found a statistically significant difference in favor of TEP only in the RI and PI values. Singh et al.[20] reported better protection of testicular function with open mesh repair. Kordzahed et al.[23] found that mesh had adverse effects on male fertility, including obstructive azoospermia. However Dong et al.[24] reported no effects on fertility after 3 years and Bouchot et al.[25] also observed no effects on fertility due to a mesh application in either open or laparoscopic surgery.

CONCLUSION

The results of this study indicated that a TEP repair of an inguinal hernia was superior to the Lichtenstein technique in terms of better preservation of testicular function.

Ethics Committee Approval

Approval for this research was granted by the Kartal Dr. Lutfi Kirdar City Hospital Clinical Research Ethics Committee on October 14, 2020 (no: 2020/514/187/2).

Peer-review

Internally peer-reviewed.

Authorship Contributions

Concept: M.M.A.; Design: M.M.A., S.K.; Supervision: S.K.; Fundings: M.M.A.; Materials: M.M.A.; Data: M.M.A.; Analysis: M.M.A., S.K.; Literature search: M.M.A., S.K.; Writing: S.K.; Critical revision: S.K.

Conflict of Interest

None declared.

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Kasık Fıtığının Laparoskopik ve Açık Mesh Onarımından Sonra Testis Fonksiyonları Üzerine Etkisi

Amaç: Gerilimsiz sentetik mesh kullanılarak yapılan Lichtenstein ve total ekstraperitoneal (TEP) onarım uygulanmış hastalarda her iki tekniğin testis volümü ve spermatik kord kan akımı üzerine olan etkilerini karşılaştırmayı amaçladık.

Gereç ve Yöntem: Ocak 2018-Haziran 2019 tarihleri arasında genel cerrahi polikliniğine başvuran ve poliklinikte kasık fıtığı tanısı alan tetkik ve konsültasyonları tamamlanarak , anestezi onayı olan 20-40 yaş arası, cinsel aktif 96 erkek hastalar çalışmaya alındı. Hastalar iki gruba randomize edildi. Hastların 48'ine Lichtenstein herniorafi (Grup 1) 48'ine ise TEP onarımı (Grup 2) yapıldı. Hastalar ameliyat sonrası 1 yıl sonra kontrole çağrılarak inguinal ve skrotal Doppler ultrason yapıldı. Ultrasonografik değerlendirmede ameliyat edilmiş taraf ve sağlam taraf testis volümleri ve spermatik kord arteriel kan akım değerleri ölçüldü. Arteriyel kan akımı ölçümünde, sistolik tepe akım hızı (Vmax), diastolik sonu akımhızı (Vmin), rezistivite indeksi (RI) ve pulsalite indeksi (PI) ölçüldü.

Bulgular: Lichtenstein herniorafi (Grup 1) yapılan tarafın ameliyat edilmemiş taraf ile karşılaştırılmasında Vmin, RI, PI ve TV değerleri açısından istatistiksel olarak anlamlı fark bulundu (sırasıyla, p=0.03, 0.01, 0.01, 0.01). TEP onarımı (Grup 2) yapılan tarafın ameliyat edilmemiş taraf ile karşılaştırmasında ise testis volümleri ve spermatik kord arteriyel kan akım değerleri arasında istatistiksel olarak anlamlı bir fark bulunmadı. Lichtenstein ve TEP grupları arasında Vmax, Vmin ve TV değerleri arasında anlamlı bir fark bulunmazken RI ve PI değerleri açısından aralarında istatistiksel olarak anlamlı fark bulundu (sırasıyla, p=0.02, 0.01)

Sonuç: Sentetik mesh kullanılarak yapılan kasık fıtığının cerrahi tedavisinde TEP onarımının, Lichtenstein tekniğine göre testis fonksiyonlarının daha iyi korunması açısından elverişli olduğunu göstermiştir.

Anahtar Sözcükler: İnguinal herni onarımı; Lichtenstein; testiküler atrofi; total ekstraperitoneal.