

Laparoscopic Transabdominal Preperitoneal Hernioplasty for Inguinal Hernia and Its Effect on Male Fertility

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Abstract: Background: The effect of laparoscopic Transabdominal Preperitoneal (TAPP) inguinal hernia repair on testicular perfusion and function is unclear. The procedure entails dissection of testicular blood vessels and vas deferens off the hernial sac and incorporation of a prosthetic mesh. This carries at minimum, a theoretical risk of compromise in testicular blood supply, which in turn may affect fertility. Hence a study was conducted to compare the effect of laparoscopic transabdominalpre peritoneal inguinal hernia repair on fertility in male patients with unilateral inguinal hernia. **Methods:** The present study is a prospective randomized study conducted on male patients with inguinal hernia, admitted to surgical department (New Damietta Al-Azhar University Hospital) and underwent Laparoscopic TAPP hernioplasty between March 2017 and March 2018. Thirty Male patients were included in this study. Semen analysis and scrotal duplex were done preoperative as well as three and six months after the operation. A p-value <0.05 was considered significant. **Results:** No statistically significant difference was noticed in sperm count, progressive motility, testicular perfusion upon comparing these preoperative values with postoperative resultsthree and six months after the operation. **Conclusion:** TAPP is feasible and excellent option for inguinal hernioplasty. No statistically significant affection of fertility post TAPP operation as regard to testicular blood flow and semen analysis.

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Keywords: Laparoscopic Transabdominal Preperitoneal Hernioplasty, Inguinal Hernia, Effect on Male Fertility

1. Introduction

Inguinal hernia is a common surgical problem and its repair is one of the most common interventions in general surgery. Worldwide over 20 million inguinal hernia repairs are performed annually (**Kingsnorth, 2004**). Laparoscopic and open surgical approaches to inguinal hernia repair are available. Modern recommendation for inguinal hernia repair includes prosthetic mesh because of shorter hospital stay and lower recurrences (**Perko et al., 2011**). Advantages of the laparoscopic method are its low recurrence rate, fast postoperative recovery, low incidence of chronic postoperative pain and high level of patient satisfaction (**Eklund et al., 2006 - Langeveld et al., 2010**). Clinical studies of testicular flow after inguinal hernia mesh repair showed different outcomes. **Sucullu et al. (2010)**, supported the hypothesis that mesh techniques in inguinal hernia repair significantly change the Doppler parameters in the early postoperative period, but do not have a significant effect on sperm concentration or rate of progressive motility. In contrast, the study by **Ramadan et al. (2009)**, showed that mesh placement

does not adversely affect ipsilateral testicular flow (**Krnić et al., 2016**). Hence, in this study, we attempt to evaluate the effects of laparoscopic Transabdominal preperitoneal (TAPP) repair on testicular blood flow and semen analysis after three and six months.

2. Patients and Methods:

Between March2017and March 2018, thirty male patients underwent Laparoscopic Transabdominal Preperitoneal (TAPP) inguinal hernia mesh repair in the department of surgery, New Damietta, Al-Azhar University Hospital, were included in this study. Inclusion criteria were male patients between (20-50) years old, with unilateral inguinal hernia, either direct, indirect or pantaloon inguinal hernia. Exclusion criteria were Age less than 20 years and more than 50 years, infertility, Bilateral hernia, recurrent hernia, complicated hernia as; obstructed or strangulated hernias, previous history of testicular trauma or operation, clinical detectable testicular disease, patients with immunosuppressive disease or debilitating disease like chronic liver, heart failure, COPD or renal impairment. Testicular color Duplex ultrasonography and semen analysis were done

preoperatively and at three and six months after the operation. Routine investigations were also done.

Operation Technique:

Antibiotic prophylaxis was given for all patients, Foley’s catheter was placed prior to surgery to empty the urinary bladder. Laparoscopic TAPP hernia repair performed under general anesthesia; in supine position with both arms tucked by the side, the head end of the table were kept 15° low to facilitate creation of pneumoperitoneum and move the bowel away from the operative field, the Veress needle used to create pneumoperitoneum, after satisfactory pneumoperitoneum, a 10 mm port were placed through the supra umbilical incision. Two 5 mm ports placed as working ports for the right and left hand of the surgeon, one on each side, at the level of umbilicus in the midclavicular line. Exploration of pelvic anatomy was done (**Figure 1**).

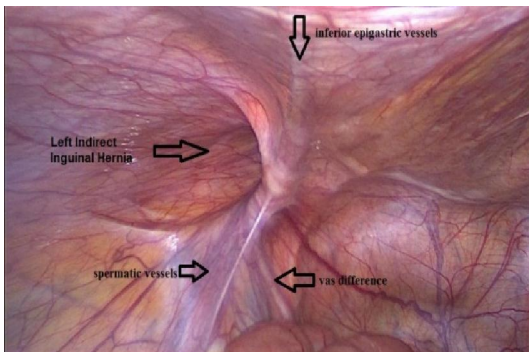


Figure (1): Laparoscopic view of the relations between internal ring, inferior epigastric vessels, vas difference and spermatic vessels.

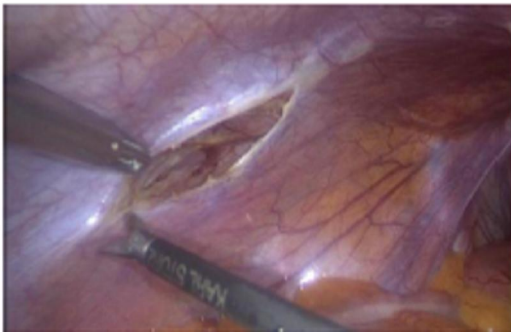


Figure (2): Peritoneal incision.

The hernia defect was inspected and the type of hernia (direct or indirect) confirmed by the position of defect in relation to the inferior epigastric vessels and cord structures. The inferior epigastric vessels can be seen coursing upwards from this point Contents of the hernial sac, if present, were reduced with the help of atraumatic bowel forceps. The peritoneal incision initiated at a point midway between the groin crease

and the umbilicus, about 5 cm above the internal ring; extending from above the anterior superior iliac spine to the medial umbilical ligament. The lower flap raised, dissection continued medially to the symphysis pubis to visualize the Cave of Retzius (**Figures 2, 3**).



Figure (3): Dissection continued medially

12X15cm Polypropylene mesh applied directly over the spermatic cord covering the myopectineal orifice (**Figures 4, 5**).

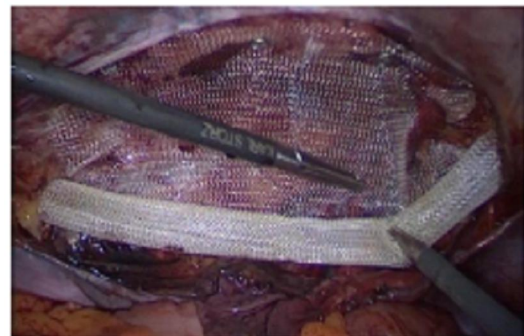


Figure (4): Mesh application.

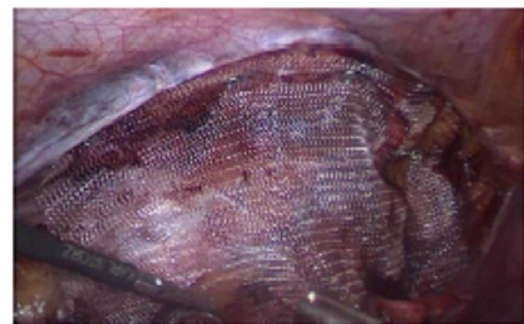


Figure (5): Fixation of the mesh.

Trans-facial sutures or tacker were applied over the medial and upper border of the mesh to anchor it to the underlying muscles. After placement of the mesh, the peritoneal flaps were closed over the mesh to prevent bowel and omental adhesions (**Figures 6, 7**). All carbon dioxide gas was evacuated to empty the

abdominal cavity and the scrotum. The port sites were closed with sutures.

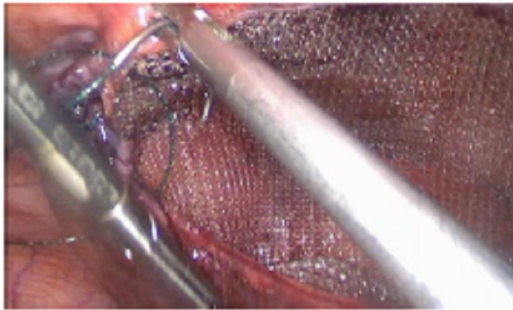


Figure (6): Suture closure of peritoneal flaps.

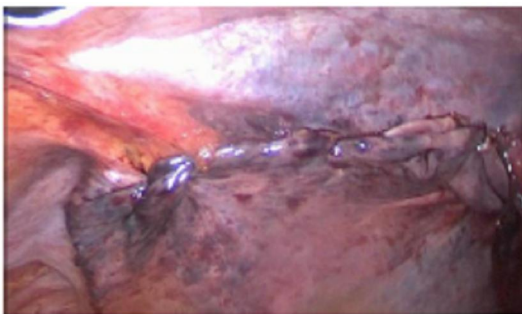


Figure (7): Complete closure of flaps.

All patients were followed up regularly with postoperative visits, after one week, three months, and after six months. They were assessed for postoperative

pain, sperm count, sperm motility, scrotal duplex, postoperative seroma, hernia recurrence and mortality.

3. Results

Thirty Male patients were included in this study, their age ranged from 20 to 40 years (mean age was 32 years). Follow up period ranged from 6 to 12 months (mean 9 months). As regard the type of hernia, there were 22 patients (73.3%) with indirect hernia, 3 patients (10%) with direct hernia and 5 patients (16.7%) with pantaloon hernia. As regard the side of hernia, there were 14 patients (46.7%) with right inguinal hernia and 16 patients (53.3%) with left inguinal hernia. The mean operative time was 67.33 minutes (ranged from 45 to 90 minutes) (**Table 3**).

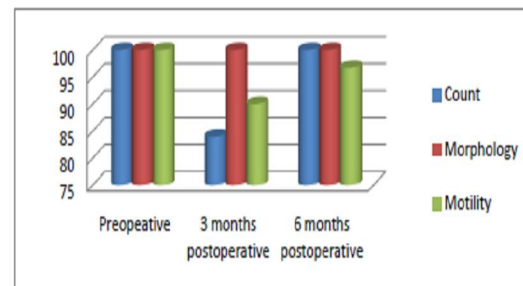


Figure (6): Three and six Months Postoperative Semen Analysis.

Table (1): Three and six Months Postoperative Semen Analysis.

Postoperative Semen Analysis		Three months postoperative		P Value	Six months postoperative		P Value
count	Decreased ↓	5 Patients	16.7%	0.052	0 Patients	0%	1
	Normal	25 Patients	83.3%		30 Patients	100%	
Motility	Decreased ↓	3 Patients	10%	0.24	1 Patient	3.3%	1
	Normal	27 Patents	90%		29 Patients	96.7%	
Morphology	Decreased ↓	0 Patients	0%	1	0 Patients	0%	1
	Normal	30 Patients	100%		30 Patients	100%	

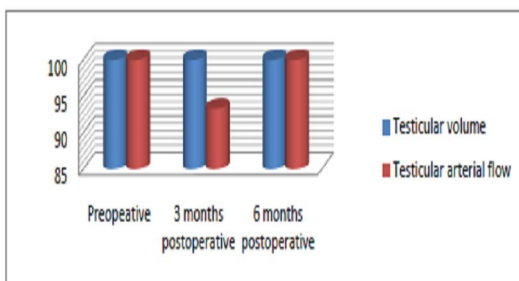


Figure (7): Three and six Months Postoperative Scrotal Duplex.

Postoperative pain was mild for 23 patients (76.7%), moderate for 6 patients (20%) and severe for

one patient (3.3%). Postoperative pain was measured using the visual analogue scale, which consists of a line, usually 100 mm long, whose ends are labeled as the extremes ('no pain' and 'pain as bad as it could be'). The patient was asked to put a mark on the line indicating his pain intensity (**Bombardier, 2000**).

There was postoperative seroma for 4 patients (13.3%), which resolved spontaneously within one month.

Preoperative sperm count, morphology and progressive motility were within the normal ranges, Three months postoperative; there were decreases of sperm count for five patients (16.7%) and decreased sperm motility for three patients (10%) however, not

statistically significant. Six months postoperative; sperm count returned to normal ranges and sperm motility returned to normal ranges for two patients (6.7%) and persisted for one patient (3.3%) insignificant statistically. These data were presented in (Table 1), (Figure 6).

As regard testicular duplex, it was normal testicular arterial flow and testicular volume for all patients preoperatively, three months later; there were

decrease of testicular arterial flow for 2 patients (6.7%) with no statistical significance (P Value 0.491) with normal testicular volume. However, six months postoperatively; the testicular arterial flow returned to normal with normal testicular volume. These data were presented in (Table 2), (Figure 7).

There was no recorded hernia recurrence or mortality in the follow up period. These demographic data were presented in (Table 3).

Table (2): Three and six Months Postoperative Scrotal Duplex.

Postoperative Scrotal Duplex						
		Three months postoperative		P Value	Six months postoperative	
Testicular Arterial Flow	Decreased ↓	2 Patients	6.7%	0.491	0 Patients	0%
	Normal	28 Patients	93.3%		30 Patients	100%
Testicular Volume	Decreased ↓	0 Patients	0%	1	0 Patient	0%
	Normal	30 Patents	100%		30 Patients	100%

Table (3): Patients Demographics. Y = years, M = months, Min = minutes.

Gender	30 Male (100%)	P Value
Age, Y, mean (range)	32 (20-40) Y	
Follow up, M, mean (range)	9 (6-12) M	
Type of Hernia		
• Indirect	22 Patients (73.3%)	
• Direct	3 Patients (10%)	
• Pantaloon	5 Patients (16.7%)	
Operative time, Min, mean (range)	67.33 (45-90) Min.	
Postoperative pain		
• Mild	23 Patients (76.7%)	
• Moderate	6 Patients (20%)	
• Severe	One patient (3.3%)	
Sperm count		
- Preoperative	Normal	0.052
- Postoperative		
• 3 Months	Decreased for 5 patients (16.7%)	
• 6 Months	Normal for all	
Sperm motility		
- Preoperative	Normal	0.52
- Postoperative		
• 3 Months	Decreased for 3 patients (10%)	
• 6 Months	Decreased for one patient (3.3%)	
Scrotal Duplex		
- Preoperative	Normal	0.49
- Postoperative		
• 3 Months	Decreased for 2 patients (6.7%)	
• 6 Months	Normal for all	
Postoperative seroma	4 Patients (13.3%)	
Hernia recurrence	0	
Mortality	0	

4. Discussion

The inguinal hernia is quite a common presentation in male. The life time rate of inguinal hernia is 25% in males and 21% in females. The risk of inguinal hernia increase with age and the incidence is around 50% by the age of 75 years (Rehman et al., 2014).

Laparoscopic inguinal hernia repair has become standard of care for patients with inguinal hernia (Gass et al., 2012). Laparoscopic repair provides very

good results where surgeons have expertise in the technique. It results in very low postoperative pain, fewer wound infection, and quick return to daily activity and work (Karthikesalingam et al., 2011).

Infertility secondary to obstructive azoospermia (normal sperm in testicular biopsy yet no sperm in the ejaculate) felt to be related to the fibroblastic involvement of the vas deferens after a heterogeneous group of mesh repairs (conventional, laparoscopic, unilateral, bilateral) (Fitzgibbons, 2005).

Spermatic cord dissection is minimized with the laparoscopic approach and subsequently the risk of groin and testicular complications resulting from injury to cord structures and adjacent nerves should be reduced (**Feldman and Wexler, 2000**).

Testicular volume is an important marker for testicular atrophy following corrective surgical operations on patients with inguinal hernias (**Akbulut et al., 2003**).

Evaluation of testicular perfusion preoperatively is very important as there are few studies shown that, testicular perfusion is impaired preoperatively on affected (hernia) side by elevated resistive index on Doppler (**Melissa et al., 2014**).

A randomized controlled trial of 120 patients done to study testicular function after laparoscopic (60 patients) and open (57 patients) mesh repair of inguinal hernias favored the laparoscopic approach. The laparoscopic group consisted of transabdominal preperitoneal (TAPP) (28 patients) and TEP (32 patients) approaches. Testicular function was measured by testicular volume, blood flow and hormones preoperatively and 3 months postoperatively.

There was a decrease in resistive index for both groups but it was significant after a laparoscopic repair (0.64 vs. 0.58, $p=0.04$) and not after an open one (0.68 vs. 0.65, $p=0.07$). There was a decrease in testicular volume (cm³) for both (open 10.7 vs. 9.2 and lap 9.8 vs. 9.3) but this was significant in the open group ($p=0.01$) (**Singh et al., 2012**).

Bansal et al. (2017) have studied 160 patients in a prospective randomized study comparing TAPP and TEP laparoscopic hernioplasty (80 patients in each group) as regard to testicular function, sexual function and quality of life over a median duration of follow up, 13 months. They found that there was an overall improvement in the testicular functions in terms of testicular volume and resistive index although not statistically significant and this change was comparable between TEP and TAPP groups. Moreover, there was a statistically significant improvement in the sexual drive score, erectile function and overall satisfaction over the follow-up period following laparoscopic inguinal hernia repair. However, sexual function improvement was similar in patients undergoing both TEP and TAPP repairs. All the domains of quality of life in the study population showed a significant improvement at a follow-up of 3 and 6 months.

They stated that, this improvement could be attributed to the fact that, there was minimal handling of tissue in laparoscopic repair. Another important observation which has come out from this study is that inguinal hernia repair in general leads to decrease in the vascular impedance of testes and improvement in

the testicular vascularity. This implies that the presence of inguinal hernia in itself is associated with some impairment in testicular blood flow which actually improves after laparoscopic repair (**Bansal et al., 2017**).

Stula et al. (2012) compared TAPP and open repair and observed a significant increase in the mean intra-testicular vessels and capsular vessels RI (Resistence index) at 3 months, but this change was statistically insignificant after 6 months of surgery. Moreover, the increase in RI was not observed in the testicular vessels thereby ruling out the role of mesh and its incorporation with the surrounding tissue with the vascular impedance.

The increase in RI was within the normal physiological range. However, this change in the testicular parameters was significantly higher in the open repair when compared with TAPP repair. They concluded that the transient increase in the RI in the early postoperative period was due to the tissue and vessel handling during surgery and subsequent inflammation and transient breach in the blood testes barrier (**Stula et al., 2012**).

Singhet al. (2012) compared the open and laparoscopic repair, they have shown that, there was a significant impairment of testicular functions following open mesh repair as compared to laparoscopic inguinal hernia repair in terms of significant decrease in testicular volume, lesser improvement in resistive index with significant decrease in testosterone (**Singhet al., 2012**).

In our study, there was no change according to testicular volume either after three months or six months. On the other hand, testicular arterial flow decreased for two patients only (from total 30) represents (6.7%) however, not statistically significant (P value 0.491) and returned to normal six months after the operation.

We speculate that, this transient early decrease in testicular arterial flow may be due to handling of the testicular vessels that resolved latter on and returned to normal after six months.

Shin et al. (2005) reported on 14 patients of azoospermia among patients who underwent operations using the Lichtenstein technique and concluded that their infertility was related to the use of polypropylene meshes that had favored obstruction of the vas deferens (**Shin et al., 2005**).

Sucullu et al. (2010) compared the effect of open inguinal hernioplasty on spermatic concentration and progressive motility. They compared Lichtenstein group (LG) and the mesh plug group (MPG) and concluded that, there was decrease in the sperm concentration and motility three months after the operation although, not statistically significant (**Sucullu et al., 2010**).

In our study: Three months postoperative, there was a decrease of sperm count for 5 patients only (from total 30) represents (16.7%) however, not statistically significant (P value 0.052) and the sperm count returned to normal ranges six months after the operation. Also, there was a decreased sperm motility for three patients (10%) however, not statistically significant (P value 0.24) however, six months after the operation, sperm motility returned to normal ranges for two patients (6.7%) and persisted for one patient (3.3%) insignificant statistically (P value 1).

So, there is no statistically significant difference in preoperative and postoperative spermiogram results. Bearing in mind the experimentally proven chronic inflammatory tissue reaction against mesh, these results indicate that chronic tissue inflammation has no adverse effect on testicular perfusion and spermatogenic function over time.

Manjunath et al. (2018) studied the outcome of laparoscopic TAPP versus Lichtenstein repair through a randomized controlled trial and found that, The open Lichtenstein procedure have a significantly less operative time compared to TAPP procedure (54±15 minutes vs. 75.7±31.6 minutes (p value 0.001). On the other hand, TAPP group had a significantly low pain postoperatively. There was no difference between the TAPP group and Lichtenstein group regarding the mean hospital stay. The mean time to return to work was 12.1±11.8 days in TAPP group, which was significantly lesser than the Lichtenstein group (20.9±4 days (p value 0.04) No recurrence was found (**Manjunath et al., 2018**).

In our study, Postoperative pain was mild for 23 patients (76.7%), moderate for six patients (20%) and severe for one patient (3.3%). The mean operative time was 67.33 ±13.8 minutes. There was no recurrence over the follow up period.

A few studies found no difference between the open Lichtenstein and TAPP groups regarding operative time (**Wang et al., 2013, Anadol et al., 2004**). Other studies found laparoscopic TAPP was quicker than the open Lichtenstein procedure (**Li et al., 2013 - Mahon et al., 2003**). Another study found that, the open Lichtenstein procedure have a significantly less operative time compared to TAPP procedure Actually, it is not the type of procedure but the learning curve in laparoscopy which decides the operative time (**Manjunath et al., 2018**).

Manjunath et al. (2018) found that, the open Lichtenstein group had three (12%) seromaformation while TAPP group had no cases of seroma formation, but the difference wasn't significant (p value 0.2). There were two cases of wound infection (both were superficial), one in each group. The Lichtenstein group had two (8%) cases of haematoma, and the

TAPP group had no case of haematoma, but the difference wasn't statistically significant (p value 0.5).

In our study, there was postoperative seroma for 4 patients (13.3%), which resolved spontaneously within one month. There was no wound infection or haematoma.

Conclusion

TAPP is feasible and excellent option for inguinal hernioplasty. Complication that may occur after TAPP is accepted, affordable and temporary. No statistically significant affection of fertility post TAPP operation as regard to testicular blood flow and semen analysis. Actually, the cause of complication is not the TAPP but the learning curve in laparoscopy which decides the surgeon options.

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