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A prospective study of the effect of Prolene mesh on testicular perfusion and volume in patients with inguinal hernia undergoing Lichtenstein's repair

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Abstract
Introduction: Lichtenstein's Tension free mesh repair is simple, safe and effective procedure that has very low recurrence rates. It is well known that, direct contact of the mesh to the vessels in the inguinal canal and perimesh fibrosis may have a negative impact on testicular flow. Most of the clinical and experimental studies shows that mesh application for hernioplasty is a safe procedure in patients. The study aims at evaluating the effect of prolene mesh on the testes in patients undergoing Lichtenstein's mesh repair.
Methodology: This study evaluates the effect of prolene mesh in testicular volume and perfusion in patients undergoing Lichtenstein's hernia repair. The study was conducted between November 2015 to May 2017 and total of 100 patients admitted with inguinal hernia, in the department of general surgery, Bangalore medical college were included.
Results: In our study, most of the patients who underwent Lichtenstein's hernia repair had uneventful post operative recovery. Seroma formation and surgical site infection were the most common complication noticed. In our study, there were no statistically significant differences between preoperative and postoperative measurements which included testicular blood flow parameters and testicular volume.
Conclusion: Hernia repair technique by Lichenstein technique does not alter the testicular perfusion and testicular size. There may be clinical and experimental study results concerning whether testicular perfusion is adversely affected. It would be difficult to impair the testicular perfusion after hernia repair because of rich arterial supply and collateral capacity. The incidence of testicular atrophy reduced by limiting dissection, by leaving distal indirect hernia sacs, and by preserving the cremasteric muscle fibres. Fine surgical dissection and reconstruction with respect for anatomy and the use of proper prosthetic material could lead to the best results.

Keywords: hernioplasty, testis, spermatic cord, atrophy, perfusion, mesh

Introduction

About 10% of people develop some type of hernia during their lifetime. Hernias are seven times more common in males than in females'. Abramson *et al*. reported that the overall current risk for a male to have an inguinal hernia is 18%, and the lifetime risk is 24% [2]. Anatomically, a close relation exists between the spermatic cord and inguinal hernia. Inguinal hernias can carry the risk of ischemia of the testis by intermittent mechanical compression (pressure) on the testicular vessels [3, 4].

In some reports, colour Doppler ultrasonography showed that pre-operatively, the sonographic resistive index(R) was significantly elevated in the affected (hernia) side compared with the normal side [5]. On the other hand, Munoz Sanchez *et al*. concluded that uncomplicated inguinal hernias cause no significant alterations in the arterial circulation of the testicle [6]. Lichtenstein hernia repair (LHR) is one of the most comfortable effective methods of inguinal hernia repair, which is based on the concept of tension-free high ligation of the sac, has become widely popular in surgical practice [7, 8]. Despite the frequency of open and laparoscopic herniorrhaphy, the effects of a hernia and its subsequent repair on testicular perfusion and function are unknown. Testicular dysfunction (atrophy) is one of the most dreaded sequelae of inguinal hernioplasty. However, literature findings show that testicular atrophy occurs in 0-2% of patients after herniorrhaphy [1, 10].

Yavetz *et al*. reported that among 8500 patients attending a fertility clinic because of infertility, 565 men (6.65%) reported an incidence of inguinal hernioplasty with or without subsequent atrophy of the testes [11]. The preoperative and postoperative use of color Doppler ultrasound (CDUS) to evaluate the spermatic cord structures and scrotal structure has been well documented in testicular pathologies and hernias [12, 13]. CDUS is extremely helpful in all cases to investigate extratesticular vascularization and testicular perfusion, with parameters optimized to display low-flow velocities, including peak systolic velocity (PSV) and end diastolic velocity (EDV). Lefort and colleagues showed that color Doppler examination of the scrotum should include measurement of intratesticular RI, as an elevated RI can be suggestive of ischemia [14]. However, most of these conditions have not been well documented using CDUS after TEP or LHR. Damage to the spermatic cord structures, testicular atrophy, and dysfunction levels as a consequence of mesh application are not well known in adults.

Methodology

Source of Data

Patients who are diagnosed with inguinal hernia who underwent Lichtenstein's Tension Free Mesh repair who were admitted in the department of general surgery Bowring and Lady Curzon Hospital and Victoria Hospital Attached to Bangalore Medical College And Research Institute.

Methods of Collection of Data

Study Design: Prospective study

Period of Study: 2015 November to 2017 may.

Place of Study: The study was carried out in the inguinal hernia patients undergoing Hernioplasty admitted in Department of General Surgery, Bowring and Lady Curzon Hospital and Victoria Hospital attached to Bangalore Medical college and research institute, Bangalore

Inclusion Criteria

Patients with uncomplicated inguinal hernia in the age group 18 to 60 years.

Exclusion Criteria

1. Patients who are having
   - Epididymo orchitis
   - Hydrocele
   - Varicocele
   - TB Orchitis
   - Syphilitic Orchitis
   - Testicular Tumor
2. Patients with complicated inguinal hernia
3. Patients not willing to participate in the study

Materials Used

- Siemens Colour Doppler with1.5Hz Transducer
- Prolene prosthetic mesh

Methodology

After obtaining clearance and approval from the Institutional Ethics committee, 100 inguinal hernia patients admitted in Bangalore medical college during the study period who satisfy the inclusion and exclusion criteria were included in the study. Written informed consent was taken

Patient's demographic data, history, clinical examination findings and lab investigations were recorded.

A pre-operative Color Doppler Ultrasound of the testes and cord structures was performed with patients in supine position and blood flow parameters of testicular artery were evaluated and noted as PSV, EDV and RI calculated. Patients were operated by Lichtenstein's Tension Free Hernia repair technique. Color Doppler Ultrasound of testes was repeated 3 months after the surgery and the above parameters were measured again and compared.

Results

Among the inguinal hernia patients about 100 patients who satisfied the inclusion criteria were included in the prospective study. In this study prospective risk factors like age distribution, side, type of inguinal hernia, precipitating factors and complications of the surgery like post operative pain, seroma formation, surgical site infection, wound dehiscence and mesh infection, recurrence after surgery were analyzed. Using Color Doppler parameters like PSV, EDV, RI were compared pre operatively and post operatively. The parameters like PSV, EDV, RI and Testicular size were compared statistically.

Age Distribution

Table 1: Age Distribution

Age	No. of patients	Percentage
13-20	2	2
21-30	12	12
31-40	32	32
41-50	28	28
51-60	26	26
TOTAL	100	100

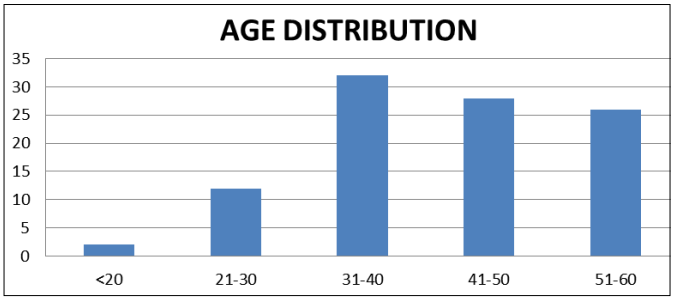

Fig 1: Age Distribution

In this study maximum number of patients belong to the age group 31-40 years. The mean age of the study group was 42.34 yrs.

Occupational Status

Table 2: Occupational Status

Occupation	Frequency	Percent
Manual Labourers	49	49
Farmers	15	15
Office Employees	20	20
Auto Drivers	16	16

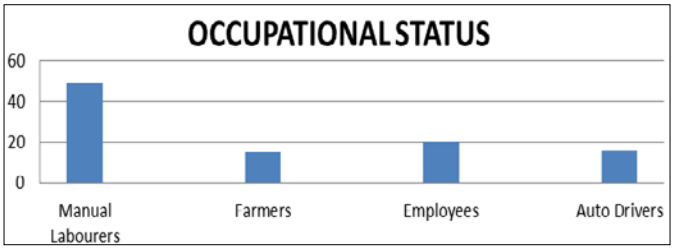

Fig 2: Occupational Status

In our study, most of the patients who underwent Hernia repair were manual labourers which constitute 49%of the study population.

Side of Inguinal Hernia

Table 3: Diagnosis-Side of hernia

Laterality	Frequency	Percentage
Left inguinal hernia	39	39

Right inguinal hernia	56	56
Bilateral	5	5

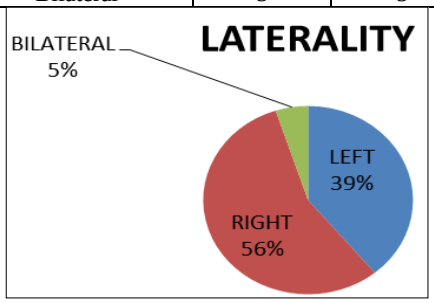

Fig 3: Diagnosis-Side of hernia

Majority of the patients in the study group had right sided inguinal hernia i.e 56%.

Type of Inguinal Hernia

Table 4: Type of Hernia

Type of hernia	Frequency
Direct inguinal hernia	41
Indirect inguinal hernia	59

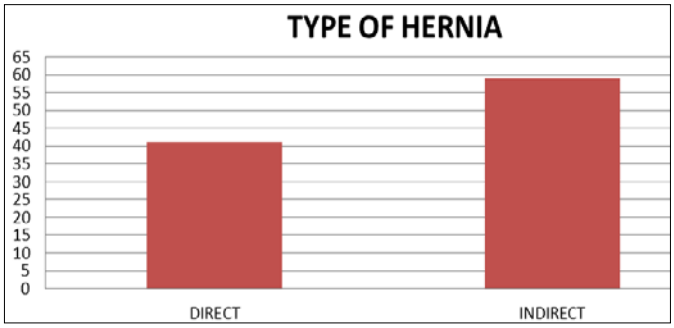

Fig 4: Type of Hernia

In our study, most of the patients were having Indirect Inguinal Hernia i.e, 59%.

Diagnosis

Table 5: Diagnosis

Side	TYPE	
	Direct	Indirect
Left	18	21
Right	21	35
Bilateral	2	3

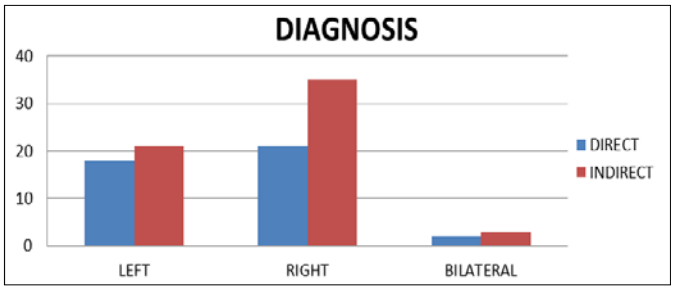

Fig 5

In our study most of the patients were diagnosed with Right Indirect Inguinal Hernia i.e, 35%, followed by Right Direct Inguinal Hernia and left indirect hernia

Duration of Symptoms

Table 6: Duration of Symptoms

Duration	Frequency
<1YR	74
>1YR	26

Precipitating Factors

Table 7: Precipitating Factors

Age Group	Smoking ± COPD	BPH	Bronchial Asthma	Chronic constipation	None
<20	0	0	0	0	2
21-30	6	0	1	0	5
31-40	24	0	0	0	8
41-50	23	0	1	1	3
51-60	20	3	0	0	3
Total	73	3	2	1	21

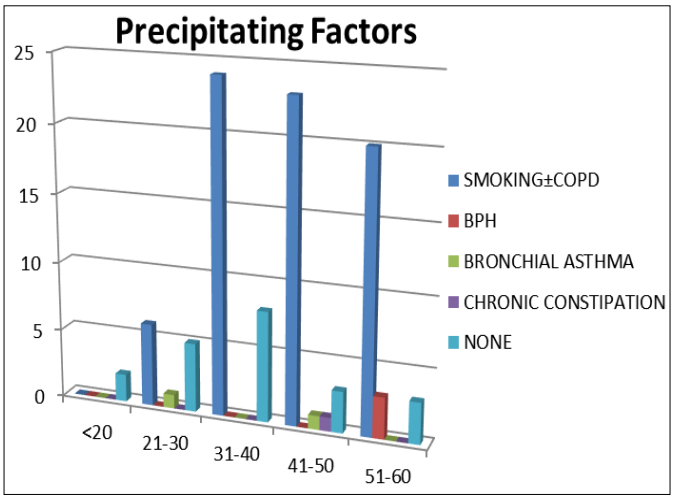

Fig 6: Postoperative Complications

Table 8: Post-operative Complications

Complications	Frequency
None	87
Seroma	5
SSI and wound Dehiscence	4
Mesh Infection	0
Urinary Retention	3
Recurrence	1

Comparison of Pre-Operative and Post-Operative Variables

Out of 100 patients, preoperative (PSV, EDV, RI and Testicular size) and postoperative (PSV, EDV, RI and Testicular size) were compared.

Table 9: Analysis of Preoperative and Postoperative variables of testicular perfusion and volume.

	N	Preoperative	Postoperative	P value
PSV(cm/sec)	100	14.06±3.012	13.984 ± 2.962	0.073
EDV(cm/sec)	100	4.976±2.405	5.143±1.824	0.158
RI	100	0.648±0.154	0.637±0.130	0.074
TS(ml)	100	14.458±4.182	14.674±3.874	0.069

Discussion

Age: In a study by Ira M. Rutkow [15], the age at presentation is as follows. It is compared with present study.

Table 10: Comparison of age incidence in the present study with standard literature

Age (years)	Present study	Ira M. Rutkow
<15	--	18%
15-44	54	26%
45-64	46	30%
>65	--	26%

In the study of Ira M. Rutkow, the highest incidence was in the age group 45-64 which was 30 cases and next was 26 cases both in 15-44 and >65 age group.In our study, 54 cases out of 100 cases were in the age group 15-44 years and 46 cases were of the age group 45-60 years. Age groups more than 60 years were not considered for the study.

Occupation

Table 12: Comparison of occupational status in the present study with standard literature.

Occupation	Frequency	Percent	M. Bay Nielson	Percent	Percent
Farmers	15	64	Constantly strenuous work	14.1	47.2
Daily Wagers	49		Intermittently strenuous work	33.1	
Auto Drivers	16	16	Walking- no heavy lifting	28.3	28.3
Office Employees	20	20	Sedentary Work	22.0	22.0
_	_	_	Unspecified	2.5	2.5
Total	100	100.0	Total	100.0	100.0

In our study the farmers and daily wagers who constitute 64% are comparable with constantly/ intermittently strenuous work group of M. Bay Nielson, who constitute 47.2%. Sedentary workers make up 20% in our study. 16% make our study in no heavy lifting category which is less than from standard study.

From our study it is shown that smokers constitute a significant size which as in literatures points to abnormal biochemical, metabolic and connective tissue disorders and points out the prevalence of smoking in general population.

In our study on comparison to the study by Mike S.L Liem and others, the number of people, involved in strenuous work is 64% (farmers and daily wagers) and the high incidence is explained by the fact that agriculture is the main occupation in India.

Precipitating Factors

Table 13: Comparison of precipitating factors in the study with standard Literature

Age Group	Smoking± COPD	BPH	Bronchial Asthma	Chronic constipation	None
<20	0	0	0	0	2
21-30	6	0	1	0	5
31-40	24	0	0	0	8
41-50	23	0	1	1	3
51-60	20	3	0	0	3
Total	73	3	2	1	21

In a study by Mike S. L Liem[16] and others, the precipitating factors were COPD in 10%, BPH in 5%, strenuous activity in 24%. It is a well-known fact that there are multifactorial causes for hernia which is indeed a tougher task to single out.

Diagnosis - Types of hernia

Table 14: Comparison of types of hernia in the present study with standard Literature.

Type of Hernia	Present study	Ira M. Rutkow study
Right-Indirect	35	36
Right-Direct	21	15
Left-Indirect	21	28
Left-Direct	18	13
Bilateral	5	2

The incidence of different types of hernia in our study is almost comparable with the study done by Rutkow.

Post-operative complication

Table 15: Post-operative complication

Complications	Frequency
None	87
Seroma	5
SSI and wound Dehiscence	4
Mesh Infection	0
Urinary Retention	3
Recurrence	1

In our study, the most of the patients who underwent Lichtenstein's hernia repair had uneventful post operative recovery. The complications noted were seroma formation, surgical site infection and wound dehiscence. One patient had Post operative recurrence of the inguinal hernia which noticed in the 3 month follow up period. Champault *et al*. [17] found recurrence rate of 3% in open group in a series of 100 patients in a randomized trail.

Testicular complications

Table 16: Comparison of pre operative and post operative Variables of Testicular perfusion and testicular volume.

	N	Pre operative	Post operative	P value
PSV(cm/sec)	100	14.06±3.012	13.984±2.962	0.073
EDV(cm/sec)	100	4.976±2.405	5.143±1.824	0.158
RI	100	0.648±0.154	0.637±0.130	0.074
TS(ml)	100	14.458±4.182	14.674±3.874	0.069

Peak Systolic Velocity (PSV) p value 0.073 (> 0.05) There is no significant difference between preoperative and postoperative PSV values.

End Diastolic Velocity (EDV) p value 0.158 is (> 0.05) there is no significant difference between preoperative and postoperative EDV values.

Resistance Index (RI) p value is 0.0.074 (> 0.05). There is no significant difference between preoperative and postoperative RI values.

Testicular Size (TS) p value 0.069 is (> 0.05) there is no significant difference between preoperative and postoperative TS values.

All Inguinal Hernia repair techniques aim to close the internal ring with a suture or a biomaterial such as a polypropylene mesh. Concern has been raised about whether the spermatic cord structures are compromised with these techniques. Surgical dissection, division or mechanical trauma to the spermatic artery and veins account for serious trophic changes in the testes. Lee *et al*. have explained that surgical manipulation of the spermatic cord imparts a small but statistically significant morphological changes in testicular size without a deleterious effect on testicular development, fertility or fecundity [10]. In some reports, inguinal hernia may impair testicular blood flow, which may be attributable to the effect of intermittent mechanical compression on the funiculus spermaticus in the inguinal canal [3-6, 14].

Testicular artery and vein injuries, thrombosis of the spermatic vein plexus, and testicular torsion are the major factors that influence testicular perfusion. Furthermore, the implantation of a non absorbable polypropylene mesh during hernia repair causes a chronic foreign body reaction involving the surrounding tissue. In cases of inguinal hernia repair using different mesh techniques, the spermatic cord structures are potentially affected by this chronic inflammatory tissue remodeling [18].

According to our study on comparing the pre operative and post operative evaluation of testicular artery parameters like PSV, EDV, RI and Testicular size with that of post operative values, the difference was found to be insignificant.

Similar the study on adverse effects of herniorraphy on testicular perfusion by O Neil, there was no significant changes in blood flow parameters when compared pre operatively and post operatively. This study by O Neil is in accordance with our study.

Also in our study the pre operative mean testicular size is 14.458±4.182 and the post operative value is 14.674±3.874, the difference was found to be statistically insignificant.

Inspite of injuries to the spermatic vessels and chronic inflammation induced morphological changes by the prosthetic mesh the testicular perfusion is not affected significantly. The probable reason may be because the testes have more vessels than expected. Anatomically, the spermatic artery divides into two branches near the testes. Jarrow *et al*. showed that frequent early branching of the internal spermatic artery prevents inadvertent interruption of testicular arterial blood flow during operations performed on the spermatic cord within the inguinal canal [19].

Many studies suggest an unknown or alternative (collateral) connection between vessels of the cord and other vessels that supply blood to the testes [20-22]. Zomorrodi and Buhluli explained that they isolated and ligated the spermatic cord at the internal ring of the inguinal canal for transfixation and placed the allografted kidney in the retroperitoneal position with anastomosis of the iliac vessels, and that mass ligation of the spermatic cord did not lead to any ischaemic problems in the follow up period [21]. Zat'ura *et al*. concluded that in the great majority of men, the blood supply of the testes is ensured by collateral circulation [22].

Peiper *et al*. reported that the implantation of a non-absorbable polypropylene mesh in the inguinal region during hernia repair causes chronic foreign body reaction involving the surrounding tissue and the spermatic cord structures in pigs. They observed that venous thrombosis of the spermatic veins occurred in five of 15 cases. The mesh repair may also lead to a decrease of arterial perfusion, testicular temperature, and the rate of seminiferus tubules with regular spermatogenesis.

Therefore, they recommend strict indications for implantation of a prosthetic mesh during inguinal hernia repair [23].

On the other hand, prosthetic materials can contract by 20-75% of its original size within one year after implantation in the inguinal region. Taylor *et al*. set out to determine whether this contraction has any effect on testicular or femoral vessel blood flow following open or laparoscopic hernia repair. They found that mesh contraction following inguinal hernioplasty does not adversely affect the testis or femoral vessels and can be used safely for both anterior and preperitoneal approaches [24].

Brisinda *et al*. also found that there were no statistically significant differences between preoperative and postoperative measurements which included testicular blood flow parameters and testicular volume [25].

Conclusion

It is clear from our study that hernia repair technique by Lichenstein herniorrhaphy does not alter the testicular perfusion and testicular size.

There may be clinical and experimental study results concerning whether testicular perfusion is adversely affected. We conclude it would be difficult to impair the testicular perfusion after hernia repair because of rich arterial supply and collateral capacity. Arterial input and venous drainage of the testes are assured by many anastomoses that protect it from ischaemic injury.

Careful dissection and preservation of the vessels are important to protect these anastomoses during hernia repair. Trauma to the spermatic cord structures should be minimized and the incidence of testicular atrophy reduced by limiting dissection beyond the pubic tubercle, by leaving distal indirect hernia sacs attached to the cord, and as in recurrent hernias, by avoiding dissection of the spermatic cord altogether by employing a posterior pre peritoneal approach. Preserving the cremasteric muscle fibres and reconstructing the fascia can protect the structures of the spermatic cord from the inflammatory reaction. Overzealous dissection of a distal hernia sac, dislocation of the testes from the scrotum into the wound, and concomitant scrotal surgeries should be avoided. Pre peritoneal repairs should be considered for recurrent hernias, not only to reduce further recurrences but also to avoid testicular complications.

It is clear that fine surgical dissection and reconstruction with respect for anatomy and the use of proper prosthetic material could lead to the best results.

Summary

- In our study the incidence of hernia was common in the younger age group, greatest in the 31-40 years' age group.
- The occurrence of hernia is common among the farmers and laborers accounting for 72% in comparison to other occupation.
- 74% patients presented within the first 1 year of onset of complaints while 26% of them presented after 1 yrs.
- In our study smoking were found to be most common precipitating factor with 72% of the patients being smokers.
- Right Indirect hernia was seen in 31 cases and right sided hernia with 54% being the most frequent type.
- In our study indirect inguinal hernia seen in 56% of patients were found to be more common.
- All the 100 patients included in our study underwent Lichtenstein's tension free mesh repair.
- Most of the patients who underwent the surgery had uneventful post operative recovery with seroma formation was observed in 5 patients and surgical site site infection were observed in 4 patients.
- In our study, there were no statistically significant differences between preoperative and postoperative measurements which included testicular blood flow parameters and testicular volume.
- Hence it is clear from our study that the prolene mesh that is used in the Lichtenstein's Repair for Inguinal Hernia will not significantly affect the testicular perfusion and hence testicular size.

References

1. Fitzgibbons RJ, Filipi CJ, Quinn TH. Inguinal hernias. In: Brunicardi FC(ed) Schwartz's principles of surgery, 8th edn. McGraw-Hill, New York, 2005, 1353-1394.
2. Abramson J, Gofin J, Hopp C, Makler A, Epstein L. The epidemiology of inguinal hernia. A survey in western Jerusalem. Journal of Epidemiology & Community Health. 1978; 32(1):59-67.
3. Hager J, Menardi G. lschemic damage of the testis as a complication of incarcerated hernia in the infant. Padiatr Padol. 1986; 21(1):17-24.
4. Turgut AT, Olcucuoglu E, Turan C. Preoperative ultrasonographic evaluation of testicular volume and blood flow in patients with inguinal hernias. J Ultrasound Med. 2006; 26(12):1657-1666.
5. Beddy P, Ridgway PF, Geoghegan T, Peirce C, Govender P, Keane FB, *et al*. Inguinal hernia repair protects testicular function a prospective study of open and laparoscopic herniorrhaphy. J Am Collsurg. 2006; 203(1):17-23.
6. Munoz Sanchez MJ, Munoz Fernandez L, Prados Olleta N, Vara Thorbeck R. Testicular-Epididymal Hemodynamics and Inguinal Hernia. European Surgical Research. 2005; 37(4):257-264.
7. Stoppa RE. The preperitoneal approach and prosthetic repair of groin hernia. In: Nyhus and Condon's hernia. Fitzgibbons R, Greenburg A, Nyhus L, editor.3rd ed. Philadelphia: Lippincott Williams, 2002, 65-69.
8. McKernan JB, Laws HL. Laparoscopic repair inguinal hernia using a totally extraperitoneal prosthetic approach. SurgEndosc. 1993; 7:26-28.
9. Collaboration EH. Laparoscopic compared with open methods of groin hernia repair: systematic review of randomized controlled trials. Br J Surg. 2000; 87:860-867.
10. Lee SL, DuBois JJ, Rishi M. Testicular damage after surgical groin exploration for elective herniorrhaphy. J Peditr Surg. 2000; 35(2):327-330.
11. Yavetz H, Harash B, Yogev L, Homonnai ZT, Paz G. Fertility of men following inguinal hernia repair. Andrologia. 1991; 23(6):443-446.
12. Ponka JL. Early and the late post operative complications

and their management. In: Ponka JL (ed)Hernias of the Abdominal wall. Saunders, Philadelphia, 1980, 605-618.
13. Hostman WG. Scrotal Imaging. Uroradiology. 1997; 24:653-671.
14. Lefort C, Thoumas D, Badachi Y, Gobet F, Pfister C, Dacher JN, *et al*. Ischaemic Orchiditis: Review of 5 cases diagnosed by color Doppler ultrasonography. J Radiol. 2001; 82(7):839-842.
15. Rutkow IM, Robbins AW. Demographic, Classificatory and socio- economic aspects of hernia repair in the United States. Surg Clin North Am. 1993; 73:413-426.
16. Llem MSL, Duyn EBD, Graaf V, Van Vroonhoen TJMV. Recurrences after Conventional Anterior and Laparoscopic Inguinal Hernia Repair. Ann Surg. 2003; 237:136-141.
17. Champault G, Rzk N, Catheline J, *et al*. Inguinal Hernia Repair, totally pre-peritoneal laparoscopic approach versus Stoppa operations. Randomized trial of 100 cases. Surg Laparoscope Endosc. 1997; 6:445-450.
18. Beddy P, Ridgway PF, Geoghegan T, Peirce C, Govender P, Keane FB, *et al*. Inguinal hernia repair protects testicular function: a prospective study of open and laparoscopic herniorraphy. Journal of the American College of Surgeons. 2006; 203(1):17-23.
19. Jarrow JP, Ogle A, Kaspar J, Hopkins M. Testicular artery ramification within the Inguinal canal. J Urol. 1992; 147(5):1290-1292.
20. Sánchez MM, Fernández LM, Olleta NP, Thorbeck RV. Testicular-epididymal hemodynamics and inguinal hernia. European surgical research. 2005; 37(4):257.
21. Zomorrodi A, Buhluli A. Viable testis after retroperitoneal mass cord ligation in internal ring of inguinal canal in 15 kidney recipients: five years of experience. InTransplantation proceedings Elsevier. 2008; 40(1):208-209.
22. Zát'ura F, Student V, Fiala R, Vrtal R. Personal experience with peroperative study of testicular blood flow in laparoscopic surgery of varicocele. Rozhledy v chirurgii: mesicnik Ceskoslovenske chirurgicke spolecnosti. 1997; 76(9):419-20.
23. Peiper C, Junge K, Klinge U, Strehlau E, Öttinger A, Schumpelick V. Is there a risk of infertility after inguinal mesh repair? Experimental studies in the pig and the rabbit. Hernia. 2006; 10(1):7-12.
24. Taylor SG, Hair A, Baxter GM, O'Dwyer PJ. Does contraction of mesh following tension free hernioplasty effect testicular or femoral vessel blood flow?. Hernia. 2001; 5(1):13-5.
25. Brisinda G, Cina A, Nigro C, Cadeddu F, Brandara F, Marniga G, *et al*. Duplex ultrasound evaluation of testicular perfusion after tension-free inguinal hernia repair: results of a prospective study. Hepato-gastroenterology. 2008; 55(84):974-8.