

Original Research Article

Study of alteration in testicular perfusion after Lichtenstein hernia repair

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ABSTRACT

Background: Inguinal hernia affects both men and women but is much more common in men who comprise over 90% of the operated patients. Considering both the operated and the non-operated inguinal hernias, the lifetime prevalence rate is 47% for men upto and including the age of 75. Repair of an inguinal hernia is one of the most common operations among adults in the western world today. Aims and objectives were to compare the alteration in testicular perfusion following Lichtenstein hernia repair.

Methods: Thirty patients diagnosed with inguinal hernia admitted in our hospital with study period of 12 months were included in the study. Color Doppler ultrasound evaluation of testicular blood flow was done for all cases. Comparisons of results between groups were done using independent t test and Pearson correlation test.

Results: The mean age of patients in the study was 46.10 ± 17.27 years. Twenty three percent of patients had COPD as comorbidity. Mean peak systolic volume (PSV) of testicular artery in preop, at 24 hours, 1 week and 3 months are 18.36 ± 2.21 , 20.27 ± 3.25 , 19.21 ± 2.31 and 18.98 ± 2.06 respectively with a $p=0.001$. On further observations, no significant difference was found in the PSV of Capsular and intratesticular artery and EDV and RI of testicular, capsular and intratesticular artery.

Conclusions: Testicular perfusion following hernioplasty can be easily monitored and evaluated with Duplex ultrasonography; the flow in the spermatic artery and testicular artery and its branches is of low resistance, with a relatively broad systolic part and holodiastolic flow. There is no evidence for a significant impairment of cord structures after open hernia repair using tension free techniques. It is clear that fine surgical dissection and reconstruction, doing respect for anatomy and using proper prosthetic material could be obtain the best results.

Keywords: Capsular artery, Color Doppler, End diastolic volume, Inguinal hernia, Intratesticular artery, Lichtenstein repair, PSV, Resistance index, Testicular artery, Testicular perfusion

INTRODUCTION

Inguinal hernia affects both men and women but is much more common in men who comprise over 90% of operated patients.¹ Considering both operated and non-operated inguinal hernias, lifetime prevalence rate is 47% for men upto and including the age of 75.² Repair of an inguinal hernia is one of the most common operations among adults in western world today. Lifetime risk of undergoing such repair is 27% for men, 3% for women.³

Several surgical techniques have been adopted for inguinal hernia repair, using both open and laparoscopic approaches. Tension free techniques became the gold standard for conventional hernia repair.⁴ A wide variety of prosthetic biomaterials have been utilized to overcome tension associated with pure tissue repairs and to restore integrity of inguinal canal floor by stimulating fibro-collagenous tissue in growth. Search for a near perfect modality of treatment of inguinal hernia has not yet ended. Rapid evolution of surgical techniques employing

newer mesh designs and materials has expanded the surgeon's armamentarium. The polyethylene (Marlex) mesh, first introduced by Usher, has gained a lot of popularity and was used in different designs by many surgeons.⁵ The literature shows a wide variation in the reported rate of complications after hernia repair which include ischemic orchitis and testicular atrophy following. According to Fong and Reid, primary ischemic orchitis occurs in 0.7-1.0% of patients undergoing open hernia surgery, with 0.35-0.65%, developing testicular atrophy. The rate of ischemic orchitis and testicular infarction increases in case of extensive dissection of the spermatic cord or delivery of the testis during surgery or in case of large hernias extending into scrotum or recurrent hernias.^{6,7}

Although the mesh used in open/laparoscopic tension free inguinal herniorrhaphy is described as an inert material, its long-term effects are debated. Experimentally all meshes cause initial and chronic inflammatory response in the recipient after implantation. One of the potential effects of inflammation induced by the mesh is ischemic orchitis and/or testicular atrophy in adult male patients.⁸

High resolution Colour Doppler ultrasound (CDUS) is capable of imaging small vessels in superficial organs and non-invasively measuring flow in them. It reliably shows testicular arterial anatomy by imaging intra-arterial blood flow and knowledge of normal color doppler appearance and waveform characteristic of testicular artery' aids in detecting alteration in blood flow.⁹

Since its introduction in 1990 by Ger et al laparoscopic inguinal hernia surgery has been modified, refined and used widely in general surgery.¹⁰ Despite series indicating its safety and efficacy, this minimal invasive approach to inguinal hernia repair still has some pitfalls. Longer operative time, learning curve, need for general anesthesia and operative costs are the major concerns related to technical difficulty and required equipment as compared with open approaches. However, in experienced hands the complications and short-term recurrence rates are comparable to open hernia repair, is less painful and results in early ambulation.

Testicular blood supply

Arterial supply to testis is primarily provided by testicular arteries. The testicular arteries are 2 long, slender vessels which arise anteriorly from the aorta a little inferior to renal arteries. Each passes inferolaterally under the parietal peritoneum on psoas major. The right testicular artery lies anterior to the inferior vena cava and posterior

to the horizontal part of the duodenum, right colic and ileocolic arteries, root of the mesentery and terminal ileum. The left testicular artery lies posterior to the inferior mesenteric vein, left colic artery and lower part of the descending colon. Each artery crosses anterior to the genitofemoral nerve, ureter and the lower part of the external iliac artery and passes to the deep inguinal ring to enter the spermatic cord and travel via the inguinal canal to enter the scrotum. In its course to the testis, the testicular artery branches into an internal artery and an inferior testicular artery and into a capital artery to the head of the epididymis. The level of this branching varies and has been noted to occur within the inguinal canal in 31% to 88% of cases. A rich arterial anastomosis occurs at the head of the epididymis, between the testicular and the capital arteries, and at the tail between the testicular, epididymal, cremasteric, and vasal arteries. The testicular arteries enter the mediastinum and ramify in the tunica vasculosa, principally in the anterior, medial, and lateral portions of the lower pole and the anterior segment of the upper pole. These capsular arteries in the tunica vasculosa supply centripetal branches that enter the testicular parenchyma and run towards the mediastinum. At the mediastinum, the centripetal arteries arborize into recurrent rami that run in the opposite direction, away from the mediastinum.

CDUS

CDUS accurately reflects the arterial anatomy of capsular and intratesticular artery. Velocity waveforms from these arteries show high level of antegrade diastolic flow throughout the cardiac cycle. This reflects the low vascular resistance of the testis. CDUS is also capable of reliably identifying testicular arteries; however, the velocity waveforms obtained from the vessels in supra-testicular region are quite variable. This variability results from sampling different vessels. In addition to the testicular artery, spermatic cord also contains the deferential and cremasteric arteries. These arteries primarily supply the epididymis and the peri-testicular scrotal tissues; however, they also contribute a variable amount of blood to testis. According to Middleton et al high resistance waveforms obtained in supra-testicular region originates from the deferential and cremasteric arteries and reflects the high vascular resistance of these extra-testicular scrotal tissues. Lower resistance waveforms obtained in supra-testicular region presumably originate from the testicular artery and therefore similar to capsular and intratesticular vessels.^{9,10}

Normal CDUS flow parameters for testicular blood vessels as defined by Middleton et al (Table 1).⁹

Table 1: Normal testicular blood flow dynamics.

Variables	Peak systolic velocity	End diastolic velocity	Resistive index
Testicular artery	7.5-27.7 (14.0 cm/se)	0-4.7 (1.9 cm/sec)	0.63-1.00 (0.84)
Capsular artery	5.0-23.4 (11.9 cm/sec)	1.8-9.2 (4.0 cm/sec)	0.46-0.78 (0.66)
Intratesticular artery	5.0-23.4 (11.9 cm/sec)	1.6-6.9 (3.6 cm/sec)	0.48-0.75 (0.62)

The operative field of inguinal hernia surgery is inevitably inclusive of spermatic cord structures, which lie at a constant risk of being affected. In 2005, Shin et al reported 14 patients with postoperative obstructive azoospermia after hernia repair with implantation of polypropylene meshes. Their report was followed by other case reports and studies focused on that problem. A discussion has thus begun about the risk of male infertility after mesh hernia repair. Men with bilateral mesh hernia repair and those with unilateral repair and impairment of contralateral testis have been considered to be at the greatest risk. In addition to this, there have been case reports of testicular infarction after laparoscopic inguinal hernia repair. Also studies have been carried out to establish scrotal Doppler ultrasonography as a valuable tool to evaluate testicular infarction after hernia surgery.¹¹

There is paucity of Indian literature on effect of hernia repair on testicular perfusion and studies need to be undertaken in this regard in setup. Objective of this study to compare alteration in testicular perfusion following Lichtenstein hernia repair in different types of hernia.

METHODS

The present randomized control trial study were conducted in the department of surgery and department of radiodiagnosis, PGIMS, Rohtak, Haryana. Male patients with inguinal hernia were selected among the patients who are admitted to our hospital and underwent Lichtenstein repair. Thirty patients diagnosed with inguinal hernia admitted in our hospital with study period of 12 months were included in the study. A total of 30 patients were included in the study and normal side act as a control. The patient came to the emergency room with incarcerated inguinal hernia, strangulated inguinal hernia and obstructed inguinal hernia; age less than 18 year are excluded from this study. After detailed history and physical examination, laboratory investigations were sent at the time of admission - hemogram, clotting time, bleeding time, urine complete examination, chest x-ray PA view, ECG, viral marker. Ethical approval had taken from institute ethical committee for this study. All patients underwent standard Lichtenstein inguinal hernioplasty under spinal anesthesia, after a thorough preoperative assessment of the patient. Informed consent was taken from all patients before the surgery.

All patients underwent colour doppler ultrasonography at admission(pre-operatively), at 24 hours post-operatively (very early post-operatively), 1 week postoperatively (early post-operatively) and 3 months post-operatively (late post-operative period) for the parameters evaluated preoperatively (PSV, EDV and RI).

Statistics

Statistical analysis was performed using the SPSS statistical package (version 17.0; SPSS Inc., Chicago, IL, USA). Continuous variables are presented as mean $\pm$ SD,

and categorical variables are presented as absolute numbers and percentages.

Continuous variables, including testicular, capsular and intratesticular PSV, EDV and RI values over time within groups were analyzed using repeated measures analysis of variance (ANOVA) followed by Bonferroni's post hoc testing.

Comparison of normally distributed continuous variables between the groups was performed using Student's t test. Nominal categorical data between groups were compared using Chi-squared test/Fisher's exact test as appropriate. $P < 0.05$ was considered statistically significant. $P < 0.05$ considered statistically significant.

RESULTS

This study included 30 patients with uncomplicated inguinal hernia. All patients enrolled in this study were above 18 years of age. Mean age of patients in current study was 46.10 years. Highest incidence of inguinal hernia (43.3%) found between age group 41-60 years.

Under study according to occupation, it was observed that 73.3% of patients were farmer, 20% were students, and 3.3% of patients each shopkeeper and tea maker.

Out of 30 patients of inguinal hernia, 23.3 percent had COPD and 10 percent had BPH.

It was observed that 33.3% of the patients were diagnosed with Lt. direct, 10% with Lt. indirect, 3.3% with both Lt. direct and Indirect, 20% with Rt. direct, 30% were diagnosed with Rt. indirect and 3.3% were diagnosed with Rt direct and indirect.

Testicular artery

Mean PSV of testicular artery at pre-op- 18.36 ± 2.21 , at 24 hours it moved upwards to 20.27 ± 3.25 , at 1 week it declined to 19.21 ± 2.31 and at 3 months it further declined to 18.98 ± 2.06 . It was observed that there was significant difference in mean PSV within operated group at 24 hours from baseline ($p = 0.003$), however. no significant change found within group at various time points.

Mean EDV of at testicular artery preop was 6.66 ± 3.27 , at 24 hours it moved to 6.55 ± 3.07 , at 1 week it increased to 6.72 ± 2.5 and at 3 months it further increased to 7.78 ± 1.09 . It was observed that there was no significant difference in mean EDV within operated group at various time points ($p = 0.124$).

Mean RI of testicular artery at preop 0.71 ± 0.27 , at 24 hours it moved to 0.69 ± 0.23 , at 1 week it decreased to 0.67 ± 0.22 and at 3 months it further decreased to 0.62 ± 0.19 . It was observed that no significant difference in mean RI within operated group at various time points ($p = 0.068$).

Table 2: Comparison of PSV between the groups and within groups over a period of 3 months.

PSV	Side				P value (between two groups)
	Operated		Contralateral		
	Mean ± SD	P value	Mean ± SD	P value	
Preop	18.36±2.21	0.001	18.52±2.37	0.071	0.792
24 hours	20.27±3.25		18.1±1.91		0.003
1 week	19.21±2.31		18.66±1.66		0.294
3 months	18.98±2.06		18.93±1.85		0.921

Table 3: Comparison of EDV between two groups and within groups over a period of 3 months.

EDV	Side				P value (between two groups)
	Operated		Contralateral		
	Mean ± SD	P value	Mean ± SD	P value	
Preop	6.66±3.27	0.124	6.24±2.54	0.123	0.580
24 hours	6.55±3.07		6.25±2.53		0.682
1 week	6.72±2.5		6.78±2.57		0.921
3 months	7.78±1.09		7.68±0.98		0.719

Table 4: Comparison of RI between two groups and within groups over a period of 3 months.

RI	Side				P value (between two groups)
	Operated		Contralateral		
	Mean ± SD	P value	Mean ± SD	P value	
Preop	0.71±0.27	0.068	0.70±0.23	0.061	0.861
24 hours	0.69±0.23		0.68±0.21		0.856
1 week	0.67±0.22		0.67±0.21		0.957
3 months	0.62±0.19		0.62±0.17		0.972

Capsular artery

Mean PSV of capsular artery at preop-16.28 $\pm$ 2.88, at 24 hours it moved upwards to 17.12 $\pm$ 2.51, at 1 week it declined to 17.10 $\pm$ 1.74 and at 3 months it further declined to 16.97 $\pm$ 1.33. It was observed that there was no significant difference in mean PSV within operated group at various time points (p=0.122). Mean EDV of the capsular artery at preop was 6.60 $\pm$ 2.86, at 24 hours it moved upwards to 6.80 $\pm$ 3.32, at 1 week it further

increased to 6.99 $\pm$ 2.70 and at 3 months it further increased to 7.83 $\pm$ 0.98. It was observed that there was no significant difference in mean EDV within operated group at various time points (p=0.147). Mean RI of capsular artery at preop was 0.64 $\pm$ 0.25, at 24 hours it remained stagnant at 0.65 $\pm$ 0.25, at 1 week it decreased to 0.62 $\pm$ 0.24 and at 3 months it further decreased to 0.56 $\pm$ 0.19. It was observed that there was no significant difference in mean RI within operated group at various time points (p=0.135).

Table 5: Comparison of PSV between two groups and within groups over a period of 3 months.

PSV	Side				P value (between two groups)
	Operated		Contralateral		
	Mean ± SD	P value	Mean ± SD	P value	
Preop	16.28±2.88	0.122	16.37±2.75	0.316	0.898
24 hours	17.12±2.51		16.27±2.36		0.185
1 week	17.10±1.74		16.86±1.72		0.593
3 months	16.97±1.33		16.62±1.60		0.365

Table 6: Comparison of EDV between two groups and within groups over a period of 3 months.

EDV	Side				P value (between two groups)
	Operated		Contralateral		
	Mean ± SD	P value	Mean ± SD	P value	
Preop	6.60±2.86	0.147	6.51±2.84	0.008	0.903
24 hours	6.80±3.32		6.35±3.06		0.588
1 week	6.99±2.70		7.02±2.58		0.965
3 months	7.83±0.98		7.76±0.89		0.774

Table 7: Comparison of RI between two groups and within the groups over a period of 3 months.

RI	Side				P value (between two groups)
	Operated		Contralateral		
	Mean ± SD	P value	Mean ± SD	P value	
Preop	0.64±0.25	0.135	0.66±0.24	0.007	0.825
24 hours	0.64±0.25		0.65±0.24		0.860
1 week	0.62±0.24		0.63±0.23		0.829
3 months	0.56±0.19		0.56±0.19		0.984

Intratesticular artery

Mean PSV of intratesticular artery at preop was 14.78±2.83, at 24 hours it moved upwards to 15.48±3.20, at 1 week it declined to 15.41±2.80 and at 3 months it further declined to 15.37±2.43. It was observed that there was no significant difference in mean PSV within the operated group at various time points (p=0.232).

Mean EDV of intratesticular artery at preop was 5.64±2.17, at 24 hours it moved upwards to 5.71±2.37, at 1 week it decreased to 5.60±2.08 and at three months it

increased significantly to 6.36±0.52. It was observed that there was no significant difference in mean EDV within the operated group at various time points (p=0.196).

Mean RI of intratesticular artery at preop was 0.70±0.28, at 24 hours it remained stagnant at 0.70±0.23, at 1 week it decreased to 0.68±0.22 and at 3 months it further decreased to 0.61±0.22.

It was observed that there was no significant difference in mean RI within the operated group at various time points (p=0.114).

Table 8: Comparison of PSV between two groups and within the groups over a period of 3 months.

PSV	Side				P value (between two groups)
	Operated		Contralateral		
	Mean ± SD	P value	Mean ± SD	P value	
Preop	14.78±2.83	0.232	15.06±2.6	0.099	0.659
24 hours	15.48±3.2		14.46±3.23		0.224
1 week	15.41±2.8		15.13±2.52		0.692
3 months	15.37±2.43		15.41±2.21		0.951

Table 9: Comparison of EDV between two groups and within groups over a period of 3 months.

EDV	Side				P value (between two groups)
	Operated		Contralateral		
	Mean ± SD	P value	Mean ± SD	P value	
Preop	5.64±2.17	0.196	5.4±2.26	0.017	0.685
24 hours	5.71±2.37		5.13±2.23		0.335
1 week	5.6±2.08		5.64±2.09		0.941
3 months	6.36±0.52		6.39±0.42		0.827

Table 10: Comparison of RI between two groups and within groups over a period of 3 months.

RI	Side				P value (between two groups)
	Operated		Contralateral		
	Mean ± SD	P value	Mean ± SD	P value	
Preop	0.70±0.28	0.114	0.70±0.22	0.012	0.909
24 hours	0.70±0.23		0.72±0.22		0.777
1 week	0.68±0.22		0.68±0.22		0.991
3 months	0.61±0.22		0.60±0.19		0.934

DISCUSSION**Number of patients**

Present study included thirty patients with uncomplicated inguinal hernia. There were other studies with enrolled

patients ranging from 26 to 64.

There were 39 patients present in Edgar et al, 64 in Suculla et al, 40 in Sinan Hatipoglu et al, 32 in Neset et al, 26 in Dilek et al and 50 in the Prabhunath et al study.^{11,13-16}

Mean age

All the patients enrolled in this study were above 18 years of age. Mean age of the patients in current study was 46.10 years. The highest incidence of inguinal hernia (43.3%) was found between the age group 41 to 60 years. 49.6 year was the mean age of patients in the series published by Edgar et al and Dilek et al reported mean age as 46.7 years (TEP group) and 54.2 years (LHR group). 10,15 Similarly, 54.2 years (TEP group) and 52.2 years (LHR group) by Neset et al and 22 years (LG group) and 23 years (MPG group) by Suculla et al and Prabhunath et al reported mean age as 43.58 years.^{12,14}

Testicular perfusion according type of hernia and duration of hernia

No statistically significant difference was found between Doppler study parameters, duration of hernia and types of hernia in current study population. Similar studies were not found on extensive literature search comparing studied Doppler parameters with different types of hernia.

Testicular perfusion: systolic velocity and diastolic velocity

The arterial flow of the testicles is fundamental for maintaining testicular volume and function. The testicular artery is the principal source of nutrition for testicles, and its diameter may reach 1.5 mm. The diastolic velocity is cited as an important parameter for diagnosing severe arterial occlusions. Stenosis in which the vessel diameter is reduced by more than 70%, diastolic velocity increases, but with total occlusion the velocity drops to zero.¹⁶⁻¹⁸

In present study there was decrease in mean systolic velocity on post-op day 90 (18.98) compared to recorded pre-op value. Similar results of decrease in mean values of SV observed by Edgar et al, Dilek et al and Prabhunath et al on post-op day 90 (18.58,17.38 and 19.38). However, difference was not statistically significant in either of studies ($p=0.003$ of current study).^{11,15}

The mean values of diastolic velocity increased on postoperative day 90 (7.78) compared to pre-operative (6.66) value. In other studies there was decrease in post-operative mean value was reported by Edgar et al (3.28) and Prabhunath et al (7.14) however study by Dilek et al reported increased on the 90 days value (5.71). The difference in values in all these studies were not statistically significant ($p=0.124$ of current study).^{11,15}

Resistance index

Elevated resistance index is important marker of ischemia in acute setting is important parameter for evaluating arterial stenosis. There indices are more representative for small-caliber vessels, since its calculation encompasses other values from Doppler wave.

In present study, mean value of resistance index preoperatively was 0.71, decreased on post-op day 90 on (0.62). In other studies, there was increased in mean values of RI on post-op day 90th. However, these differences not statistically significant in either of studies. These differences not statistically significant.^{11,12,14,15,19}

Limitations

The study has some limitations, as it is prospective with drawbacks to the study as small sample size, short study duration of a year and unsatisfactory patient compliance for follow up.

CONCLUSION

The aim of all inguinal hernia repair techniques is to close the internal ring with a suture or a biomaterial such as polypropylene mesh. The matter has been raised whether or not the spermatic cord structures are compromised with these techniques. The spermatic cord structures may be exposed to invasive surgical intervention during inguinal hernia reconstruction. Surgical dissection, division, or mechanical trauma to the spermatic artery and veins account for serious trophic changes in the testis. There are many applications to protect the testicular perfusion. Surgeons should be trained that all inguinal hernias should be repaired at diagnosis, even if asymptomatic. General opinion is that neither open nor laparoscopic hernioplasty techniques do not affect the testicular circulation. It is clear that fine surgical dissection and reconstruction, doing respect for anatomy and using proper prosthetic material could be obtain the best results.

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REFERENCES

1. Abramson I, Gofin J, Hopp C, Makler A, Epstein LM. The epidemiology of inguinal hernia. A survey in western Jerusalem. J Epidemiol Commu Hlth. 1978;32(1):59-67.
2. Primates P, Goldaere MJ. Inguinal hernia repair: incidence of elective and emergency surgery, readmission and mortality. Int J Epidemiol 1996;25(4):835-9.
3. Fitzgibbons RJ, Giobbie HA, Gibbs JO, Dunlop DD, Reda DJ, McCarthy M et al. Watchful waiting vs. repair of inguinal hernia in minimally symptomatic men: a randomized clinical trial. JAMA 2006;295(3):285-92.

4. Amid PK. Lichtenstein open tension-free hernioplasty. Woodbury, CT: Cine-Med. 1997;100:187-90.
5. Usher FC, Hill JR, Ochsner JL. Hernia repair with Marlex mesh: a comparison of techniques. *Surgery* 1959;46:718-24.
6. Fong MD, Wantz GE. Prevention of ischemic orchitis during inguinal hernioplasty. *Surg Gynecol Obstet* 1992;174(5):399-404.
7. Reid I, Devlin HB. Testicular atrophy as a consequence of inguinal hernia repair. *Br J Surg.* 1994;81(1):91-6.
8. Klinge U, Klosterhallen B, Muller M. Foreign body reaction to meshes used for the repair of abdominal wall hernias. *Fur J Surg.* 1999;165(7):665-9.
9. Middleton WD, Thorne D, Nielson GL. Colour Doppler ultrasound of the normal testis. *AJR Am J Roentgenol.* 1989;152(2):293-7.
10. Ger R. The laparoscopic management of gionin hernias. *Contempt Surg.* 1991;39(1):15-9.
11. Lima Neto EV, Goldenberg A, Jucá MJ. Prospective study on the effects of a polypropylene prosthesis on testicular volume and arterial flow in patients undergoing surgical correction for inguinal hernia. *Acta Cirurgica Brasileira.* 2007;22(4):266-71.
12. Sucullu I, Filiz AI, Sen B, Ozdemir Y, Yucel E, Sinan H et al. The effects of inguinal hernia repair on testicular function in young adults: a prospective randomized study. *Hernia.* 2010;14(2):165-9.
13. Hatipoğlu S, Turhan AN, Kapan S, Gönenç M, Palabıyık F, Aygün E. The comparison of the effects of the anterior preperitoneal mesh repair and Lichtenstein procedure on testicular blood flow and volume in patients with inguinal hernias. *Med J Bakırköy.* 2010;6:14-9.
14. Koksall N, Altinli E, Sumer A, Celik A, Onur E, Demir K et al. Impact of herniorrhaphy technique on testicular perfusion: results of a prospective study. *Surg Laparosc Endosco Percut Tech.* 2010;20(3):186-9.
15. Nath P, Dey S, Karim T, Jain A, Katiyar VK, Patel G. Study of testicular perfusion after Lichtenstein hernioplasty in uncomplicated inguinal hernia. *Int Surg J.* 2018;5:1104-10.
16. Skandalakis JE, Skandalakis LJ, Colborn GL. Testicular atrophy and neuropathy in herniorrhaphy. *Am Surg.* 1996;62(9):775-82.
17. Uzzo RG, Lemack GE, Morrissey KP, Goldstein M. Effects of mesh bioprosthesis on the spermatic cord structures: a preliminary report in a canine model. *J Urol.* 1999;161(4):1344-49.
18. Zwiebel WJ, Pellerito JS. Conceitos básicos da análise do espectro de frequência Doppler e exame ultra-sônico do fluxo sanguíneo. In: Zwiebel WJ, Pellerito JS. *Introdução a ultra-sonografia vascular.* 5th Ed. São Paulo: Elsevier. 2005:45-64.
19. Fernandez EJM, Mora ODP, Tamayo YG, Becomo AGL, Aladro F. Testicular perfusion in Lichtenstein hernioplasty. *Revista Cubana de Cirugia.* 2016;55(1):12-20.

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