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Testicular Perfusion and Semen Parameters after Lichtenstein Meshplasty: A Prospective Observational Study

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Abstract: ***Background**: Lichtenstein tension-free mesh repair is widely used for open inguinal hernia surgery. Because the mesh and operative dissection lie close to the spermatic cord, concern persists regarding possible effects on testicular blood flow and reproductive parameters. **Methods**: This prospective observational study included 100 adult men undergoing elective Lichtenstein meshplasty for uncomplicated inguinal hernia. Testicular perfusion was evaluated using Doppler ultrasonography before surgery and during postoperative follow-up, with measurement of peak systolic velocity (PSV), end-diastolic velocity (EDV), and resistive index (RI). Semen analysis included sperm count, progressive motility, and abnormal morphology. Assessments were reported immediately after surgery and at 3, 6, and 12 months. Paired comparisons were performed using the Wilcoxon signed-rank test. **Results**: The mean age was 44.74 ± 13.78 years (range 19-78 years). Mean PSV was 10.96 ± 10.61 cm/s preoperatively and 9.96 ± 3.25, 9.96 ± 3.25, 9.86 ± 3.34, and 9.93 ± 3.31 cm/s at the postoperative, 3-month, 6-month, and 12-month assessments, respectively; none of the paired differences was significant (p=0.317, 0.317, 0.180, and 0.180). Mean EDV remained approximately 3.61-3.62 cm/s throughout follow-up (all p>0.05), while RI remained 0.53 ± 0.11 at every time point. Mean sperm count changed from 26.47 ± 8.00 to 26.57 ± 8.09 million/mL and remained stable through 12 months (p=0.703 for each comparison). Progressive motility and abnormal morphology also remained unchanged. **Conclusion**: In men with uncomplicated inguinal hernia, Lichtenstein meshplasty was not associated with a statistically significant deterioration in Doppler-based testicular perfusion or the measured semen parameters during 12 months of follow-up. Careful cord handling and non-constrictive mesh placement remain essential.*

Keywords: inguinal hernia; Lichtenstein meshplasty; testicular perfusion; Doppler ultrasonography; semen analysis; resistive index

1. Introduction

Inguinal hernia repair is among the most frequently performed operations in general surgery. The Lichtenstein tension-free technique remains a standard open repair because it is technically reproducible, accommodates a broad range of patients, and is associated with low recurrence when performed correctly.[1,2]

The spermatic cord is routinely mobilized during open repair, and the prosthetic mesh is positioned in close proximity to the testicular vessels, vas deferens, and pampiniform plexus. Traction, edema, venous congestion, excessive narrowing of the reconstructed deep ring, direct vascular injury, or later mesh-related fibrosis could theoretically alter testicular perfusion.[3] Although ischemic orchitis and testicular atrophy are uncommon, their functional and medicolegal implications make objective evaluation important.

Colour Doppler ultrasonography permits non-invasive, repeatable assessment of testicular arterial haemodynamics through PSV, EDV, and RI. Previous studies have generally been reassuring, although transient postoperative changes and methodological heterogeneity have been reported.

[49]The present study therefore assessed serial Doppler perfusion indices together with semen parameters for one year after Lichtenstein meshplasty.

2. Aim And Objectives

Aim

To evaluate alterations in testicular perfusion following Lichtenstein meshplasty for inguinal hernia repair.

Objectives:

- To compare testicular Doppler parameters before surgery and during postoperative follow-up.
- To assess postoperative changes in sperm count, progressive motility, and morphology.
- To determine whether any measured alteration persisted through 12 months.

3. Materials and Methods

Study design and setting

A prospective observational study was undertaken in the Department of General Surgery at a tertiary care teaching hospital in Latur. The available thesis records identify a cohort of 100 adult male patients undergoing elective Lichtenstein mesh repair for uncomplicated inguinal hernia. The exact study period and the detailed eligibility criteria should be inserted from the approved protocol because the first page of the Materials and Methods section was absent from the supplied PDF.

Preoperative assessment

Baseline demographic and clinical information was

recorded. Before surgery, testicular perfusion was assessed by Doppler ultrasonography and a baseline semen analysis was obtained.

Operative technique

All patients underwent open Lichtenstein tension-free meshplasty. The operative principle was careful identification and mobilization of the spermatic cord, treatment of the hernia sac, placement of a flat polypropylene mesh over the posterior wall, and reconstruction of the deep ring without constricting the cord. Detailed operative notes were reviewed for documented testicular or cord injury.

Outcome assessment

Doppler measurements included PSV, EDV, and RI. The same parameters were recorded postoperatively and at 3, 6, and 12 months. Semen analysis included sperm count (million/mL), rapid progressive motility (%), and abnormal morphology (%). Clinical follow-up included assessment for postoperative infertility and perfusion-related complications.

Statistical analysis

Continuous variables were summarized using mean, standard deviation, median, minimum, and maximum; categorical variables were presented as frequencies and percentages. The source analysis reported non-normal distribution of PSV and used the Wilcoxon signed-rank test for paired comparisons between baseline and each postoperative time point. A two-sided p value below 0.05 was considered statistically significant.

Ethical Considerations

The study was conducted after approval by the Institutional Review Board. Written informed consent was obtained, confidentiality was maintained, and access to study data was restricted to authorized personnel. The ethics approval number should be inserted before submission.

4. Results

All 100 participants were men. The mean age was 44.74 ± 13.78 years, with an age range of 19-78 years. The largest age group was 40-49 years (29%), followed by 30-39 years (24%) and 50-59 years (21%).

Table 1: Age distribution of the study population (n=100)

Age group (years)	Number	Percentage
19-29	11	11.0
30-39	24	24.0
40-49	29	29.0
50-59	21	21.0
60-69	11	11.0
70-79	4	4.0
Total	100	100.0

Doppler parameters remained stable across follow-up. Mean PSV was numerically lower after surgery, but none of the paired comparisons reached statistical significance. EDV remained between 3.61 and 3.62 cm/s, and RI was unchanged at 0.53 ± 0.11.

Table 2: Serial Doppler assessment of testicular perfusion

Parame ter	Preoperative	Postoperative	3 months	6 months	12 months
PSV, cm/s	10.96 ± 10.61	9.96 ± 3.25	9.96 ± 3.25	9.86 ± 3.34	9.93 ± 3.31
EDV, cm/s	3.61 ± 1.09	3.61 ± 1.09	3.61 ± 1.09	3.62 ± 1.08	3.61 ± 1.09
RI	0.53 ± 0.11	0.53 ± 0.11	0.53 ± 0.11	0.53 ± 0.11	0.53 ± 0.11

Values are mean ± standard deviation. PSV: peak systolic velocity; EDV: end-diastolic velocity; RI: resistive index.

Table 3: Wilcoxon signed-rank comparisons with preoperative Doppler values

Parameter	Postoperative	3 months	6 months	12 months
PSV p value	0.317	0.317	0.180	0.180
EDV p value	1.000	1.000	0.844	1.000

Semen parameters were similarly stable. Mean sperm count increased minimally from 26.47± 8.00 million/mL to 26.57 ± 8.09 million/mL and remained at that level at every postoperative assessment. The paired sperm-count comparisons were not significant (p=0.703 at each time point). Progressive motility and abnormal morphology were identical across all recorded assessments.

Table 4: Serial semen parameters before and after Lichtenstein meshplasty

Parameter	Preoperative	Postoperative	3 months	6 months	12 months
Sperm count, million/ mL	26.47 ± 8.00	26.57 ± 8.09	26.57± 8.09	26.57 ± 8.09	26.57 ± 8.09
Rapid progressive motility, %	40.29 ± 8.02	40.29 ± 8.02	40.29 ± 8.02	40.29 ± 8.02	40.29 ± 8.02
Abnormal morphology, %	20.00 ± 0.00	20.00 ± 0.00	20.00 ± 0.00	20.00 ± 0.00	20.00 ± 0.00

Values are mean ± standard deviation. For sperm count, p=0.703 for each postoperative comparison with baseline. Inferential p values for motility and morphology were not reported in the source thesis.

5. Discussion

The present study found no statistically significant deterioration in testicular perfusion or the measured semen parameters during the first postoperative year after Lichtenstein meshplasty. PSV, EDV, and RI remained close to their baseline values, while sperm count, progressive motility, and morphology were stable. These findings support the vascular safety of properly performed Lichtenstein repair in uncomplicated inguinal hernia.

Preservation of PSV suggests that arterial inflow was not materially compromised. Aguilar-García et al. reported no significant intratesticular perfusion difference after unilateral Lichtenstein repair, and Bulus et al. similarly found no adverse effect on testicular arterial perfusion or sexual-

function measures.[4,8] Koksal et al. observed no significant difference in testicular perfusion between Lichtenstein and totally extraperitoneal repair during follow-up.[5]

EDV and RI also remained stable, indicating no sustained increase in downstream resistance or venous-congestion-related impairment. These findings are consistent with Lima Neto et al., who found no significant change in testicular volume or arterial flow after polypropylene mesh repair, and with Gürbulak et al., who reported comparable Doppler outcomes after open and laparoscopic repair.[6,9]

The stable semen profile is clinically relevant because perfusion changes are important principally when they translate into impaired testicular function. The minor numerical increase in sperm count was not statistically significant, and motility and morphology were unchanged. Previous prospective studies have likewise generally failed to demonstrate clinically important long-term deterioration in testicular function after uncomplicated mesh repair.[4,10]

The reassuring results should not be interpreted as evidence that vascular complications are impossible. The mechanism of injury is more likely to involve operative trauma, excessive traction, constriction at the deep ring, thrombosis, or severe inflammatory response than the mere presence of mesh. Meticulous dissection, preservation of collateral arterial supply, avoidance of unnecessary skeletonization of the cord, and tension-free mesh placement remain central to prevention.

An important data-quality issue should be verified before journal submission: the source table reports a preoperative PSV maximum of 111 cm/s, producing a disproportionately large baseline standard deviation. Because the remaining reported PSV values were between 2 and 15 cm/s, this extreme value may represent a genuine outlier or a transcription error. The original Doppler record and master chart should be checked without altering the dataset unless a documented correction is available.

6. Limitations

- The study was conducted at a single centre and included only 100 patients, limiting external generalizability.
- Only uncomplicated elective hernias were represented; the results may not apply to recurrent, incarcerated, obstructed, or large inguinoscrotal hernias.
- Doppler ultrasonography is operator-dependent, and minor changes in probe position or sampling site may influence PSV, EDV, and RI.
- There was no non-mesh or laparoscopic control group.
- Follow-up was limited to 12 months and may not capture very late effects of fibrosis or mesh contraction.
- Serum testosterone, FSH, inhibin B, testicular volume, and formal fertility outcomes were not assessed.

The supplied thesis PDF omitted the first page of the Materials and Methods section; the study period, full eligibility criteria, Doppler equipment details, and ethics approval number require insertion from the approved protocol.

7. Conclusion

Lichtenstein meshplasty for uncomplicated inguinal hernia was not associated with a statistically significant adverse change in testicular PSV, EDV, RI, sperm count, progressive motility, or morphology during 12 months of follow-up. The procedure appears safe with respect to the measured testicular vascular and reproductive parameters when meticulous cord handling and non-constrictive mesh placement are maintained. Larger multicentre controlled studies with standardized Doppler protocols and longer follow-up are warranted.

Declarations

Ethics approval: Approved by the Institutional Review Board; approval number and date to be inserted.

Consent to participate: Written informed consent was obtained from all participants.

Funding: No external funding was reported. **Conflict of interest:** The authors declare no conflict of interest.

Data availability: The data supporting the findings are contained in the study master chart and may be made available by the corresponding author subject to institutional approval.

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