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AN ANALYSIS COMPARING THE MODIFIED LICHTENSTEIN APPROACH WITH THE LICHTENSTEIN PROCEDURE FOR THE TREATMENT OF THE INGUINAL HERNIAS

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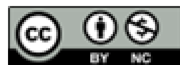

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ABSTRACT

Background: Inguinal hernia repair is one of the most frequently performed operations in general surgery. The Lichtenstein tension-free mesh repair is widely accepted as the standard open technique; however, postoperative pain and early complications continue to influence patient recovery and duration of hospital stay. Modifications to the conventional technique have been proposed to improve postoperative outcomes. The objective is to compare Modified Lichtenstein Repair with conventional Lichtenstein Repair in terms of postoperative pain, early complications, operative duration, and hospital stay in patients undergoing open inguinal hernia repair. **Materials and Methods:** This prospective comparative study included 106 patients with unilateral inguinal hernia, allocated equally into two groups: Modified Lichtenstein Repair (n = 53) and conventional Lichtenstein Repair (n = 53). Baseline demographic characteristics were comparable. Operative duration was recorded. Postoperative pain was assessed using the Visual Analogue Scale at 6, 24, and 48 hours. Postoperative complications including orchitis, seroma, hematoma, surgical site infection, and testicular atrophy were documented. Duration of hospital stay was analyzed. Statistical analysis was performed using appropriate tests, with $p < 0.05$ considered significant. **Result:** The mean age was comparable between the Modified Lichtenstein and conventional Lichtenstein groups (44.6 ± 6.8 vs 45.2 ± 7.5 years; p = 0.68). The mean duration of surgery was slightly longer in the Modified Lichtenstein group (48.2 ± 6.9 vs 45.6 ± 7.4 minutes; p = 0.04). Postoperative pain scores were significantly lower in the Modified Lichtenstein group at 6 hours (4.2 ± 1.1 vs 5.6 ± 1.3), 24 hours (3.1 ± 1.0 vs 4.5 ± 1.2), and 48 hours (2.1 ± 0.9 vs 3.4 ± 1.1) ($p < 0.001$ at all intervals). The incidence of postoperative orchitis, seroma, and hematoma was significantly lower in the Modified Lichtenstein group. Surgical site infection and testicular atrophy rates were comparable between the groups. Overall postoperative complications were significantly reduced in the Modified Lichtenstein group (26.4% vs 71.7%; $p < 0.001$), and hospital stay was significantly shorter. **Conclusion:** Modified Lichtenstein Repair is a safe and effective refinement of conventional Lichtenstein Repair, providing superior postoperative pain control, reduced early complication rates, and shorter hospital stay, despite a marginal increase in operative time. The technique may be preferentially adopted to enhance early postoperative recovery following open inguinal hernia repair.

INTRODUCTION

Inguinal hernia is one of the most commonly encountered conditions in general surgical practice and accounts for a substantial proportion of elective surgical procedures worldwide. Large epidemiological studies have demonstrated that inguinal hernia repair remains among the most frequently performed operations, with a significant lifetime risk, particularly in adult males.[1,2] The condition arises due to a complex interplay of

anatomical weakness, degeneration of the transversalis fascia, and increased intra-abdominal pressure, leading to protrusion of abdominal contents through the inguinal canal.[3,4]

From an anatomical and pathophysiological perspective, the integrity of the myopectineal orifice plays a central role in the development of inguinal hernias. Classical descriptions by Fruchaud and subsequent anatomical studies have emphasized the importance of fascial attenuation and collagen imbalance in hernia formation.[5,6] These observations have shaped modern surgical approaches, shifting the emphasis from tissue tension repairs to reinforcement of the weakened posterior wall using prosthetic materials.

The advent of tension-free mesh repair represented a major milestone in inguinal hernia surgery. The Lichtenstein tension-free hernioplasty, first described in the late 1980s, gained widespread acceptance due to its simplicity, reproducibility, and low recurrence rates.[7,8] Subsequent clinical trials and long-term outcome studies confirmed the superiority of meshbased repairs over traditional tissue repairs, leading to the endorsement of the Lichtenstein technique as the standard open method in international and European hernia guidelines.[9,10] As a result, Lichtenstein repair continues to be widely practiced, particularly in tertiary care centers and resource-limited settings.

Despite its effectiveness in reducing recurrence, postoperative morbidity following

Lichtenstein repair remains a clinical concern. Early postoperative complications such as pain, orchitis, seroma, hematoma, and surgical site infection may adversely affect patient comfort, prolong hospital stay, and delay return to normal activities.[11] Postoperative pain, in particular, has been identified as a significant determinant of patient satisfaction and functional recovery and has also been implicated in the development of chronic groin pain after hernia repair.[12,13] Factors contributing to postoperative pain include the extent of tissue dissection, handling of inguinal nerves, mesh fixation methods, and inflammatory response to the prosthetic material.[14]

In an effort to improve postoperative outcomes, various modifications of the standard Lichtenstein technique have been proposed. These modifications aim to optimize mesh placement, reinforce the medial compartment of the myopectineal orifice, and minimize unnecessary manipulation of the spermatic cord and surrounding neurovascular structures.[15,16] Preliminary studies have suggested that such technical refinements may reduce postoperative pain and early complications without compromising the fundamental principles of tension-free repair.[17] However, comparative evidence evaluating the clinical benefits of modified Lichtenstein techniques over the conventional approach remains limited, particularly in the context of prospective studies.

The present study was therefore undertaken to compare Modified Lichtenstein Repair with conventional Lichtenstein Repair in patients undergoing open inguinal hernia surgery. The primary objective was to evaluate postoperative pain and early complication rates, while secondary objectives included assessment of operative duration and hospital stay. By employing a prospective comparative design and standardized outcome assessment, this study seeks to provide evidence that may assist surgeons in selecting techniques that optimize postoperative recovery without increasing operative morbidity.

MATERIALS AND METHODS

Study Design and Setting: This prospective comparative study was conducted in the Department of General Surgery at a tertiary care teaching hospital in Puducherry over the study period approved by the Institutional Ethics Committee. The study was performed in accordance with ethical principles outlined in the Declaration of Helsinki, and written informed consent was obtained from all participants prior to enrolment.

Study Population: Patients diagnosed with unilateral inguinal hernia and planned for elective open mesh repair were assessed for eligibility. Adult patients aged between 18 and 65 years with primary, reducible inguinal hernia were included in the study. Patients with recurrent hernia, bilateral hernia, complicated hernia (irreducible, obstructed, or strangulated), those unfit for surgery, or those unwilling to participate were excluded.

Sample Size: The sample size was calculated based on a previous comparative study by Hosni MK et al.,[17] considering postoperative outcomes between Modified Lichtenstein Repair and conventional Lichtenstein Repair. A total of 106 patients were included in the study, with 53 patients allocated to each group.

Group Allocation

Eligible patients were allocated into two equal groups:

- **Group A:** Modified Lichtenstein Repair (n = 53)
- **Group B:** Conventional Lichtenstein Repair (n = 53)

Both groups were comparable with respect to baseline demographic characteristics.

Preoperative Assessment: All patients underwent a standardized preoperative evaluation, including detailed history, clinical examination, and routine laboratory investigations. Pre-anesthetic evaluation and fitness for surgery were obtained. Prophylactic antibiotics were administered as per institutional protocol.

Surgical Technique: All surgeries were performed under appropriate anesthesia by experienced surgeons. In the conventional Lichtenstein Repair group, a standard tension-free mesh hernioplasty was performed using a polypropylene mesh placed over the posterior wall of the inguinal canal. In the Modified Lichtenstein Repair group, modifications were applied to the standard technique with emphasis

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on optimal mesh positioning and reinforcement of the medial compartment, while minimizing unnecessary handling of the spermatic cord structures. The fundamental principles of tension-free mesh placement were maintained in both techniques.
The duration of surgery was recorded from skin incision to skin closure.

Postoperative Management: Postoperatively, all patients received standardized analgesia and postoperative care as per departmental protocol. Patients were monitored for intraoperative and postoperative complications.

Outcome Measures: Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 6 hours, 24 hours, and 48 hours following surgery. Postoperative complications including orchitis, seroma, hematoma, surgical site infection, and testicular atrophy were documented. Overall postoperative complications were recorded as a composite outcome. Duration of hospital stay was categorized as less than 3 days or 3 days or more.

Follow-up: Patients were followed up during the immediate postoperative period and subsequently on an outpatient basis for up to three months to assess recovery and detect any complications.

Statistical Analysis: Data were entered into a spreadsheet and analyzed using JASP 0.18.3.0 statistical software. Continuous variables were expressed as mean ± standard deviation and compared using the independent Student's t-test. Categorical variables were expressed as frequencies and percentages and compared using the Chi-square test. A p-value < 0.05 was considered statistically significant.

RESULTS

A total of 106 patients with inguinal hernia were included in the study, with 53 patients each undergoing Modified Lichtenstein Repair and conventional Lichtenstein Repair. The mean age was comparable between the Modified Lichtenstein and Lichtenstein groups (44.6 ± 6.8 vs 45.2 ± 7.5 years; p = 0.68). The mean duration of surgery was slightly longer in the Modified Lichtenstein group compared to the Lichtenstein group (48.2 ± 6.9 vs 45.6 ± 7.4 minutes), and this difference was statistically significant (p = 0.04) [Table 1]. Postoperative pain assessed using the Visual Analogue Scale was significantly lower in the Modified Lichtenstein group at all evaluated time intervals, with mean VAS scores at 6 hours (4.2 ± 1.1 vs 5.6 ± 1.3), 24 hours (3.1 ± 1.0 vs 4.5 ± 1.2), and 48 hours (2.1 ± 0.9 vs 3.4 ± 1.1), all showing p < 0.001 [Table 2]. Postoperative orchitis occurred in 4 patients (7.5%) in the Modified Lichtenstein group and 18 patients (34.0%) in the Lichtenstein group (p < 0.01), while seroma formation was observed in 4 (7.5%) and 15 (28.3%) patients respectively (p = 0.006), and hematoma in 3 (5.7%) and 11 (20.8%) patients respectively (p = 0.025) [Table 3]. Surgical site infection rates (15.1% vs 18.9%; p = 0.59) and testicular atrophy (1.9% vs 3.8%; p = 0.56) were comparable between the two groups. Overall postoperative complications were significantly lower in the Modified Lichtenstein group compared to the Lichtenstein group (26.4% vs 71.7%; p < 0.001) [Table 4]. The duration of hospital stay was also significantly shorter in the Modified Lichtenstein group, with 90.6% of patients discharged within 3 days compared to 26.4% in the Lichtenstein group (p < 0.001) [Table 5].

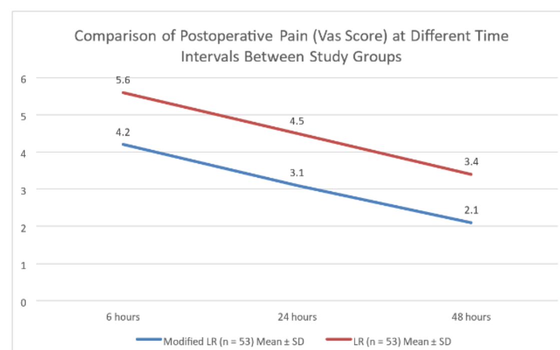

Figure 1: Comparison of Postoperative Pain (Vas Score) at Different Time Intervals Between Study Groups

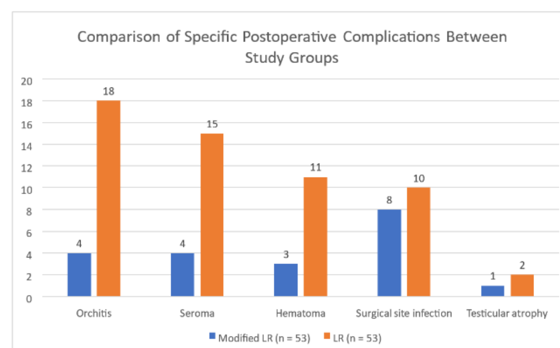

Figure 2: Comparison of Specific Postoperative Complications Between Study Groups.

Table 1: Baseline Characteristics and Operative Details of Study Participants

Variable	Modified Lichtenstein Repair (n = 53)	Lichtenstein Repair (n = 53)	p value
Age (years), Mean ± SD	44.6 ± 6.8	45.2 ± 7.5	0.68
Duration of surgery (minutes), Mean ± SD	48.2 ± 6.9	45.6 ± 7.4	0.04*

Table 2: Comparison of Postoperative Pain Scores (VAS) Between Study Groups

Postoperative time interval	Modified LR (Mean ± SD)	LR (Mean ± SD)	p value
6 hours	4.2 ± 1.1	5.6 ± 1.3	< 0.001*
24 hours	3.1 ± 1.0	4.5 ± 1.2	< 0.001*
48 hours	2.1 ± 0.9	3.4 ± 1.1	< 0.001*

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Table 3: Comparison of Specific Postoperative Complications Between Study Groups

Complication	Modified LR (n = 53)	LR (n = 53)	p value
Orchitis	4 (7.5%)	18 (34.0%)	< 0.01*
Seroma	4 (7.5%)	15 (28.3%)	0.006*
Hematoma	3 (5.7%)	11 (20.8%)	0.025*
Surgical site infection	8 (15.1%)	10 (18.9%)	0.59
Testicular atrophy	1 (1.9%)	2 (3.8%)	0.56

Table 4: Overall Postoperative Complications in the Study Groups

Overall complications	Modified LR (n = 53)	LR (n = 53)
Present	14 (26.4%)	38 (71.7%)
Absent	39 (73.6%)	15 (28.3%)
	p-value < 0.001	

Table 5: Comparison of Duration of Hospital Stay Between Study Groups

Duration of hospital stay	Modified LR (n = 53)	LR (n = 53)
< 3 days	48 (90.6%)	14 (26.4%)
≥ 3 days	5 (9.4%)	39 (73.6%)
	p-value < 0.001	

DISCUSSION

Open mesh repair remains the mainstay of inguinal hernia surgery in routine clinical practice, particularly in tertiary care and resource-limited settings where laparoscopic repair is not universally feasible. The Lichtenstein tension-free mesh repair has been widely accepted because of its simplicity, reproducibility, and consistently low recurrence rates reported across large clinical series and guideline documents.[7–10] Nevertheless, postoperative morbidity— especially pain and early complications—continues to influence patient recovery, duration of hospitalization, and overall satisfaction.[11,12] This has driven continued interest in refining the standard technique to improve short-term outcomes without increasing operative risk.

In the present study, the baseline demographic profile of patients was comparable between the Modified Lichtenstein Repair and conventional Lichtenstein Repair groups, with mean ages of 44.6 ± 6.8 years and 45.2 ± 7.5 years respectively (p = 0.68). This age distribution is consistent with epidemiological data reported in population-based studies, which demonstrate peak incidence of inguinal hernia repair in the fourth and fifth decades of life.[1,2] Similar age profiles have been reported in randomized and observational studies evaluating open mesh repair, supporting the external validity of the present cohort.[3,4]

The mean duration of surgery was slightly longer in the Modified Lichtenstein group (48.2 ± 6.9 minutes) compared to the conventional Lichtenstein group (45.6 ± 7.4 minutes), with this difference reaching statistical significance (p = 0.04). Although statistically significant, the absolute difference of approximately 2–3 minutes is clinically modest. Hosni et al. reported a similar finding in their randomized controlled study, where the modified technique required marginally longer operative time than standard Lichtenstein repair, without an increase in intraoperative complications or postoperative morbidity.[18] These findings suggest that the additional technical steps involved in optimizing mesh placement and reinforcing the medial compartment do not impose a clinically relevant operative burden.

Postoperative pain is a key determinant of early recovery following inguinal hernia repair and has been linked to delayed ambulation, prolonged hospital stay, and the development of chronic groin pain.[12–14] In the present study, postoperative pain assessed using the Visual Analogue Scale was consistently and significantly lower in the Modified Lichtenstein group at all evaluated time points. At 6 hours, mean VAS scores were 4.2 ± 1.1 in the Modified Lichtenstein group compared to 5.6 ± 1.3 in the conventional group; at 24 hours, 3.1 ± 1.0 versus 4.5 ± 1.2; and at 48 hours, 2.1 ± 0.9 versus 3.4 ± 1.1, with p < 0.001 at all intervals. Poobalan et al. demonstrated that higher early postoperative pain scores following open inguinal hernia repair are predictive of persistent pain and impaired quality of life.[12,13] The consistently lower pain scores observed in the present study therefore represent a clinically meaningful improvement rather than a transient postoperative effect.

Early postoperative complications were significantly less frequent in the Modified Lichtenstein group. Postoperative orchitis occurred in 7.5% of patients in the Modified Lichtenstein group compared to 34.0% in the conventional Lichtenstein group (p < 0.01). Orchitis has been attributed to excessive manipulation of the spermatic cord and impairment of venous drainage during hernia repair.[11] The markedly lower incidence observed with the modified technique supports the concept that refined dissection and minimized cord handling can substantially reduce this complication. Hosni et al. similarly reported lower rates of orchitis in patients undergoing modified Lichtenstein repair compared to the standard technique.[17]

Postoperative seroma formation was observed in 7.5% of patients in the Modified Lichtenstein group compared to 28.3% in the conventional group (p = 0.006). Seroma formation is thought to result from

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dead space creation and inflammatory response to mesh placement.[11] Studies emphasizing optimal mesh positioning and medial compartment reinforcement have reported reduced seroma rates, findings that align with the results of the present study.[15,16] Hematoma formation was also significantly lower in the Modified Lichtenstein group (5.7% vs 20.8%; $p = 0.025$), further supporting improved early postoperative outcomes with the modified approach.

In contrast, surgical site infection rates were comparable between the two groups (15.1% vs 18.9%; $p = 0.59$), consistent with infection rates reported in open mesh repair studies.[11,17] Testicular atrophy was rare, occurring in 1.9% of patients in the Modified Lichtenstein group and 3.8% in the conventional group, with no statistically significant difference. Previous studies have reported testicular atrophy rates below 5% following open inguinal hernia repair when meticulous surgical technique is employed,[18] which is in agreement with the present findings.

When individual complications were considered collectively, overall postoperative complications were significantly lower in the Modified Lichtenstein group (26.4%) compared to the conventional Lichtenstein group (71.7%) ($p < 0.001$). This substantial reduction in cumulative morbidity highlights the additive benefit of improvements across multiple postoperative endpoints rather than reliance on a single outcome. Reduced overall morbidity translated into a significantly shorter duration of hospital stay, with 90.6% of patients in the Modified Lichtenstein group discharged within three days compared to 26.4% in the conventional group ($p < 0.001$). Shorter hospital stay reflects improved pain control and fewer complications and has important implications for healthcare resource utilization, particularly in high-volume surgical units.[19,20]

CONCLUSION

The present study demonstrates that Modified Lichtenstein Repair offers clear advantages over conventional Lichtenstein Repair in the management of inguinal hernia. Despite a marginal increase in operative time, the modified technique resulted in significantly lower postoperative pain scores at all early time intervals, reduced incidence of orchitis, seroma, and hematoma, lower overall postoperative complication rates, and a significantly shorter duration of hospital stay. These benefits were achieved without an increase in surgical site infection or testicular atrophy, underscoring the safety of the procedure. Modified Lichtenstein Repair therefore represents a safe and effective refinement of standard open mesh repair and may be preferentially adopted in routine surgical practice to enhance early postoperative recovery.

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