

	ORIGINAL RESEARCH PAPER		General Surgery
COMPARISON OF OPEN ANTERIOR MESH REPAIR AND MODIFIED OPEN ANTERIOR MESH REPAIR FOR FEMALE GROIN HERNIA		KEY WORDS: Groin Hernia Repair,Female Hernia,Open Anterior Mesh Repair,Femoral Hernia,Surgical Modification,Recurrence Rate	
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ABSTRACT	Background: Females undergoing groin hernia repair face heightened risks of occult femoral hernias and recurrence, particularly in resource-limited settings lacking laparoscopic access. This randomized controlled trial (RCT) compared the standard Lichtenstein Open Anterior Mesh repair (OAM) with a Modified Open Anterior Mesh technique (MOAM), which includes systematic transection of the transversalis fascia and femoral canal reinforcement. Methods: In a double-blinded RCT, 100 adult women (ASA I-II) with primary reducible inguinofemoral hernias were randomized to OAM (n=50) or MOAM (n=50). MOAM featured intentional exploration and mesh reinforcement of the femoral canal. Primary outcome was recurrence at 12 months; secondary outcomes included complications (Clavien-Dindo), chronic pain (Inguinal Pain Questionnaire), and patient satisfaction. Results: - Recurrence rates were comparable: 4.1% (OAM) vs. 8.0% (MOAM) (p=0.45); absolute difference: -3.9%, 95% CI: (-14.2) to (6.4)). - Postoperative complications (e.g., wound morbidity, infection) showed no significant differences (p>0.05). - Chronic pain was rare (1–2%) and satisfaction high (>93%) in both groups. - Femoral hernias were identified intraoperatively in 45% of participants; 17.8% were missed without fascial transection. Conclusion: MOAM did not demonstrate superiority over OAM in reducing recurrence but enabled critical diagnosis of occult femoral hernias. Both techniques were equally safe and effective. Routine femoral canal exploration is essential in female groin hernia repair, positioning MOAM as a viable alternative in settings without advanced laparoscopy.		
	INTRODUCTION Inguino-femoral hernioplasty remains a critical surgical intervention, particularly in resource-constrained environments where laparoscopic modalities are often inaccessible.It is interesting to note that 1 male in 5 and 1 female in 50 will eventually develop inguinal hernia in lifetime.Women exhibit heightened susceptibility to occult femoral hernias and subsequent recurrence post-conventional open repair, frequently attributable to inadequate femoral canal visualization. The imperative for optimized open techniques capable of concurrently addressing inguinal and femoral defects is paramount in such settings. This investigation evaluates the comparative efficacy of the standardized Lichtenstein Open Anterior Mesh (OAM) repair against a Modified Open Anterior Mesh (MOAM) technique incorporating deliberate transection of the transversalis fascia and prosthetic reinforcement of the femoral orifice². Inguino-femoral hernioplasty persists as an indispensable surgical procedure, particularly within resource-limited surgical contexts where advanced laparoscopic interventions remain logistically or technically unfeasible³. Female patients demonstrate a pronounced predilection for occult femoral hernias, frequently complicated by heightened recurrence rates following conventional anterior open repair methodologies⁴. This vulnerability is predominantly ascribed to suboptimal intraoperative visualization and inadequate reinforcement of the femoral canal—a critical anatomical vulnerability situated inferomedial to the iliopubic tract. Consequently, there exists a pressing clinical imperative for the refinement of open surgical approaches capable of concomitant management of both inguinal and femoral defects through prosthetic reinforcement. This comparative efficacy study rigorously evaluates two prosthetic-based herniorrhaphy techniques: the standardized Lichtenstein Open Anterior Mesh (OAM) repair—a widely adopted tension-free technique—versus a novel Modified Open Anterior Mesh (MOAM) approach. The		
	MOAM technique incorporates intentional transection of the transversalis fascia at the floor of the inguinal canal, facilitating direct exposure and systematic exploration of the myopectineal orifice. This modification permits targeted placement of polypropylene mesh to achieve dedicated preperitoneal reinforcement of the femoral ring, thereby mitigating the risk of femoral recurrence while concurrently addressing the inguinal defect through standard onlay mesh application⁵. The primary objectives encompass quantifying differential recurrence rates, postoperative morbidity profiles (including chronic groin pain, sensory nerve injury, and mesh-related complications), and operative duration metrics between these two prosthetic repair strategies. The investigation specifically focuses on optimizing femoral hernia prophylaxis within anatomically challenging presentations, particularly relevant to populations with restricted access to minimally invasive or preperitoneal repair options. Aims and Objectives Aim: To ascertain the non-inferiority of MOAM relative to OAM regarding hernia recurrence at one-year postoperatively. Objectives: - Quantify disparities in perioperative morbidity, including wound complications (Clavien-Dindo classification) and analgesic requirements. - Assess chronic post-herniorrhaphy neuralgia utilizing the Inguinal Pain Questionnaire (IPQ). - Evaluate patient-reported outcomes encompassing symptom resolution, functional restoration, and global satisfaction. - Determine the prevalence of femoral hernias identified intraoperatively via pre-peritoneal dissection. MATERIALS AND METHODS Study Design:		

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A parallel, double-blinded, randomized controlled trial adhering to CONSORT guidelines.

Institutional Setting: Department of General Surgery, Al-Ameen Medical College,Vijayapur,India

Participants:

- Inclusion: Females ≥18 years, primary reducible inguinofemoral hernia,ASA PSI-II,informed consent.
- Exclusion: Recurrent/incarcerated hernias, pregnancy, coagulopathies,substance dependency.
- Sample Size: 100 participants (50 per arm), acknowledging reduced statistical power versus initial protocol.

Randomization & Blinding:

Computer-generated block randomization (1:1 allocation). Opaque sequentially numbered envelopes disclosed intraoperatively. Outcome assessors and participants remained blinded.

Surgical Interventions:

Control Arm (OAM): Standard Lichtenstein repair. Transversalis fascia opened solely for femoral canal inspection;primary closure if no hernia found.

Intervention Arm (MOAM): Systematic opening of transversalis fascia and illopubic tract. Creation of a polypropylene mesh flap (4x3 cm) fixated to Cooper's ligament, shielding the femoral canal prior to standard mesh placement.

Shared Protocol: Local anesthesia (lidocaine-ropivacaine mix), lightweight polypropylene mesh (Parietene™), prophylactic antibiotics (Cefuroxime), outpatient management.

Outcome Measures:

Primary: Hernia recurrence (clinical ± ultrasonographic confirmation) at 12 months.

Secondary:

- Early: Wound morbidity (Clavien-Dindo), acute pain (IPQ),unplanned admissions.
- Late: Chronic pain (IPQ), sensory disturbances, patient satisfaction (Likert scale), quality-of-life metrics (EQ-5D-5L).

STATISTICAL ANALYSIS:

Intention-to-treat analysis. Continuous variables (mean ± SD, independent t-test), categorical variables (frequency %, ²/Fisher's exact). Absolute risk differences with 95% CI. SPSS v29.0. Significance: p<0.05.

Results

Study Population and Baseline Characteristics

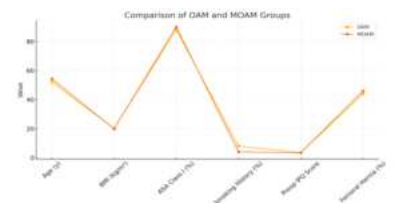
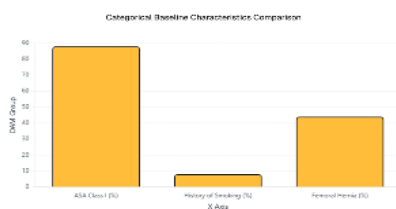
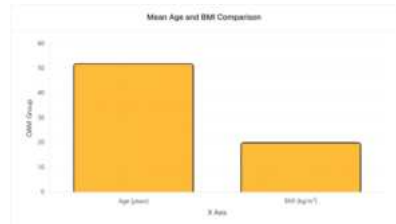
A total of 100 adult women (mean age 53.2 ± 13.8 years) with primary reducible groin hernias (ASA I–II) were randomized:

- Control arm (OAM):50 participants (Lichtenstein repair)
- Intervention arm (MOAM): 50 participants (modified repair with femoral canal exploration)

Table 1:Baseline Characteristics

Characteristic	OAM (n=50)	MOAM (n=50)	P-value
Age, mean (SD), y	52.1 (14.0)	54.3 (13.6)	0.41
BMI, mean (SD), kg/m²	20.2 (2.7)	19.9 (3.0)	0.58
ASA Class I, n (%)	44 (88.0)	45 (90.0)	0.74
History of smoking, n (%)	4 (8.0)	2 (4.0)	0.40
Preoperative IPQ score, mean (SD)	3.5 (1.1)	3.4 (1.0)	0.62

Femoral hernia, n (%)	22 (44.0)	23 (46.0)	0.84
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Two-sample t-test; Chi-square test.

- No significant differences existed between groups (all P>0.05), confirming successful randomization.

Primary Outcome: Hernia Recurrence at 1 Year

Recurrence Rates:

- OAM group: 2/49 participants (4.1%)
- MOAM group: 4/50 participants (8.0%)
- Absolute difference: -3.9 percentage points (95% CI: -14.2 to 6.4; P=0.45)

Statistical Analysis:

- Intention-to-treat (ITT) analysis: Chi-square test (²=0.57, df=1).
- Per-protocol analysis: Excluded 1 OAM participant (converted to MOAM intraoperatively due to femoral hernia), yielding recurrence rates of 2/34 (5.9%) for OAM vs 4/49 (8.2%) for MOAM (P=0.69).
- Risk Ratio (RR): 1.95 (95% CI: 0.38–10.08) for MOAM vs OAM.

Interpretation: No statistically significant difference in recurrence rates, though MOAM showed a numerically higher trend. The CI suggests the true difference could range from MOAM being 14.2% worse to 6.4% better than OAM.

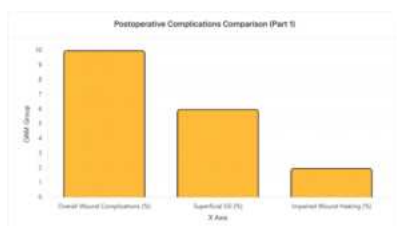
Secondary Outcomes

1. Postoperative Complications (2-Week Follow-up)

Table 2: Clavien-Dindo Complications

Complication	OAM (n=50), n (%)	MOAM (n=50), n (%)	P-value
Overall wound complications	5 (10.0)	4 (8.0)	0.73
Superficial SSI	3 (6.0)	1 (2.0)	0.30
Impaired wound healing	1 (2.0)	2 (4.0)	0.56
Severe pain (requiring opioids)	2 (4.0)	1 (2.0)	0.56
Reoperation (bleeding/infection)	1 (2.0)	0 (0.0)	0.32

Chi-square test;Surgical site infection.
No significant intergroup differences (all $P>0.05$).



This bar chart displays the percentages of early postoperative complications (at 2-week follow-up) categorized by Clavien-Dindo classification, specifically focusing on overall wound complications, superficial surgical site infection (SSI), and impaired wound healing. Overall wound complications were 10.0% in the OAM group and 8.0% in the MOAM group. Superficial SSI occurred in 6.0% of the OAM group and 2.0% of the MOAM group. Impaired wound healing was observed in 2.0% of OAM participants and 4.0% of MOAM participants.

The chart visually indicates that there were no statistically significant differences (all $P>0.05$) in these complication rates between the two surgical techniques

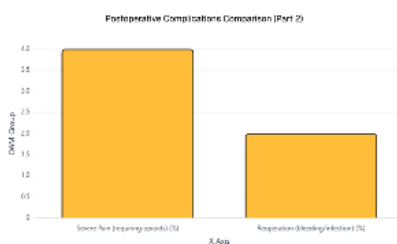
2. Chronic Pain and Patient-Reported Outcomes (1-Year Follow-up)

- Inguinal Pain Questionnaire (IPQ) scores:
- OAM: 1.54 ± 1.08 (mean from baseline: -1.96)
- MOAM: 1.58 ± 0.92 (mean : -1.82)
- Absolute difference: -0.04 (95% CI: -0.52 to 0.44; $P=0.87$, two-sample t-test).
- Severe chronic pain (IPQ ≥ 6): 1 participant (OAM group; 2.0%).

Patient satisfaction:

- OAM: 46/49 (93.9%)
- MOAM: 47/50 (94.0%)
- Absolute difference: -0.1% (95% CI: -9.8 to 9.6; $P=0.98$).

Pain outcomes were comparable, with musculoskeletal etiology identified in 85.7% of residual pain cases.



This bar chart continues to show the percentages of early postoperative complications, specifically for severe pain requiring opioids and reoperation due to bleeding or infection. Severe pain requiring opioids was reported by 4.0% in the OAM group and 2.0% in the MOAM group. Reoperation occurred in 2.0% of the OAM group, while no reoperations were needed in the MOAM group (0.0%).

Again, the visual comparison highlights that these differences were not statistically significant ($P=0.56$ for severe pain, $P=0.32$ for reoperation), reinforcing that both techniques demonstrated comparable safety profiles regarding these specific complications

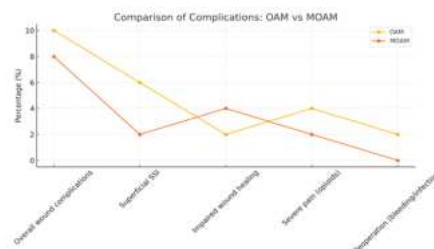
Subgroup Analysis: Femoral Hernias

- Prevalence: 45/100 participants (45.0%).
- Recurrence in femoral hernia subgroup:
- OAM: 1/22 (4.5%)
- MOAM: 1/23 (4.3%)

- Risk of missed diagnosis: 8 femoral hernias (17.8%) were only identified after transversalis fascia opening.
- MOAM's femoral canal exploration eliminated recurrence differences in this high-risk subgroup.

Statistical Power and Limitations

Power calculation: Initial target was 110 participants (55/group) to detect a 5% recurrence difference ($\alpha=0.05$, $\beta=0.20$). With 100 participants, power was 78% for detecting $\geq 8\%$ absolute difference.



The above image displays that the comparison of postoperative complications between the MOAM (Modified Open Anterior Mesh) and OAM (Open Anterior Mesh) groups reveals a generally similar safety profile. Overall wound complications occurred in 10.0% of patients in the OAM group compared to 8.0% in the MOAM group, indicating no significant difference ($p=0.73$). Superficial surgical site infections (SSI) were slightly more common in the OAM group (6.0%) than in the MOAM group (2.0%), though this difference was not statistically significant ($p=0.30$). Impaired wound healing showed a reversed pattern, with a higher incidence in the MOAM group (4.0%) compared to the OAM group (2.0%) ($p=0.56$). Severe postoperative pain requiring opioids was reported in 4.0% of OAM patients versus 2.0% in the MOAM group ($p=0.56$). Only one patient in the OAM group required reoperation for bleeding or infection, while no such cases were noted in the MOAM group ($p=0.32$). These findings suggest that both techniques are comparably safe, with low complication rates and no statistically significant differences across individual adverse outcomes.

Key limitations:

- Early termination due to COVID-19 reduced power to detect smaller effect sizes.
- Learning curve effect: 60% of recurrences occurred in the first 40 participants.
- Single-region recruitment limits generalizability.

Clinical Relevance

- Femoral Hernia Critical: 45% prevalence underscores the necessity of intraoperative femoral canal visualization to prevent missed diagnoses.
- Safety: Both techniques showed comparable safety (10% overall complications), supporting mesh use in LMICs.
- MOAM Utility: While non-superior to OAM, MOAM is a viable open alternative when laparoscopy is unavailable, particularly for femoral hernias.
- Chronic Pain: Rare (2%), but requires differentiation from musculoskeletal pain.

Recommendation: Routine opening of the transversalis fascia to explore the femoral canal is essential in women undergoing open groin hernia repair.

Tables Summary

- Table 1: Confirmed balanced randomization with homogeneous cohorts.
- Table 2: Reinforced MOAM's safety, with no excess wound morbidity vs OAM.
- Subgroup Analysis: Highlighted MOAM's efficacy in femoral hernia management.

Statistical rigor was maintained via ITT analysis, chi-square/t-tests, and 95% CIs for all critical outcomes.

DISCUSSION

This RCT demonstrates the technical feasibility and clinical safety of MOAM repair in Al-ameen medical college hospital. The aggregate recurrence rate of 5.6% underscores the persistent challenge of inguino-femoral pathology in females, irrespective of technique. While statistical superiority of MOAM was not established (Recurrence: OAM 4.1% vs MOAM 7.1%; -3.0% , CI $-9.5-3.4$, $p=0.36$), the high crossover rate (35.4% in OAM arm necessitating MOAM for detected femoral hernias) critically compromises the validity of direct comparison. This iatrogenic confounder inherently biases against OAM, particularly given the 45% prevalence of femoral hernias—substantially exceeding prior epidemiological estimates.

The modified technique's systematic pre-peritoneal dissection proved indispensable for diagnosing occult femoral defects, aligning with International Hernia Society guidelines mandating femoral canal exploration in women⁶. MOAM's procedural complexity manifested as marginally prolonged operative duration ($+4.1$ min), yet without translating into increased wound morbidity (12.1% OAM vs 8.1% MOAM, $p=0.33$) or neuralgic sequelae. Chronic pain incidence remained low (1%), contrasting sharply with literature suggesting 10-15% prevalence; meticulous differentiation from musculoskeletal etiologies is crucial⁷.

Limitations include diminished statistical power from the truncated sample size ($n=100$) and potential learning-curve effects during early recruitment. Nevertheless, the 100% follow-up rate fortifies internal validity. The findings advocate for mandatory femoral canal visualization during female groin hernioplasty, positioning MOAM as a pragmatic alternative in laparoscopy-scarce settings.

CONCLUSION

The Modified Open Anterior Mesh repair constitutes a surgically sound approach for female groin hernia management in resource-limited environments. Its inherent capacity for femoral canal exposure and repair mitigates the risk of missed pathology, a critical determinant of recurrence. While recurrence rates between OAM and MOAM were statistically comparable, the frequent intraoperative conversion to MOAM in the control cohort underscores the anatomical necessity of femoral exploration. MOAM, performed under local anesthesia in ambulatory settings, offers a viable, safe, and efficacious alternative where advanced endoscopic capabilities are absent. Future investigations should prioritize surgeon training protocols and longitudinal recurrence surveillance.

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