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Original Article

Comparison of Modified Darn Repair and Mesh Repair for Inguinal Hernia: Randomized Control Trial

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ABSTRACT

Objective: To compare the outcome of modified darn repair and mesh repair in patients presenting with inguinal hernia.

Methodology: This randomized controlled trial was executed at SMBBMU, Larkana (November 2022–December 2023), encompassing 350 individuals diagnosed with inguinal hernia (ages 18–60, either gender). Subjects were randomly allocated to either the Modified Darn Repair (MDR) or Mesh Repair (MR) cohorts employing the SNOSE methodology. The evaluated outcomes comprised operative duration, postoperative discomfort, duration of hospital stay, recovery period, and complications. Data were subjected to statistical analysis utilizing SPSS version 26, with statistical significance established at $p \leq 0.05$.

Results: This study included 350 patients (186 MR, 164 MDR) with a mean age of 33.32 ± 9.85 years (MR) and 32.34 ± 8.37 years (MDR). Males constituted 90.3% (MR) and 95.7% (MDR). Compared to MR, MDR had a shorter operative time (38.75 ± 6.36 vs. 40.93 ± 7.31 mins, p = 0.003), lower pain scores (3.77 ± 1.29 vs. 4.16 ± 1.57, p = 0.012), faster recovery (15.06 ± 2.73 vs. 15.82 ± 2.93 days, p = 0.013), and fewer complications, supporting its efficacy as an alternative approach.

Conclusion: This investigation indicated that Modified Darn Repair (MDR) and Mesh Repair (MR) are both effective options for the treatment of inguinal hernia. MDR had some benefits such as shorter hospital stays, less postoperative pain, and lower complication rates. It is, therefore, a viable alternative, particularly for patients with a risk of mesh-related complications, given its lower infection and recurrence rates. The current findings need to be confirmed in larger studies involving multiple study centres.

Keywords: Hernia surgery, Mesh repair, Modified darn repair, Postoperative complications, Recurrence rate

INTRODUCTION

Inguinal hernia is one of the most common types of surgical pathological entity, reaching a lifetime prevalence of 25% in men and 2% in women[1]. The elderly are particularly affected by this condition, and one study reported that nearly half of all hernias in males are diagnosed in the aged[1]. Inguinal hernia repair is one of the most frequently performed general surgical procedures worldwide owing to its high prevalence. Approximately 1 million abdominal wall hernia repairs are performed per year in the United States, 770,000 of which are for inguinal hernias[2]. Although surgical techniques have undergone an evolutionary process, they represent a historical continuum and the myriad makeups of effectiveness, safety and recovery are still debated amongst surgeons.

For decades, the Lichtenstein tension-free mesh repair (LMR) has remained the most viable surgical approach due to its low recurrence rates and long-term safety profile[3]. However, the increasing concerns about chronic postoperative pain, foreign body reactions, and mesh-related complications have encouraged scientists and surgeons to search for different treatment methods[4–6]. One such solution to these issues might be the Modified Darn Repair (MDR), which appears to supplement the weakened abdominal wall with reinforcement without the use of a permanent mesh. At the same time, MDR has been reported to offer similar or even better postoperative recovery, pain, and recurrence outcomes than the most common surgical approaches[7,8].

The darning repair technique offers an economical alternative to mesh-based approaches, particularly in settings where access to synthetic mesh is constrained due to financial or logistical limitations. This technique utilizes commonly available suturing materials, making it more feasible in resource-limited environments. In contrast, mesh-based techniques such as the Lichtenstein procedure often require specialized materials and training[9].

Several studies have evaluated differences between the MDR and the Lichtenstein technique in terms of mean operative time, post-operative pain and recurrence rates. Recent comparative studies evaluating the modified darn repair (MDR) versus mesh-based techniques have revealed meaningful clinical distinctions. The mean hospital stay was slightly shorter for the MDR group (1 ± 0.4 days) compared to the mesh repair group (1.2 ± 0.6 days). Although operative time was longer for the MDR technique (58.4 ± 9.2 minutes vs. 51.3 ± 10.6 minutes), early postoperative pain scores were marginally lower (3.9 vs. 4.1), indicating a potential benefit of MDR in early pain management[10]. In another study, the average surgical durations were recorded as 56 minutes for Lichtenstein repair and 48 minutes for MDR; however, neither technique significantly diminished the time required for patients to return to work, with individuals taking up to 20 days to resume normal activities post-intervention. Notably, the MDR was associated with fewer postoperative complications (1.9% compared to 11.7% for the Lichtenstein repair), and no recurrences were documented within the MDR cohort[11].

In consideration of these findings, Modified Darn Repair emerges as a superior alternative to mesh-based techniques, particularly in individuals with an elevated likelihood of enduring

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pain, mesh extrusion, or financial constraints[12,13]. Assessing the economic and clinical ramifications of various hernia repair methodologies is imperative in resource-constrained nations such as Pakistan, where healthcare accessibility poses a significant obstacle. Achieving optimal outcomes at minimal cost is essential, given that both patients and healthcare facilities are encumbered by the financial implications of hospitalization and extended recovery periods.

At present, there exists a paucity of local data that juxtaposes MDR with Lichtenstein repair within the Pakistani demographic. Hence, this investigation seeks to furnish a direct comparison between Modified Darn Repair and Mesh Repair, with the objective of ascertaining which technique yields superior recovery, diminished complications, and enhanced patient satisfaction. The results may serve to inform surgical decision-making processes and aid in the formulation of standardized protocols for hernia management across both affluent and resource-limited healthcare environments.

METHODOLOGY

This randomized controlled trial (RCT) was executed from November 2022 to December 2023 at the Department of Surgery Unit III, Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU) located in Larkana. Employing a non-probability consecutive sampling approach, a total of 350 participants, irrespective of gender, aged between 18 and 60 years, who exhibited clinical symptoms (pain, swelling in the inguinal region, scrotal swelling accompanied by a positive cough impulse) suggestive of inguinal hernia were recruited.

This investigation included individuals categorized as American Society of Anaesthesiologists (ASA) I or II, while excluding those presenting with strangulated or recurrent hernias, obesity (BMI > 30 kg/m²), coagulopathy, or other significant comorbid conditions.

All subjects were given full details regarding the purpose, risks, and benefits to them of the study before they gave their written informed consent to take part.

The mean hospital stay reported in a previous comparative study between the Modified Darn Repair (MDR) and Lichtenstein Mesh Repair (MR) techniques was 1 ± 0.4 days and 1.2 ± 0.6 days, respectively[10]. Based on this effect size, the required sample size was calculated using OpenEpi version 3.0, with a power of 80% and a significance level of 5%. To accommodate potential attrition and ensure adequate statistical power, the final adjusted sample size was set at 350 participants, comprising 186 individuals in the MR group and 164 individuals in the MDR group.

Participants were randomly assigned to one of two groups through a computer-generated random number sequence, with allocation concealed throughout the randomization process to maintain the integrity of randomization and mitigate selection bias.

The concealment of allocation was achieved via the sequentially numbered, opaque, sealed envelope (SNOSE) approach, executed by an independent researcher who was not involved in the recruitment of subjects or the surgical procedures and examinations. Patients in group A (n=186) underwent Lichtenstein tension-free mesh repair (MR), while those in group B (n=164) received Modified Darn Repair (MDR) utilizing polypropylene sutures.

In the Mesh Repair (MR) cohort, Polypropylene sutures used the surgical intervention was performed under spinal anaesthesia. The hernia sac was carefully dissected, mobilized, and extracted through a conventional inguinal incision. The external oblique aponeurosis was subsequently closed over the mesh, followed by a layered closure of the skin.

In the MDR group, the hernia sac was dissected through the inguinal incision. Crossed continuous tension-free polypropylene sutures were utilized for the repair, engaging both the inguinal ligament and the fascia of the internal oblique muscle.

All procedures were carried out with the utmost precision to avert excessive pressure on the spermatic cord, with the final ligature positioned 2-3 cm lateral to the deep ring, accompanied by supplementary sutures to fortify the area prior to the layered closure of the skin.

The efficacy of both surgical techniques was assessed through various clinical parameters. The duration of the surgical procedure was meticulously documented (in seconds; stopwatch) from the initiation of the initial incision to the conclusion of the final suture. The Numeric Rating Scale (NRS; 0–10; 0 signifies no pain and 10 denotes the worst pain conceivable) was employed to appraise postoperative pain levels 24 hours following surgery.

The length of stay in the hospital was registered in days, from the time of admission to time of discharge. The time taken to return to normal physical activities was also documented. Postoperative complications (wound infection, hematoma, urinary retention, scrotal seroma, recurrence) were recorded systematically during the follow-up period.

Data collection was executed in a systematic manner employing a structured proforma, and subsequent statistical analysis was conducted utilizing SPSS version 26. The independent sample t-test and Chi-square test was used to compare the outcomes and complications between groups at a significance level of 5%.

RESULTS

The investigation encompassed a total of 350 subjects, with 186 individuals assigned to the MR cohort and 164 individuals assigned to the MDR cohort. The average age of participants within the MR cohort was 33.32 years (SD ± 9.85), whereas the MDR cohort exhibited a marginally younger average age of 32.34 years (SD ± 8.37).

Gender distribution showed a significant preponderance of male subjects in both the MR cohort (90.3%) and the MDR cohort (95.7%). In contrast, the proportion of female participants was much lower 9.7% in the MR group and 4.3% in the MDR group.

The MR cohort had 33.3% of hernias classified as direct and 66.7% classified as indirect. In comparison, the distribution of direct vs indirect hernias in the MDR cohort was 25.0% and 75.0%, respectively. In MR cohort, local anaesthesia was used in 4.8% patients, spinal anaesthesia in 85.5%, and general anaesthesia was given to 9.7% patients

The MDR cohort displayed a marginally higher incidence of local anaesthesia (9.1%) and a lower incidence of general anaesthesia (6.1%).

The laterality of hernias was predominantly right sided in both cohorts, with 64.5% in the MR cohort and 72.6% in the MDR cohort. Left-sided hernias were comparatively infrequent, accounting for 35.5% in the MR cohort and 27.4% in the MDR cohort, as delineated in **Table I.**

The mean duration of hospital stay was slightly extended for the MR cohort (2.71 days) relative to the MDR cohort (2.52 days),

although this discrepancy did not achieve statistical significance (p-value = 0.063).

Pain assessment scores were elevated in the MR cohort (4.16) in comparison to the MDR cohort (3.77), with a statistically significant difference (p-value = 0.012), suggesting that individuals in the MR cohort experienced greater postoperative pain.

The length of the surgical procedure was greater for the MR cohort (40.93 minutes) when juxtaposed with the MDR cohort (38.75 minutes), and this difference was statistically significant (p-value = 0.003), indicating that MR surgical interventions may necessitate a longer duration.

The resumption of physical activity was observed to be slightly protracted in the MR cohort (15.82 days) compared to the MDR cohort (15.06 days), with a significant p-value of 0.013, indicating an extended recovery period for patients in the MR cohort.

Complications were observed to be more frequent in the MR cohort, particularly with regard to wound infections (8.1% vs. 1.8%, p-value = 0.007) and recurrence rates (10.8% vs. 3.7%, p-value = 0.012), both of which reached statistical significance, underscoring an elevated risk of complications among MR patients, as illustrated in **Table II.**

In the demographic cohort of individuals aged 18 to 30 years, the mean duration of hospitalization was marginally extended for the MR cohort (2.70 days) in comparison to the MDR cohort (2.53 days), although this disparity did not reach statistical significance (p-value = 0.212). The pain assessment scores were elevated in the MR cohort (4.12) relative to the MDR cohort (3.81), yet this variation similarly did not attain statistical significance (p-value = 0.150). The procedural duration was extended for the MR cohort (41.09 minutes) as opposed to the MDR cohort (39.25 minutes), with a p-value of 0.052, thereby indicating a trend that approaches statistical significance. The resumption of physical activity was marginally postponed in the MR cohort (15.87 days) compared to the MDR cohort (15.20 days), with a p-value of 0.066, implying a potential difference that may justify further scholarly inquiry. Complications, including wound infections, were more prevalent in the MR cohort (7.8%) than in the MDR cohort (2.2%); however, this distinction did not achieve statistical significance (p-value = 0.075). In the demographic cohort exceeding 30 years of age, the MR cohort exhibited a prolonged average hospitalization duration (2.72 days) in comparison to the MDR cohort (2.51 days), although this difference did not reach statistical significance (p-value = 0.167).

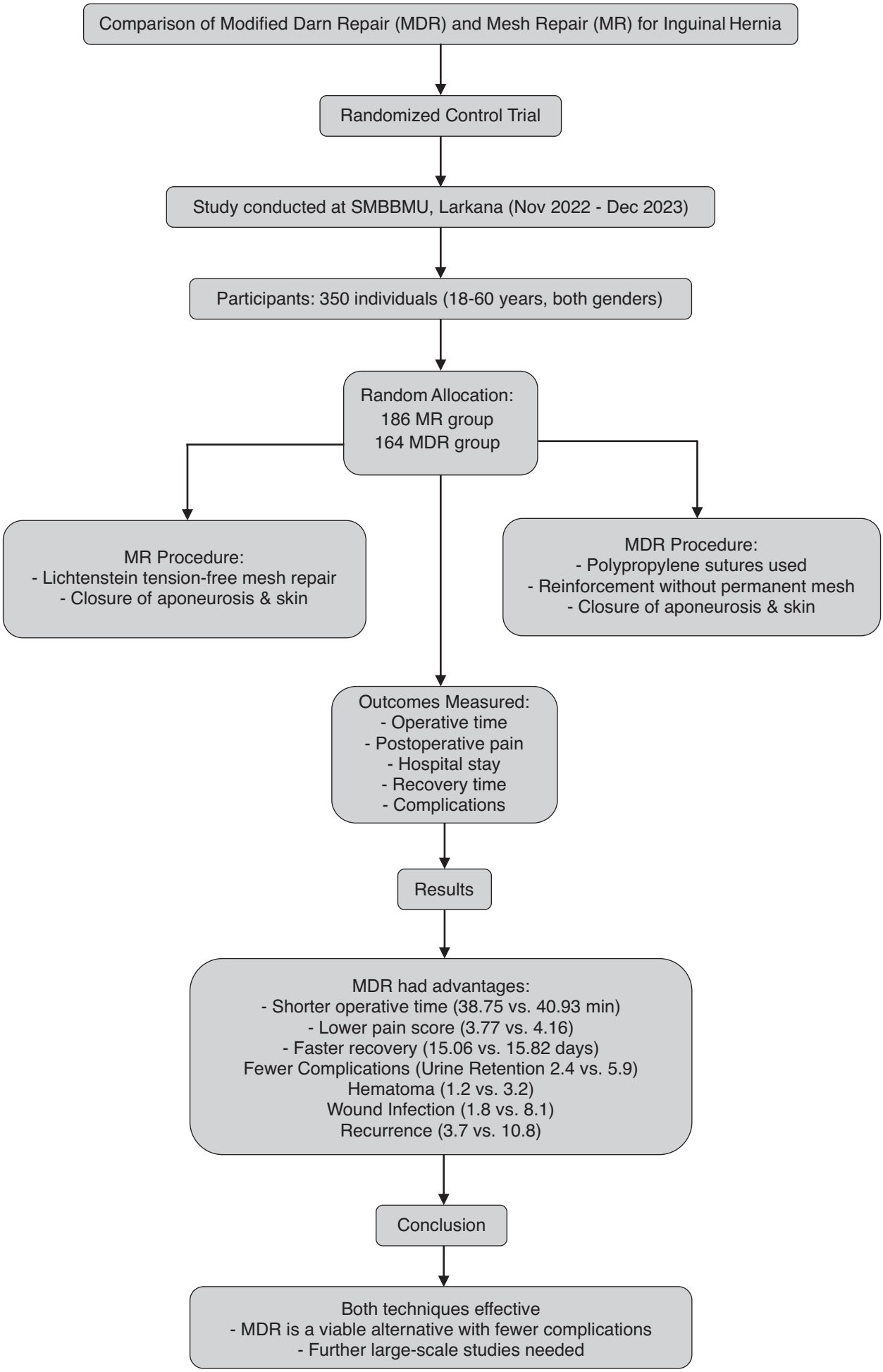
Pain assessment scores were significantly elevated in the MR cohort (4.22) as compared to the MDR cohort (3.71), with a p-value of 0.033, indicating a significant divergence in pain perception. The duration of the procedure was also prolonged for the MR cohort (40.73 minutes) in contrast to the MDR cohort (38.12 minutes), with a statistically significant p-value of 0.028. Complications within the over 30 age group revealed a significant difference in the incidence of wound infections (8.4% in MR vs. 1.4% in MDR, p-value = 0.047) and recurrence rates (12.0% in MR vs. 1.4% in MDR, p-value = 0.008), thereby indicating a heightened risk of complications in the MR cohort as depicted in **Table III.**

Table I: Characteristics of Study Participants (n=350)

Baseline Characteristic		Groups	
		MR (n=186)	**MDR** (n=164)
Age in years, Mean ± SD		33.32 ± 9.85	32.34 ± 8.37
Gender	Male, n (%)	168 (90.3)	157 (95.7)
	Female, n (%)	18 (9.7)	7 (4.3)
Type of Hernia	Direct, n (%)	62 (33.3)	41 (25.0)
	Indirect, n (%)	124 (66.7)	123 (75.0)
Anesthesia Type	Local, n (%)	9 (4.8)	15 (9.1)
	Spinal, n (%)	159 (85.5)	139 (84.8)
	General, n (%)	18 (9.7)	10 (6.1)
Side of Hernia	Right, n (%)	120 (64.5)	119 (72.6)
	Left, n (%)	66 (35.5)	45 (27.4)

Table II: Comparison of Outcomes and Complications Between Groups (n=350)					
Surgical Outcomes & Complications		**Groups**		**95% Confidence Interval**	**P-Value**
		MR (n=186)	**MDR** (n=164)		
Hospital Stay in days		2.71 ± 1.01	2.52 ± 0.88	-0.010------0.393	0.063
Pain Score		4.16 ± 1.57	3.77 ± 1.29	0.087------0.699	0.012*
Duration of Procedure in mins		40.93 ± 7.31	38.75 ± 6.36	0.729------3.631	0.003*
Return to Physical Activity in days		15.82 ± 2.93	15.06 ± 2.73	0.157------1.355	0.013*
Complications, n (%)	Retention of Urine	11 (5.9)	4 (2.4)	0.785------8.055	0.089
	Hematoma	6 (3.2)	2 (1.2)	0.537------13.566	0.187
	Seroma Scrotal	9 (4.8)	8 (4.9)	0.373------2.632	0.986
	Wound Infection	15 (8.1)	3 (1.8)	1.338------16.565	0.007*
	Recurrence	20 (10.8)	6 (3.7)	1.242------8.105	0.012*

Table III: Comparison of Outcomes & Complications Between Groups (n=350)				
Age Group 18---30				
Outcomes & Complications	**Groups**		**95% Confidence Interval**	**P-Value**
	MR (n=186)	**MDR** (n=164)		
Hospital Stay (days)	2.70 ± 0.99	2.53 ± 0.89	-0.099------0.442	0.212
Pain Score	4.12 ± 1.59	3.81 ± 1.28	-0.111------0.717	0.150
Duration of Procedure (mins)	41.09 ± 6.74	39.25 ± 6.27	-0.018------3.687	0.052*
Return to Physical Activity (days)	15.87 ± 2.60	15.20 ± 2.46	-0.044------1.396	0.066
Complications, n (%)				
Retention of Urine	4 (3.9)	2 (2.2)	0.322------10.054	0.402
Hematoma	4 (3.9)	1 (1.1)	0.399------33.142	0.225
Seroma Scrotal	4 (3.9)	4 (4.4)	0.213------3.619	0.569
Wound Infection	8 (7.8)	2 (2.2)	0.775------18.125	0.075
Recurrence	10 (9.7)	5 (5.5)	0.608------5.628	0.273
Age Group > 30				
Hospital Stay (days)	2.72 ± 1.04	2.51 ± 0.88	-0.091------0.523	0.167
Pain Score	4.22 ± 1.56	3.71 ± 1.32	0.043------0.966	0.033*
Duration of Procedure (mins)	40.73 ± 8.00	38.12 ± 6.45	0.290------4.933	0.028*
Return to Physical Activity (days)	15.75 ± 3.32	14.89 ± 3.04	-0.156------1.869	0.097
Complications, n (%)				
Retention of Urine	7 (8.4)	2 (2.7)	0.657------16.267	0.118
Hematoma	2 (2.4)	1 (1.4)	0.158------20.020	0.548
Seroma Scrotal	5 (6.0)	4 (5.5)	0.285------4.283	0.581
Wound Infection	7 (8.4)	1 (1.4)	0.796------55.245	0.047*
Recurrence	10 (12.0)	1 (1.4)	1. 231------79.047	0.008*


Comparison of Modified Darn Repair (MDR) and Mesh Repair (MR) for Inguinal Hernia
Randomized Control Trial
Study conducted at SMBBMU, Larkana (Nov 2022 - Dec 2023)
Participants: 350 individuals (18-60 years, both genders)
Random Allocation:
186 MR group
164 MDR group
MR Procedure:
- Lichtenstein tension-free mesh repair
- Closure of aponeurosis & skin
MDR Procedure:
- Polypropylene sutures used
- Reinforcement without permanent mesh
- Closure of aponeurosis & skin
Outcomes Measured:
- Operative time
- Postoperative pain
- Hospital stay
- Recovery time
- Complications
Results
MDR had advantages:
- Shorter operative time (38.75 vs. 40.93 min)
- Lower pain score (3.77 vs. 4.16)
- Faster recovery (15.06 vs. 15.82 days)
Fewer Complications (Urine Retention 2.4 vs. 5.9)
Hematoma (1.2 vs. 3.2)
Wound Infection (1.8 vs. 8.1)
Recurrence (3.7 vs. 10.8)
Conclusion
Both techniques effective
- MDR is a viable alternative with fewer complications
- Further large-scale studies needed

DISCUSSION

The comparison between modified darn repair (MDR) and mesh repair (MR) for inguinal hernia continues to be a significant topic in surgical research. While mesh repair remains the gold standard due to its lower recurrence rates, MDR is gaining attention for its advantages in reducing postoperative pain, avoiding foreign body reactions, and offering a faster recovery. Several studies have provided comparative data on key outcomes such as hospital stay, postoperative pain, operative duration, and return to physical activity, helping to refine surgical decision-making[14-16].

The available studies indicate that MDR has a slight edge in reducing hospital stay and postoperative pain. Our study found that the hospital stay was 2.71 ± 1.01 days for MR vs. 2.52 ± 0.88 days for MDR, and pain scores were lower in MDR (3.77 ± 1.29 vs. 4.16 ± 1.57 for MR). Additionally, operative time was marginally shorter in MDR (38.75 ± 6.36 vs. 40.93 ± 7.31 minutes for MR), and patients returned to physical activity sooner (15.06 ± 2.73 vs. 15.82 ± 2.93 days for MR). A similar study demonstrated comparable results with mean hospital stay of 33.97 ± 4.97 vs. 39.76 ± 6.40 days, lower MDR pain scores (3.64 ± 2.97 vs. 4.23 ± 2.69 in MR), and lower procedure time (36.38 ± 5.16 vs. 39.02 ± 7.65 min for MR)[17].

Kalim et al.[18] and Saeed et al[19] reported shorter mean operative times in MDR (35 ± 17.03 vs. 50 ± 19.76 minutes in MR; P = 0.0001) and 36.62 ± 6.98 vs. 45.81 ± 9.29 minutes, respectively. Thus, these results suggested that MDR can be a suitable alternative, particularly those associated with a relatively short recovery period and low pain scores.

Even though Modified Darn Repair (MDR) is related with less pain, less operating time and faster return to work, recurrence rate appears to remain a major complication. Implantable mesh has proven to be a chronic, durable approach to prevent hernia recurrence.

Studies performed by Lockhart et al.[20] and Smith et al.[21] have shown that recurrence rates with mesh repair are lower than similar results with native tissue repair; but with more chronic pain and foreign body reactions due to mesh. Oberg et al. have shown that chronic pain is more common after mesh repair than after non-mesh procedures[22]. These results provide additional support for using alternative methodologies, such as MDR, in certain populations.

A comparative analysis of modified darn repair and mesh repair for inguinal hernia yields critical insights regarding the advantages and disadvantages inherent to these two surgical techniques. Notable strengths of this study encompass a comprehensive evaluation of significant outcomes, including duration of hospital stay, postoperative pain levels, surgical time, and resumption of routine physical activities.

The findings reveal a modest benefit of MDR over mesh repair in terms of diminishing the length of hospital stay and postoperative pain; however, there is a marginally shorter operative time and a quicker return to athletic activities. These outcomes are consistent with earlier research, reinforcing the potential advantages of MDR for facilitating accelerated recovery and pain alleviation.

Nonetheless, there exist several limitations associated with the study. The recurrence rate remains the most critical concern, as mesh repair continues to be regarded as the gold standard due to its demonstrated long-term durability and reduced recurrence rates. This investigation did not provide sufficient long-term follow-up data, which is essential for assessing the sustainability of the benefits attributed to MDR.

Moreover, studies with longer duration should be organized with multi-center randomized controlled trials to provide accurate estimates of recurrence rates and potential complications. Finally, the cost-effectiveness of each surgical technique in different health care systems should also be assessed. For clinicians, MDR may be an acceptable compromise for patients with the goal of restoring function and minimizing pain early but it needs to be carefully balanced with the sacrifice of risk of recurrence.

CONCLUSION

This investigation indicated that Modified Darn Repair (MDR) and Mesh Repair (MR) are both effective options for the treatment of inguinal hernia. MDR had some benefits such as shorter hospital stays, less postoperative pain, and lower complication rates. It is, therefore, a viable alternative, particularly for patients with a risk of mesh-related complications, given its lower infection and recurrence rates. The current findings need to be confirmed in larger studies involving multiple study centres.

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