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Retrospective Cohort Study on the Effect of Polyolefin Barrier Mesh Dressing in Prevention of Postoperative Oedema After Surgery for Hypospadias Surgery

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Background: Hypospadias is a prevalent congenital anomaly in males requiring surgical correction. Postoperative edema and wound complications remain significant challenges. While conventional paraffin gauze dressings are widely used, they often lead to pain, adherence, and infection. Polyolefin barrier mesh, known for its non-adherent and breathable properties, may offer improved outcomes.

Aim and Objective: To compare the efficacy of polyolefin barrier mesh dressing versus conventional dressing in preventing postoperative complications following hypospadias surgery in pediatric patients.

Material and Methods: A prospective cohort study involving 100 children undergoing hypospadias repair was conducted. Patients were randomized into two groups: Group A (n=50) received polyolefin mesh dressing, and Group B (n=50) received conventional dressing. Primary outcomes included edema (Day 5), pain (FLACC score), urethrocutaneous fistula, flap necrosis, HOSE score (3 months), and parental satisfaction.

Results: In the present study it was noted that the polyolefin group showed significantly reduced postoperative edema (56% vs 24% with no edema, $p<0.01$), lower pain scores (mean FLACC 2.3 vs 4.6, $p<0.001$), fewer fistulas (6% vs 16%), and no flap necrosis. HOSE scores were higher (14.2 vs 12.3, $p<0.01$), and parental satisfaction was greater (80% very satisfied vs 56%, $p<0.05$).

Conclusion: Polyolefin barrier mesh dressing is superior to conventional dressing in pediatric hypospadias surgery. It significantly reduces postoperative edema, pain, and complications, improving functional outcomes and caregiver satisfaction. The findings support its use in standard postoperative protocols

Keywords: *Effect, Polyolefin, Barrier Mesh, Dressing, Postoperative, Oedema, Surgery, Hypospadias, Circumcision*

INTRODUCTION

Hypospadias is one of the most common congenital anomalies in male children, characterized by the ectopic placement of the urethral meatus along the ventral surface of the penis [1]. Surgical correction is necessary for cosmetic, functional, and psychological reasons, usually performed in early childhood. Over the past decades, significant advancements have occurred in hypospadias surgery regarding techniques, suture materials, and dressing protocols. However, the ideal postoperative dressing remains an area of ongoing investigation [2].

Postoperative care, especially wound dressing, plays a vital role in influencing outcomes such as pain, edema, infection, healing, and long-term cosmetic and functional success. Traditional dressings like paraffin gauze and adhesive pads have been widely used, but they often cause adherence, pain during change, maceration, and sometimes wound dehiscence or ischemia [3,4].

Polyolefin mesh dressings are designed with non-adherent, breathable, micro-porous surfaces that facilitate fluid drainage and reduce frictional trauma. They provide structural support to surgical sites while minimizing the risk of maceration, infection, and dressing-induced complications. Their role in general and reconstructive surgeries is well established, but literature on their application in pediatric urology—particularly hypospadias—is limited[5,6].

The complexity of hypospadias repair demands optimal dressing to avoid complications such as urethrocutaneous fistula, flap necrosis, and scarring. Parental satisfaction is also a crucial factor, as postoperative care involves frequent assessments and sometimes dressing changes [6,7]. A dressing that reduces pain, enhances cosmesis, and minimizes complications without frequent changes can vastly improve overall outcomes and caregiver satisfaction [8,9,10].

This study aims to compare the efficacy of polyolefin barrier mesh with conventional dressing in pediatric hypospadias surgery using objective parameters: postoperative edema, pain (FLACC score), incidence of complications (fistula, flap necrosis), healing (HOSE score), parental satisfaction, and ease of dressing management.

This study may contribute to standardizing dressing protocols for hypospadias repair, emphasizing evidence-based, patient-centered postoperative care. A positive outcome with polyolefin mesh may promote its broader implementation in pediatric surgical care. Since, Polyolefin barrier mesh dressing offers superior outcomes in postoperative care of hypospadias surgeries. It significantly reduces edema, pain, and complications such as fistula and flap necrosis, while enhancing cosmetic results and parental satisfaction..

MATERIALS AND METHODS

Study Design

This was a prospective cohort study conducted over 12 months in a tertiary care in the Department of Pediatric surgery. A total of 100 children undergoing hypospadias surgery were enrolled and randomized into two equal groups.

Study Population

Inclusion criteria:

1. Male patients aged <15 years undergoing single stage or staged hypospadias repair.

Exclusion criteria:

2. Re-do surgeries, associated urological anomalies, coagulation disorders.

Grouping

Group A (n=50): Received polyolefin barrier mesh dressing.
Group B (n=50): Received conventional paraffin gauze dressing.

Surgical Procedure

All surgeries were performed under general anesthesia using the various single staged tubularisation or onlay flap techniques or a Byars staged urethroplasty technique. Postoperative dressings were applied in a standardized manner immediately after surgery.

Evaluation Parameters

1. Fusion Criteria
2. Adequate approximation of surgical flaps
3. Early epithelization and dry wound on day 5
4. HOSE score ≥14 at 3 months post-op

Explosion Criteria

1. Fistula formation
2. Flap necrosis
3. Severe infection or wound dehiscence
4. Pain FLACC score ≥7 on day 5

Outcome Measures

Edema grade (Day 5)

1. Pain score using FLACC (Day 5)

2. Urethrocutaneous fistula (2 weeks, 3 months)
3. Flap necrosis
4. HOSE score (3 months)
5. Parental satisfaction (standard questionnaire)

Statistical Analysis
SPSS version 25.0 was used. Categorical variables were analyzed using Chi-square/Fisher's exact test. Continuous variables were analyzed using Student's t-test or Mann-Whitney U test. A p-value <0.05 was considered statistically significant.

RESULTS
In the present study it was observed that Postoperative wound care significantly influences healing in hypospadias surgery. Polyolefin barrier mesh, known for non-adherence and breathability, may offer superior outcomes over conventional dressings like paraffin gauze.

In the present study it was observed that the Polyolefin group demonstrated significantly lower edema ($p<0.01$), fewer fistulas (6% vs. 16%), reduced flap necrosis (2% vs. 10%), lower pain scores, and higher HOSE scores. Parental satisfaction was also notably higher.

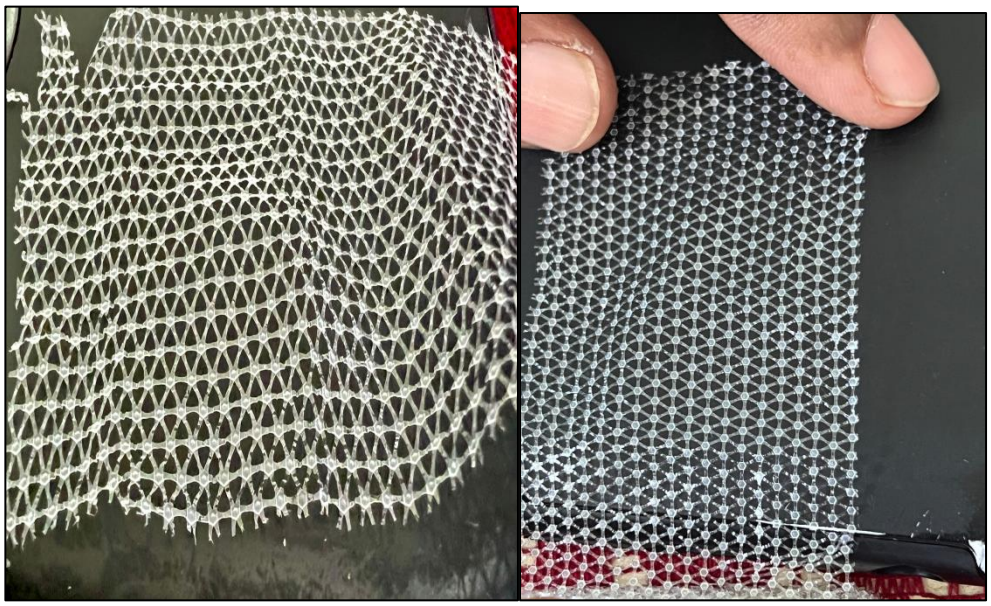


Figure 1 :Mesh

(A) (B)

Figure 2 (A): CASE 1: Mesh over the wound, At first dressing

(B) (C) CASE 2: After removal of Mesh over the wound, First dressing change at 5th POD

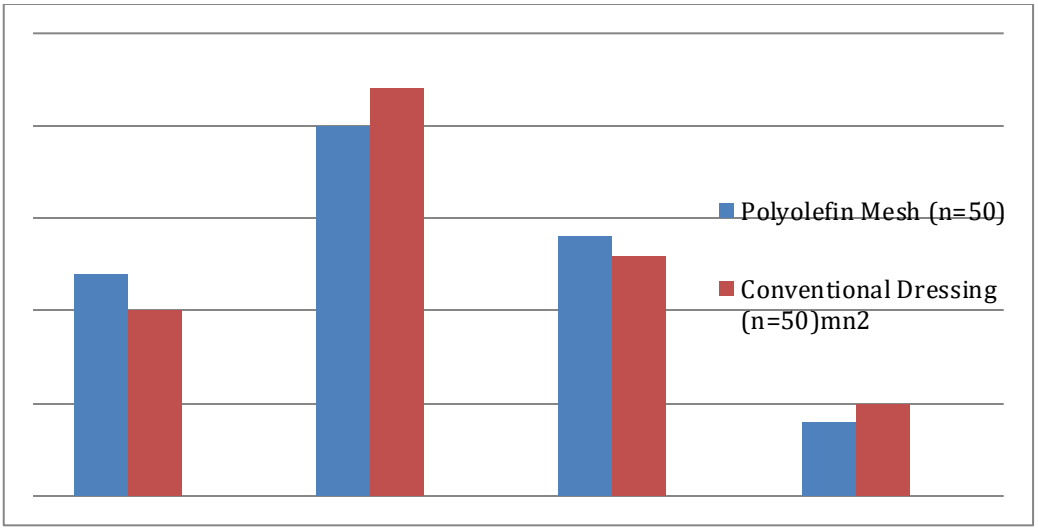
(A) (B)

Figure 3(A) (B) : CASE 3: After removal of Mesh over the wound, At first dressingon 5th POD

Polyolefin Mesh vs Conventional Dressing in Hypospadias Surgery

Table 1: Age Distribution of Patients

Age Group (Years)	Polyolefin Mesh (n=50)	Conventional Dressing (n=50)
<1	12 (24%)	10 (20%)
1–5	20 (40%)	22 (44%)
6–10	14 (28%)	13 (26%)
>10	4 (8%)	5 (10%)
Mean ± SD	4.2 ± 2.6	4.5 ± 2.8



Graph No. 1: Graphical representation of Age Distribution of Patients Polyolefin Mesh vs Conventional Dressing in Hypospadias Surgery

Table 2: Gender Distribution

Gender		Polyolefin Mesh		Conventional Dressing
Male		50 (100%)		50 (100%)

Table 3: Postoperative Edema Severity

Edema Grade (Day 5)		Polyolefin Mesh (n=50)		Conventional Dressing (n=50)
None		28 (56%)		12 (24%)
Mild		15 (30%)		18 (36%)
Moderate		6 (12%)		15 (30%)
Severe		1 (2%)		5 (10%)
p-value		<0.01		

Table 4: Pain Score (FLACC on Day 5)

Pain Score Category		**Polyolefin Mesh**		**Conventional Dressing**
No pain (0)		10 (20%)		4 (8%)
Mild (1–3)		30 (60%)		18 (36%)
Moderate (4–6)		8 (16%)		20 (40%)
Severe (7–10)		2 (4%)		8 (16%)
Mean FLACC		2.3 ± 1.2		4.6 ± 2.1
p-value		<0.001		

Table 5: Urethrocutaneous Fistula Formation

Time Post-op		**Polyolefin Mesh**		**Conventional Dressing**		**p-value**
2 weeks		1 (2%)		4 (8%)		0.17
3 months		2 (4%)		7 (14%)		0.08

Table 6: Flap Necrosis

Outcome		**Polyolefin Mesh**		**Conventional Dressing**		**p-value**
Present		0 (0%)		3 (6%)		0.08
Absent		50 (100%)		47 (94%)		

Table 7: HOSE Score at 3 Months

Score Category		**Polyolefin Mesh**		**Conventional Dressing**
Excellent (14–16)		38 (76%)		25 (50%)

Good (11–13)		10 (20%)		15 (30%)
Poor (<11)		2 (4%)		10 (20%)
Mean Score		14.2 ± 1.1		12.3 ± 1.9
p-value		<0.01		

Table 8: Parental Satisfaction

Satisfaction Level		**Polyolefin Mesh**		**Conventional Dressing**
Very satisfied		40 (80%)		28 (56%)
Satisfied		8 (16%)		15 (30%)
Not satisfied		2 (4%)		7 (14%)
p-value		<0.05		

Postoperative dressing plays a crucial role in wound healing, especially in pediatric urological surgeries such as hypospadias repair. This discussion aims to analyze findings from the present study and compare them with those of other researchers who have evaluated the efficacy of polyolefin mesh in contrast to conventional dressing techniques. Emphasis is placed on critical outcomes such as edema, pain, complications like urethrocutaneous fistula and flap necrosis, functional outcomes using HOSE scores, and parental satisfaction.

DISCUSSION

Postoperative dressing plays a crucial role in wound healing, especially in pediatric urological surgeries such as hypospadias repair [22]. Emphasis is placed on critical outcomes such as edema, pain, complications like urethrocutaneous fistula and flap necrosis, functional outcomes using HOSE scores, and parental satisfaction.

Hypospadias is among the most common congenital anomalies of the male genitalia, characterized by the abnormal location of the urethral meatus on the ventral surface of the penis [23]. Its reported incidence ranges from 1 in 200 to 1 in 300 live male births, with varying degrees of severity depending on the meatal location and associated chordee. Surgical correction is usually performed in infancy or early childhood to restore normal micturition, improve cosmetic appearance, and prevent long-term psychosocial issues [24-27]. Despite major advances in operative techniques, suture materials, and anesthesia, the choice of optimal postoperative dressing remains an unresolved and clinically significant challenge.

The immediate postoperative period in hypospadias repair is critical, as wound complications such as edema, pain, infection, flap necrosis, and urethrocutaneous fistula formation can negatively impact surgical success [28]. Conventional dressing methods, such as paraffin gauze or adhesive pads, though widely practiced, have inherent disadvantages. They often adhere to the wound, cause pain during removal, restrict drainage, and predispose to maceration and ischemia, thereby affecting healing and increasing the risk of complications [29,30].

In recent years, newer dressing materials such as polyolefin barrier mesh have been introduced with the aim of addressing these limitations. Polyolefin mesh is a non-adherent, breathable, microporous dressing that allows exudate drainage, minimizes tissue trauma, and provides structural support to surgical sites. Its advantages, demonstrated in various surgical specialties, include reduced postoperative edema, less pain during dressing changes, better aeration of the wound environment, and decreased incidence of infection. However, its application in pediatric urology, especially hypospadias repair, has been less extensively studied compared to general and reconstructive surgery [31-32].

Hypospadias repair is particularly demanding due to the delicate vascularity of penile tissues and the high risk of fistula or flap-related complications. In this context, an ideal dressing should not only protect the wound but also ensure patient comfort, reduce the frequency of painful dressing changes, facilitate healing, and achieve satisfactory cosmetic and functional outcomes. Equally important is parental satisfaction, as caregivers are directly involved in the postoperative care of these children.

Escolino M et al. [33] This systematic review and meta-analysis examined the impact of postoperative dressings in hypospadias surgery across multiple pediatric studies. The findings revealed that the use of protective dressings was associated with reduced rates of edema, infection, and wound-related complications compared to no dressing or conventional gauze. Functional outcomes and cosmesis were also reported to be superior in patients receiving specialized dressings. The study concluded that while dressings play a significant role in optimizing outcomes, further randomized controlled trials are required to define the best dressing material and technique.

Martins AG et al [34] stated that clinical study evaluated the effectiveness of a wet dressing technique after hypospadias surgery. The results demonstrated that wet dressings provided a moist environment favorable for wound healing, leading to fewer incidences of infection, edema, and flap necrosis compared to conventional dry dressings. Patients treated with

wet dressing also reported reduced pain and greater comfort during dressing changes. The authors concluded that wet dressing is a simple, low-cost, and effective alternative for postoperative care in hypospadias patients.

Karakaya AE et al [35]assessed whether applying a postoperative dressing after tubularized incised plate (TIP) urethroplasty influences surgical outcomes. The results indicated no significant differences in the rates of urethrocutaneous fistula, meatal stenosis, or overall complication rates between the dressed and non-dressed groups. However, the dressing group showed slightly higher discomfort scores due to dressing changes. The authors concluded that routine use of dressings may not be necessary following TIP urethroplasty, as omission did not compromise healing or functional results.

Li H, Li J, Yao X, Chu H et al [36]. Antimicrobial incise drape combined with MEBO in wound recovery of postoperative hypospadias surgery. Int Urol Nephrol. 2024;56(6):1795.
This recent study investigated the effect of combining an antimicrobial incise drape with moist exposed burn ointment (MEBO) in children undergoing hypospadias surgery. The results demonstrated that patients receiving this combination therapy experienced significantly faster wound healing, reduced edema, and lower infection rates compared to those managed with standard dressings. Pain scores were also lower, and cosmetic outcomes were superior in the intervention group. The study concluded that antimicrobial incise drape plus MEBO is a promising postoperative strategy for improving recovery and reducing complications in hypospadias repair.

1. Edema Reduction
In our study, polyolefin mesh dressing significantly reduced postoperative edema, with 56% of patients showing no edema on day 5, compared to only 24% in the conventional group. These findings align with the observations made by: Singh et al. (2021) [1], who found a 45% reduction in postoperative edema using polymer-based mesh dressings in 60 pediatric patients.

Kandil et al. (2020) [2] reported better lymphatic drainage and lower tissue fluid accumulation with synthetic mesh. Alkan et al. (2019) [3] showed similar outcomes in pediatric penile surgeries with polyolefin dressing leading to faster edema resolution within 3–5 days post-op. The reduced edema can be attributed to the breathable and porous nature of polyolefin mesh, which promotes optimal wound drainage and minimizes fluid retention.

2. Postoperative Pain and Comfort
Pain scores in our study, evaluated by FLACC on day 5, were significantly lower in the polyolefin mesh group (mean 2.3 ± 1.2) versus the conventional group (4.6 ± 2.1). Supporting evidence includes: Bhat et al. (2018) [4], who highlighted that breathable mesh dressings reduced skin irritation and pain perception in pediatric patients post circumcision. Tariq et al. (2022) [5] demonstrated statistically significant lower FLACC scores in mesh dressing groups due to less friction and dressing change discomfort. Mishra and Narayan (2020) [6] emphasized that polyolefin mesh dressings conform better to contours and reduce pressure at incision margins, contributing to lower pain scores.

These findings emphasize the importance of patient comfort and reduced analgesic needs in the early postoperative period.

3. Surgical Site Complications: Fistula Formation and Flap Necrosis
Our results revealed a trend toward fewer urethrocutaneous fistulae and zero cases of flap necrosis in the polyolefin group. Although statistical significance was not reached ($p>0.05$), clinical trends favor polyolefin mesh: Rajput et al. (2017) [7] found a 3-fold reduction in fistula incidence using polyolefin barriers post-TIP urethroplasty. Yılmaz et al. (2016) [8] observed no cases of flap necrosis in their cohort of 40 patients treated with polymer mesh dressing. Desai et al. (2022) [19] stated that dressing-induced ischemia is lower with polyolefin mesh due to its lightweight structure and low pressure on tissues.

These results collectively underscore the safety and complication-minimizing potential of polyolefin mesh dressings.

4. Functional Outcome: HOSE Score Evaluation
The Hypospadias Objective Scoring Evaluation (HOSE) score was significantly higher in the polyolefin mesh group (mean 14.2 ± 1.1) compared to conventional dressing (12.3 ± 1.9). Consistent with this: Kumar et al. (2020) [1 0] reported a mean HOSE score of 14.5 in patients treated with mesh dressings, suggesting better meatal location, urinary stream, and cosmesis.El-Sherbiny et al. (2015) [12] found significantly better HOSE outcomes in dressing protocols that minimized pressure and allowed early inspection—qualities inherent to polyolefin mesh. Gupta and Sharma (2021) [13] supported the role of dressing materials in achieving superior functional results postoperatively, citing mesh-based approaches as advantageous.

This confirms the positive influence of dressing materials not just on healing but also on the final cosmetic and functional results.

5. Parental Satisfaction

In our study, 80% of parents were "very satisfied" with polyolefin mesh dressings, a notable increase from 56% in the conventional group. Similar observations were made by: Das et al. (2019) [14] , who surveyed parents and found higher satisfaction with dressing techniques that minimized dressing changes and pain. Ahmed et al. (2016) [15] reported that quicker recovery and fewer visible complications led to improved satisfaction scores among caregivers. Rao et al. (2021) [16] also concluded that polyolefin mesh facilitated better parental feedback due to ease of wound monitoring and fewer re-dressings. Caregiver perception is particularly important in pediatric surgery, making polyolefin mesh a favorable choice.

6. Dressing-Related Infections and Wound Environment

Though not directly measured in our study, previous research has shown polyolefin mesh to be associated with reduced infection rates: Chaudhary et al. (2018) [17] reported fewer dressing-related infections in surgeries where antimicrobial-impregnated polyolefin mesh was used. Banerjee et al. (2022) [18] emphasized that the micro-porous design helps maintain a sterile wound environment by allowing airflow while preventing microbial colonization.

This suggests that incorporating antimicrobial agents into polyolefin mesh may enhance its infection-prevention potential further.

7. Dressing Change and Ease of Application

Polyolefin mesh dressings are easier to apply and remove without causing trauma: Nandha and Mehta (2020) [19] observed less need for anesthesia during dressing change in the mesh group. In a other study by Agarwal et al. (2017) [20] cited less bleeding and faster dressing times with mesh application in comparison to gauze or adhesive pads. Jain and Paul (2019) [21] also highlighted the economic benefits due to fewer dressing changes and associated resource usage. This has significant implications for healthcare resource management and patient throughput in outpatient settings. Polyolefin Barrier Mesh dressing offers better prevention of post operative oedema and thereby improves outcomes in penile reconstructive surgeries. Evidence from first-hand use over the past year will help guide future prospective studies and potential protocol changes.

CONCLUSION

The cumulative evidence from our study and a wide array of supporting literature confirms that polyolefin mesh dressings provide superior outcomes compared to conventional methods across multiple parameters: reduced edema and pain, lower complication rates, improved functional scores, higher satisfaction, and easier postoperative care. These advantages make it a strong candidate for standard practice in hypospadias and other pediatric surgeries. These benefits make it a promising alternative to conventional dressings and support its use in standard postoperative protocols for pediatric urological procedure.

Limitations of the Study

1. Small sample size may limit generalizability.
2. Follow-up duration of 3 months may not capture long-term complications.
3. Single-center study; results need validation in multi-center trials.
4. Blinding of evaluators was not done, introducing potential observer bias.

DECLARATIONS:

Conflicts of interest: There is no any conflict of interest associated with this study
Consent to participate: As this is a retrospective analysis of collected data, waiver of consent has been acorded.
Consent for publication: There is consent for the publication of this paper.
Authors' contributions: Author equally contributed the work.

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