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Original Article

Outcome of Small-Diameter Urethrocutaneous Fistula Repair: By Ligation with Cauterization versus only Ligation Technique

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Abstract

Urethrocutaneous fistula (UCF) remains the most prevalent and taxing complication following hypospadias surgery, necessitating secondary interventions that are often fraught with high recurrence rates. This article presents a comprehensive study comparing two surgical modalities for the management of small-diameter UCF (≤ 4 mm) in pediatric patients: ligation with diathermy cauterization of the external epithelium versus only ligation. Through a prospective randomized controlled trial involving 46 patients at the Dhaka Shishu (Children) Hospital, this research evaluates operative time, hospital stay, recurrence rates, and postoperative complications. While both techniques demonstrate high efficacy, the integration of diathermy cauterization offers a theoretical advantage in obliterating the epithelial lining of the fistula tract, potentially reducing the risk of recurrence. Comparing success rate and complications between groups there was no statistically significant differences. This article provides a deep dive into the historical, embryological, and clinical frameworks surrounding hypospadias and its complications, offering a professional roadmap for pediatric urologists and surgeons.

Keywords: Hypospadias, urethro-cutaneous fistula, recurrence, ligation, cauterization.

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Chapter 1: Introduction

Hypospadias is a complex congenital malformation characterized by the incomplete development of the male urethra, resulting in a meatus that is positioned ventrally and proximally to the normal glans site[1-4]. This arrest in development often involves the foreskin and the ventral aspect of the penis, frequently accompanied by chordee (ventral curvature). Epidemiological data suggests an incidence of approximately 1 in 250 newborns, or roughly 1 in 125 live male births, making it one of the most common urogenital anomalies encountered in pediatric surgery. The contemporary surgical paradigm emphasizes early intervention, typically between 6 and 18 months of age. The primary objectives of hypospadias repair are dual: functional and aesthetic. Despite advancements in surgical techniques—most notably the Tubularized Incised Plate (TIP) or Snodgrass repair- the occurrence of urethra-cutaneous fistula (UCF) remains a significant hurdle[5-6]. UCF is defined as an abnormal epithelialized communication between the neo-urethra and the skin. Its incidence varies widely depending on the severity of the initial hypospadias and the technique used, but it remains the "Achilles' heel" of hypospadias surgery. The management of UCF is historically challenging[7-10]. While large fistulae often require complex flap procedures (such as dartos or tunica vaginalis flaps), small-diameter fistulae

(≤4 mm) present a unique opportunity for simpler, less invasive techniques[11-13]. Simple ligation of the fistula tract is a common practice, particularly in resource- limited settings like Bangladesh, due to its technical ease. However, the recurrence of the fistula after simple ligation remains a concern, often attributed to the persistence of the epithelial lining within the tract. Recent literature has suggested that cauterizing the external epithelium of the dissected fistula tract before ligation may enhance the success rate by ensuring the complete destruction of the epithelial bridge, thereby promoting primary intention healing of the underlying connective tissue. This study aims to fill that void by providing a rigorous comparison between ligation with cauterization and simple ligation. The integration of low-frequency diathermy cauterization of the external epithelium of the fistula tract, combined with ligation, results in superior outcomes and lower recurrence rates compared to simple ligation alone for small-diameter UCF. Our aim of the study was to evaluate and compare the clinical outcomes of small-diameter UCF repair using ligation with cauterization versus simple ligation.

The modern era was ushered in by the Snodgrass (1994) technique, which utilized the urethral plate incision to allow for a tension-free tubularization. However, as techniques became more sophisticated, the focus shifted from "how to build the urethra" to "how to prevent the fistula."

A profound understanding of penile anatomy is critical for successful UCF repair. The penis consists of three erectile bodies: the paired corpora cavernosa and the single corpus spongiosum, which houses the urethra. For fistula repair, the preservation of the subdermal plexus is vital to prevent tissue necrosis and subsequent recurrence. A fistula is, by definition, a tract lined with epithelium. In the context of hypospadias repair, a UCF forms when there is a breakdown in the suture line or tissue necrosis, allowing urine to escape and eventually epithelializing the path between the urethra and the skin. Factors contributing to UCF formation include: ischemia, tension, distal obstruction and infection. Jamal et al. (2010) reported that tight ligation combined with fulguration of the epithelium was highly successful in a small cohort[14]. This technique relies on the principle that destroying the epithelial lining of the tract converts a "fistula" into a "simple wound," which can then heal via secondary intention or primary closure. Conversely, Karakus et al. (2017) advocated for simple ligation for fistulae ≤2 mm, reporting excellent results[15]. The debate remains whether the thermal injury from cauterization aids healing by removing epithelium or hinders it by causing localized necrosis.

Chapter 2: **Methodology**

This research was conducted as a prospective randomized controlled trial (RCT) at the Dhaka Shishu (Children) Hospital. The study spanned from October 2017 to February 2020. A total of 46 pediatric patients with small-diameter UCF (≤4 mm) were enrolled. Inclusion criteria were limited to patients with solitary coronal or penile fistulae. Patients with multiple fistulae, active urethral strictures, or meatal stenosis were excluded to ensure that the outcomes were not confounded by distal obstruction.

Patients were randomized via a lottery system into two groups: Group A: Ligation with low-frequency diathermy cauterization of the external epithelium. Group B: Ligation without cauterization. All patients underwent a thorough clinical evaluation and routine hematological screening. Urine cultures were obtained to ensure sterility, as pre-operative urinary tract infections (UTIs) are a known risk factor for surgical failure.

Operative Steps for Ligation & Cauterization group: Saline irrigation with proximal pressure was used to pinpoint the fistula. An 8Fr feeding tube was inserted into the urethra to prevent narrowing during ligation. The fistula tract was circumferentially dissected down to its base at the neo-urethra. The base was ligated with 6/0 Vicryl. The external epithelium of the dissected tract (the part above the ligature) was cauterized using a fine-tip diathermy probe (Fig-1). A second layer of local dartos/subcutaneous tissue was imbricated over the stump. The skin was closed with 5/0 Vicryl Rapid in an overlapping fashion (Fig- 2). Operative Steps for only Ligation group: The steps were identical to Group A, with the critical omission of the diathermy cauterization step. The tract was dissected and ligated, followed by the same multi-layer closure. Postoperatively all patients received intravenous antibiotics (Cephradine) and analgesics. Urethral stents were typically removed within 24 hours. Follow-up was scheduled at 2 weeks, 6 weeks, 3 months, and 6 months to monitor for recurrence and complications.



Photograph 1: Cauterization of external epithelium of the tract; Photograph 2: After closure of skin

Chapter 3: Results

Consolidated Comparison of Study Groups A and B (N=46)

Merged summary of demographic, clinical, operative, and postoperative characteristics across Tables I–X. ns = not significant (P value from chi-square test for categorical variables and unpaired t-test for continuous variables, P>0.05 unless stated otherwise).

Characteristic	Group A (n=23)	Group B (n=23)	P value
Demographic characteristics			
Age (months)			
12–24	2 (8.7)	2 (8.7)	0.696ns
25–36	5 (21.7)	8 (34.8)	0.326ns
37–48	7 (30.4)	2 (8.7)	0.067ns
49–60	4 (17.4)	4 (17.4)	0.650ns
>60	5 (21.7)	7 (30.4)	0.502ns
Clinical characteristics			
Type of hypospadias			
Anterior	15 (65.2)	12 (52.2)	0.369ns
Middle	8 (34.8)	11 (47.8)	0.134ns
Site of fistula			
Coronal	14 (60.9)	15 (65.2)	0.760ns
Mid-penile	3 (13.0)	2 (8.7)	0.500ns
Proximal penile	1 (4.3)	3 (13.0)	0.308ns
Sub-coronal	5 (21.7)	3 (13.0)	0.350ns
Size of fistula (mm)			
<2	15 (65.2)	16 (69.6)	0.753ns
2–4	8 (34.8)	7 (30.4)	0.750ns
Operative & postoperative outcomes			
Operation time (min) Mean±SD	26.8 ± 3.6	27.0 ± 4.2	0.851ns
Wound infection			
Present	2 (8.7)	3 (13.0)	0.500ns
Absent	21 (91.3)	20 (87.0)	
Wound disruption			
Present	1 (4.3)	2 (8.7)	0.500ns
Absent	22 (95.7)	21 (91.3)	
Hospital stays (days)			
≤3	17 (73.9)	16 (69.6)	
>3	6 (26.1)	7 (30.4)	
Mean±SD	3.74 ± 1.39	3.91 ± 1.38	0.106ns
Recurrence of fistula			
Present	2 (8.7)	4 (17.4)	0.332ns
Absent	21 (91.3)	19 (82.6)	
Site of fistula recurrence (n=6) *	(n=2)	(n=4)	
Coronal	1 (50.0)	3 (75.0)	0.600ns
Sub-coronal	1 (50.0)	1 (25.0)	0.540ns

**Site of fistula recurrence is reported among the subset of patients who developed recurrence (Group A, n=2; Group B, n=4), not among the full study sample (n=46).*

The age distribution was comparable between both groups, with the majority of patients falling in the 25–60 months range. There was no statistically significant difference in age (p=0.696).

Regarding the initial hypospadias type, 65.2% of Group A and 52.2% of Group B had anterior hypospadias. The most common site for the resulting fistula was the coronal region (60.9% in Group A and 65.2% in Group B). The mean operative time was 26.8 ± 3.6 minutes for Group A and 27.0 ± 4.2 minutes for Group B. The addition of cauterization did not significantly increase the surgical duration (p=0.851). Most patients were discharged on the 3rd postoperative day. The mean stay was 3.74 days for Group A and 3.91 days for Group B (p=0.106). Wound Infection occurred in 8.7% of Group A and 13.0% of Group B. Wound disruption observed in 4.3% of Group A and 8.7% of Group B. The primary outcome of interest showed a recurrence rate of 8.7% (2 patients) in Group A versus 17.4% (4 patients) in Group B. While the recurrence rate in the cauterization group was 50% lower than the simple ligation group, the difference did not reach statistical significance (p=0.332) within this sample size.

Chapter 4: Discussion

The repair of a UCF is often more difficult than the primary hypospadias repair. The presence of scar tissue, reduced vascularity, and the psychological burden on the parents make every subsequent surgery higher stakes[16]. Small fistulae (≤4 mm) are deceptive; while they seem easy to close, their recurrence rate in literature ranges from 10% to 30%. The use of diathermy in penile surgery has historically been viewed with caution due to the risk of thermal injury to the corpora or the urethra[17]. However, our study supports the findings of Jamal et al. (2010), suggesting that localized, low-frequency cauterization is safe. The biological rationale for cauterization is the destruction of the epithelial lining. In simple ligation, if any portion of the epithelial tract remains distal to the ligature, it may form a micro-cyst or provide a pathway for epithelial migration if the suture dissolves prematurely. Cauterization creates a denuded surface that facilitates fibroblastic activity and solid tissue fusion. Our recurrence rate of 8.7% in the cauterization group is consistent with international benchmarks for successful fistula repair. In contrast, the 17.4% recurrence in the simple ligation group highlights the limitations of that technique. Interestingly, our data showed that the majority of recurrences occurred at the coronal site. This is consistent with the findings of Elbakry (2001), who noted that coronal fistulae are the most difficult to treat due to the lack of substantial subcutaneous tissue for multi-layered closure and the high mobility of the glans[18]. One of the critical factors for success identified in this study was the use of an intraoperative stent (8Fr feeding tube). This ensures that the ligation does not inadvertently stenose the neo-urethra. Furthermore, the "second layer"

of subcutaneous tissue is non-negotiable[19]. Even in small fistulae, a single-layer closure is almost destined to fail.

The primary limitation of this study is the sample size. While the trend favored cauterization, a larger cohort would be required to achieve statistical significance for the recurrence rate. Additionally, the study was conducted at a single center, which may limit the generalizability of the results.

Chapter 5: Conclusion and Recommendations

Conclusion

Both ligation with cauterization and simple ligation are viable, quick, and technically accessible methods for repairing small-diameter urethro-cutaneous fistulae in pediatric patients. However, ligation combined with diathermy cauterization of the external epithelium demonstrated a lower absolute recurrence rate (8.7% vs 17.4%) and fewer wound complications.

Recommendations

Multi-center trials with larger sample sizes are recommended to further validate the statistical superiority of the cauterization technique.

Chapter 6: Acknowledgement

Lastly, I give my highest regards to the parents all my study subjects, who consented without any hesitation for all examinations and investigations.

Chapter 7: References

1. Duckett JK, Baskin LS. Hypospadias. In: Gillenwater JY, Grayhack JT, Howards SS, Duckett JW, editors. Adult and pediatric urology. 3rd ed. St Louis: Mosby-Year Book; 1996. p. 2549-2589.
2. Baskin LS. Hypospadias. In: Coran AG, Adzick NS, Krummel TM, Laberge JM, Shamberger RC, Caldamone AA, editors. Pediatric Surgery. 7th ed. Philadelphia: Mosby Elsevier; 2012.
3. Hadidi AT. Men behind principles and principles behind techniques. In: Hadidi AT, Azmy AF, Hypospadias surgery: An illustrated guide. Heidelberg: Springer-varlag; 2004.p. 20.
4. Murphy JP, 2014. Hypospadias. In: Holcomb, G.W., Murphy, P.J. and Ostlie, D.J., editors. Ashcraft's Pediatric Surgery. 6th ed. Philadelphia: Elsevier Saunders; pp. 794-809.
5. Snodgrass W. Tubularized incised plate urethroplasty for distal hypospadias. J Urol. 1994;151(2):464-465.
6. Al-Ghorairy BA, et al. Analysis of five-year experience with tubularized incised plate urethroplasty. Eur J Pediatr Surg. 2009;19(2):90-95.
7. Jumbi T, et al. Urethro-cutaneous Fistula After Hypospadias Repair: A Single Institution Study. Ann Afr Surg, 2019;16(2):59-63.
8. Singh AP, et al. A simple procedure for management of urethrocutaneous fistula after hypospadias repair. Menoufia Medical Journal, 2019;32(4):1223.
9. Awad M.S. A simple novel technique [PUIT] for closure of urethrocutaneous fistula after hypospadias repair: Preliminary results. Indian Journal of Plastic Surgery, 2005;38 (2):114-118.
10. Malone PR. Urethrocutaneous fistula: preserve the tract and turn it inside out: the PATIO repair. BJU international, 2009;104(4):550-554.
11. Ahuja RB. A de-epithelialized 'turnover dartos flap' in the repair of urethral fistula. J Plast Reconstr Aesthet Surg. 2009;62(3):374-379.
12. Neilson AG, et al. Repair of hypospadias fistula using a penile skin advancement flap with penile dartos interposition. Journal of pediatric urology, 2013;9 6):890-894.
13. Routh JC, et al. Tunneled tunica vaginalis flap is an effective technique for recurrent urethrocutaneous fistulas following tubularized incised plate urethroplasty. The Journal of urology, 2006;176(4):1578-1581.
14. Jamal YS, et al. Management of small urethrocutaneous fistula by tight ligation with fulguration. Ann Pediatr Surg. 2010;6(3-4):150-153.
15. Karakus SC, et al. A simple technique for small-diameter urethrocutaneous fistula repair: ligation. J Pediatr Urol. 2017;13(1):88-90.
16. Majstorovic M, et al. Psychosexual Functioning Outcome Testing after Hypospadias Repair. Healthcare, 2020;(8):32.
17. Altakhais TI. Electrosurgery use in circumcision in children: Is it safe? Urology Annals, 2017;(9):1-3.
18. Elbakry A. Management of urethrocutaneous fistula after hypospadias repair: 10 years' experience. BJU Int. 2001;88(6):590-595.
19. Bakan V, et al. A Dorsal double-layer dartos flap for preventing fistulae formation in the Snodgrass technique. Urologia internationalis, 2007;78(3): 241-244.