E-ISSN: 2616-3470
P-ISSN: 2616-3462

https://www.surgeryscience.com
2024; 8(1): 34-38
Received: 21-11-2023
Accepted: 28-12-2023

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A comparative study on primary hypospadias repair using dartos fascia flap versus tunica vaginalis flap in paediatric age group

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DOI: https://doi.org/10.33545/surgery.2024.v8.i1a.1046

Abstract
Background: The most frequent complication of hypospadias surgery is the development of fistulas, which necessitates a subsequent surgical procedure. Various methods for supplying vascularized soft tissue coverage to the neourethra have been documented. The components consist of de-epithelized skin, corpus spongiosum, dartos fascia, and tunica vaginalis. The aim of our study was to compare the results of standard tubularized incised plate urethroplasty (TIP) repair employing dartos flap and tunica vaginalis flaps in patients of hypospadias. The tubularized incised plate (TIP) urethroplasty is the predominant method used to address hypospadias. Nevertheless, urethrocutaneous fistula (UCF) remains a prevalent consequence of this procedure. Various methods have been suggested to reduce the occurrence of this problem by supplying vascularized flaps to the neourethra. The objective of the study was to evaluate the results of repairing hypospadias utilizing a tunica vaginalis (TV) flap compared to employing preputial dartos (PD) fascia.
Aim: To compare tunica vaginalis with dartos flap as soft tissue cover in primary hypospadias repair.
Methods: This study was conducted in the Department of Surgery of G S medical college and hospital Hapur. The study focused on patients diagnosed with distal, mid penile, and proximal penile types of hypospadias. The total number of cases examined was 60. A cohort of 30 patients from Group A was intentionally chosen to undergo repair utilizing TVF for the purpose of providing soft tissue coverage. Group B consisted of 30 patients who were similar in age and had the same type of hypospadias.
Conclusions: The current study observed a greater incidence of fistula formation and skin necrosis in the dartos flap group compared to the tunica vaginalis group. The Tunica vaginalis flap clearly outperforms the preputial dartos flap, and we highly advocate its application as a waterproofing second layer in hypospadias instances.

Keywords: Hypospadias, vaginalis, tunica, urethrocutaneous fistula

1. Introduction
Hypospadias surgery is one of the challenging areas in pediatric urology and has undergone continuous evolution even in the well-described surgeries. Hypospadias is the most common male genital tract anomaly with approximately 0.8-8.2 per 1000 male newborns [1]. Tubularized Incised Plate (TIP) urethroplasty, as described by Snodgrass is the method of choice for treating distal and mid shaft hypospadias with a low complication rate [2].

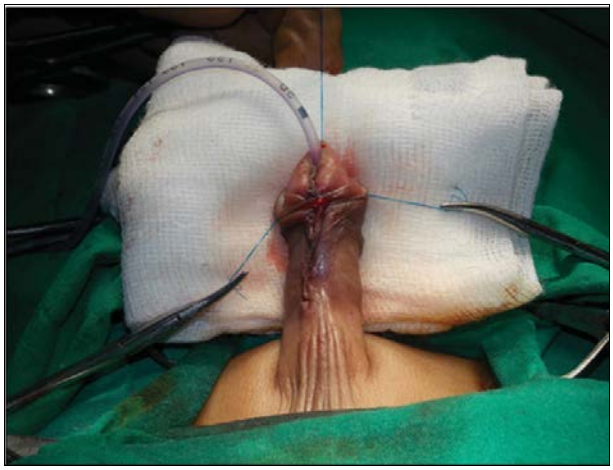

Fig 1: Immediate postoperative photograph of tubularized incised plate urethroplasty with preputial dartos vascular cover showing completed repair

Hypospadias is a congenital abnormality characterized by the incomplete fusion of urethral folds, resulting in the opening of the meatal orifice on the underside of the penis. It has an incidence of 1 in 300 live births [1, 2]. In 1994, Snodgrass introduced the tubularised incised plate (TIP) urethroplasty procedure. Several vascularized flaps, such the dartos flap and tunica vaginalis flap (TVF), were developed to address the issue of blood supply to the repaired area.

Despite significant breakthroughs in urethroplasty methods, complications such as meatal stenosis, urethral stricture, urethrocutaneous fistula (UCF), and urethral diverticulum still occur [3].

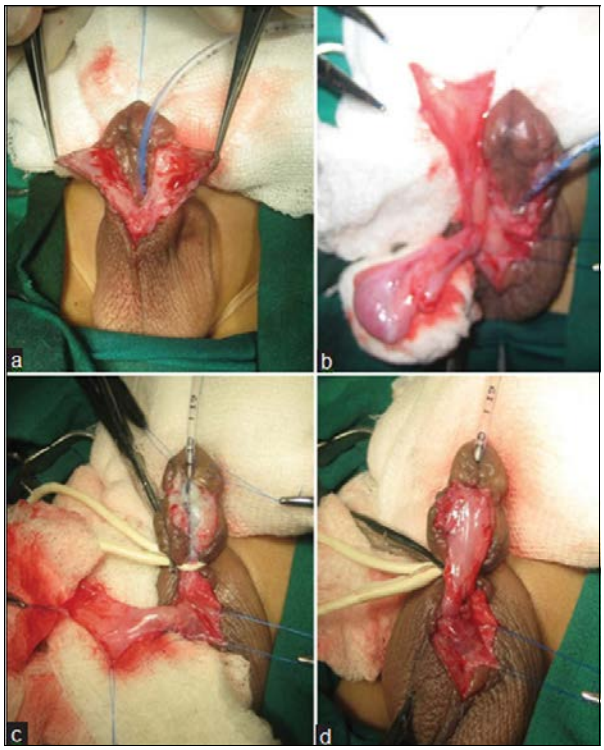

Fig 2: Intraoperative photographs of tubularized incised plate urethroplasty with tunica vaginalis vascular cover. (a) Dissected skin flaps. (b) Testis being delivered into operative field for harvesting tunica vaginalis flap. (c) Harvested tunica vaginalis flap. (d) Tunica vaginalis flap covering neourethra

Fistula formation is the most frequent complication that arises from hypospadias surgery, necessitating the need for re-operation. Various methods for supplying vascularized soft tissue coverage to the neourethra have been documented. The components consist of de-epithelized skin, corpus spongiosum, dartos fascia, and tunica vaginalis [4, 7]. The dartos fascia and tunica vaginalis both offer strong protection to the urethra and serve as a barrier between the suture lines.

Fig 3: Immediate postoperative photograph of tubularized incised plate urethroplasty with tunica vaginalis flap showing completed repair

The most commonly utilized source of Dartos fascia is the dorsal penile skin. Novices may encounter challenges when harvesting dartos fascia due to the need for meticulous and adept dissection in order to elevate the dartos flap while preserving the intrinsic blood supply to the outer skin. When the outer skin is moved to cover the ventral area, it may lose its vitality and result in skin necrosis. The tunica vaginalis flap possesses robust vascularity due to its distinct blood supply, which is independent of the vascularity of the penile skin, in contrast to the dartos fascia.

The selection between the two flaps relies primarily on the surgeon's preference and expertise rather than scientific substantiation. The utilization of TVF has been proposed as a supplementary vascularized covering in TIP urethroplasty and has proven to be efficacious in diminishing the rates of urethrocutaneous fistula (UCF). The aim of this study was to examine the results of standard tubularized incised plate urethroplasty (TIP) repair employing dartos flap and tunica vaginalis flaps in instances of hypospadias.

Fig 4: Clinical photograph of follow-up patient of tunica vaginalis flap repair showing well-healed scar

2. Methods

This study was conducted in the Department of Surgery GS

medical college and hospital Hapur. The patients included in the study were diagnosed with distal, mid penile, and proximal penile types of hypospadias. This study comprised all patients diagnosed with distal, mid penile, and proximal hypospadias who visited the Paediatric Surgery OPD. The total number of cases examined was 60.

2.1 Inclusion criteria

1. Patients who were admitted to the pediatric surgery division of the surgery department were clinically diagnosed with hypospadias, specifically distal, mid penile, and proximal penile cases.
2. All patients who were eligible for primary Snodgrass repair.
3. Patients who expressed a willingness to participate in the study and were open to undergoing postoperative follow-up and evaluations.
4. Male patients aged 12 months to 18 years.

2.2 Exclusion criteria

1. Patients who underwent flap repair, redo surgeries, or had previous inguinoscrotal procedures such as hernia repair, hydrocele repair, or orchidopexy were not included in the study.
2. Patients presenting with penoscrotal, scrotal, and perineal types of hypospadias were not included in the study.
3. Patients who had severe chordee that required the division of the urethral plate were not included in the study and were scheduled for a two-stage repair procedure.

The demographic information of all patients was recorded. A comprehensive history and thorough physical examination were conducted for all patients and documented in the case record sheet. Measurements of the penis were recorded in the case record sheet. Operative risk and postoperative consequences were thoroughly communicated to all patients. All patients provided informed and written consent. Prior to surgery, all patients were instructed to abstain from consuming any food or beverages for a period of 6 hours. All patients received an enema application on the evening before to their surgery. The lower belly, genitalia, and upper thighs were meticulously cleansed with betadine scrub on the evening prior to the procedure. The operative procedure was performed according to the normal protocol. Patients were monitored for a duration of 1 month after surgery, both in the ward and in the outpatient department (OPD). Every surgical complication was recorded. Antibiotics were administered intravenously for a duration of 3 days, after which they were switched to oral administration. The act of dressing occurred on the fifth day. The catheter was extracted on the tenth day. Subsequently, the youngsters were regularly monitored. The data was characterized using descriptive statistics. The chi-square test was employed to analyze categorical data. The Yates correction was implemented. A P value less than 0.05 was deemed to be statistically significant. The study was conducted utilizing the Statistical Package for the Social Sciences (SPSS 12.0 version; SPSS, Inc., Chicago, IL, USA).

3. Results

The patients' ages ranged from 1 to 18 years at the time of surgery for hypospadias. The mean age was 4.690909 years, with a standard deviation of 3.151265. The most prevalent age for undergoing surgery is typically four years old. The median of the distribution was 7 years, as seen in Table 1.

Table 1: Age at time of surgery

<2 years	10	16.66%
2 - <4 years	17	28.33%
4 - <6 years	12	20.0%
6 - <8 years	8	13.33%
8 - <10 years	7	11.66%
10 - <12 years	4	6.66%
12 - <18 years	2	3.33%
Total	60	100%

The number of patients in both flap groups was nearly comparable. The two groups were similar in terms of age and the kind of hypospadias, as shown in Table 2.

Table 2: Age wise use of type of flaps

	Dartos	**TVF**
<2 years	4	5
2 - <4 years	9	8
4 - <6 years	6	6
6 - <8 years	4	4
8 - <10 years	3	3
10 -<12 years	3	3
12 - <18 years	1	1

Table 3: Type of hypospadias

Distal	28
Mid penile	20
Proximal penile	12

The distal variety of hypospadias is the most prevalent, accounting for 46.6% of cases. The next most frequent kind of hypospadias is mid penile, accounting for 33.33% of cases, followed by proximal penile, which accounts for 20.0% of cases (Table 3).

Table 4: Wound Infection

	No	**Mild**	**Moderate**	**Severe**
TVF	24 (80.00%)	5 (16.6%)	1 (3.33%)	0 (0%)
Dartos	16 (53.3%)	10 (33.3%)	3 (10.0%)	1 (3.33%)

Chi square- 5.05, d.f.- 1, p value- <0.05

Within the Dartos flap group, a total of 33.3% of patients experienced a moderate infection characterized by superficial skin discharge. This infection was effectively treated with the use of dressings and antibiotics tailored to the specific sensitivities identified during culture testing. 10.7% of patients experienced a significant wound infection, resulting in partial wound dehiscence and finally a urethrocutaneous fistula. A total of 3.33% of patients experienced a serious wound infection, which resulted in full wound dehiscence and ultimately led to the establishment of a urethrocutaneous fistula.

Within the TVF group, a total of 16.6% of patients experienced a minor infection characterized by superficial skin discharge. This condition was effectively treated with the use of dressing and antibiotics, administered based on the results of culture sensitivity testing. 3.3% of patients experienced a significant wound infection, resulting in partial wound dehiscence and ultimately leading to a urethrocutaneous fistula (Table 4).

Table 5: Wound Dehiscence

TVF	23 (76.6%)	5 (16.6%)	1 (3.3%)	**1 (3.3%)**
Dartos	18 (60.0%)	7 (23.33%)	3 (10.0%)	2 (6.66%)

Chi square- 2.094, d.f.- 3, p value- >0.05

Within the Dartos flap group, a quarter of the patients experienced a slight separation of the wound (1-2 sutures), which was treated by applying dressings and administering antibiotics based on the results of culture sensitivity tests. 10.0% of patients experienced partial wound dehiscence, which ultimately resulted in a urethrocutaneous fistula. Complete wound dehiscence occurred in 7.1% of patients, resulting in the establishment of urethrocutaneous fistula. In TVF group, 18.5% patients suffered mild wound dehiscence (1 -2 sutures) which was handled by dressing and antibiotics as per culture and sensitivity. Partial wound dehiscence occurred in 3.3% of patients, ultimately resulting in the formation of a urethrocutaneous fistula. Table 5 shows that 3.3% of patients experienced full wound dehiscence, which ultimately resulted in the formation of a urethrocutaneous fistula.

Table 6: Residual chordee according to type of flap

TVF	2	28
Dartos	2	28

Both the Dartos group and the TVF group had an equal number of patients (2) who experienced residual chordee, as shown in Table 6.

Table 7: Residual Torsion

TVF	1	29
Dartos	1	29

Both the TVF group and the Dartos group each included one patient who experienced residual torsion, as indicated in Table 7.

4. Discussion

Infection poses a significant risk to the healing process and can be averted through preoperative povidine iodine cleaning, administration of prophylactic antibiotics, utilization of antibiotic solution during surgery, prevention of hematoma, and local application of Mercurochrome.

Within the TVF group, only one patient (3.7%) experienced skin necrosis, whereas in the Dartos group, five patients (17.86%) acquired skin necrosis. The utilization of the dartos flap may result in impairment to the inherent blood circulation to the external skin, hence increasing the incidence of necrosis. TVF is independent of the skin, hence the ventral skin cover is always intact. Two almost identical trials demonstrated that no patients experienced skin necrosis. A study conducted by Dhua AK *et al* shown that out of the patients included in the dartos flap group, three individuals with skin necrosis were treated conservatively, but none of the patients in the TVF group required such management.

Within the Dartos flap group, a quarter of the patients experienced a slight separation of the incision, including 1-2 sutures. This was treated by applying dressings and administering antibiotics based on the results of culture sensitivity tests. 10.7% of patients experienced partial wound dehiscence, which ultimately resulted in a urethrocutaneous fistula. Complete wound dehiscence occurred in 7.1% of patients, resulting in the establishment of urethrocutaneous fistula. Within the TVF group, a total of 18.0% of patients experienced a slight wound dehiscence, characterized by the separation of 1-2 sutures. This condition was effectively treated with the application of dressings and antibiotics, according to the specific culture and sensitivity results. 3.7% of patients experienced partial wound dehiscence, which ultimately resulted in the formation of an urethrocutaneous fistula. Complete wound dehiscence, which ultimately results in urethrocutaneous fistula, occurred in 3.7% of patients. Wound dehiscence can occur due to various factors such as infection, edema, hematoma, erections, reduced blood flow, weakened suture material, tension at the suture line, and forceful removal of dressing.

Applying precise surgical technique, by opposing the dartos fascia over the urethroplasty and aligning the skin borders correctly, together with appropriate postoperative care, can effectively prevent it. It is not recommended to do resuturing on the raw area. Irrespective of the cause of tissue breakdown, it is necessary to remove devitalized and necrotic tissue before proceeding with any surgical repair. In a separate investigation, it was shown that none of the patients experienced wound dehiscence.

The likelihood of torsion occurring is higher in a single dartos flap (with mild glanular torsion at 90.7% and significant glanular torsion at 9.3%) compared to a double dartos flap (with 0% occurrence of torsion). The problem originates from insufficient mobilization of the vascular pedicle and excessive traction applied to the pedicle.

5. Conclusion

In this study, the author observed a greater incidence of fistula formation and skin necrosis in the group that underwent the dartos flap procedure, in comparison to the group that underwent the tunica vaginalis procedure. The Tunica vaginalis flap clearly surpasses the preputial dartos flap and we highly advocate its application as a waterproofing second layer in hypospadias situations.

The findings of the present study reflect the work conducted at a peripheral tertiary facility in India, specifically in the field of hypospadiology. The author suggests conducting a large-scale trial in order to establish the hypothesis with statistical significance.

6. Conflict of Interest

Not available

7. Financial Support

Not available

8. References

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How to Cite This Article
Ranjay N, Garg P, Mahatme T, Kumar A, Gaur M. A comparative study on primary hypospadias repair using dartos fascia flap versus tunica vaginalis flap in paediatric age group. International Journal of Surgery Science. 2024;8(1):34-38.