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SUPERIORITY OF TUNICA VAGINALIS FLAP OVER DARTOS FLAP AS A WATERPROOFING LAYER IN TUBULARISED INCISED PLATE URETHROPLASTY (TIP) REPAIR FOR PROXIMAL AND MIDPENILE HYPOSPADIAS CASES

Surgery

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ABSTRACT

INTRODUCTION- Hypospadias is one of the most common malformations of male genitalia, with a traditionally quoted incidence of 1 in 300 male births. However, epidemiological evidence suggests that in developed Western countries the incidence is increasing and may be as high as 8 in 1000 male births. Both genetic and environmental factors are implicated in the cause and numerous theories have been proposed about both the cause and the changing prevalence[2-4], several techniques of providing vascularized soft tissue cover to neourethra have been described which includes dartos fascia and tunica vaginalis flap.Both dartos fascia and tunica vaginalis provide robust cover to the urethra and act as a barrier between the sutures lines. The purpose of our study was to compare outcomes of standard tubularised incised plate urethroplasty (TIP) repair using dartos flap and TVF in different type of hypospadias cases.

MATERIAL AND METHODS- This study was carried out in the Department of Surgery (Paediatric Surgery Division) of Pt. J. N. M. Medical College and associated Dr. B. R. A. M. Hospital, Raipur (C.G.) in patients diagnosed to had distal, mid penile and proximal penile type of hypospadias. The study was carried out during the period from February 2016 to September 2017. Total no of cases studied were 55. All admitted patients for primary Snodgrass repair were randomized into two groups by Simple Random method to avoid selection bias.Group A of 27 patients were prospectively selected for repair using TVF for soft tissue cover. Group B of 28 Patients, comparable in age and type of hypospadias, who underwent TIP repair using dartos flap as soft tissue cover. Descriptive statistics were employed to characterize the data. Fischer exact test was used for categorical data. A *P* value of <0.05 was considered statistically significant.

RESULTS- Maximum number of patients belongs to age group 2 years - 4 years (i.e., 14.5 %). Next common group being 4 -<6 years (11%). Out of 55 patients, 21 patients (31.18 %) had no chordee, 32 patients (58.18%) had superficial chordee and 2 patients (3.64%) had deep chordee. In mid penile and proximal hypospedias cases dartos group had higher rate of fistula formation than the TVF group, while fistula rate in distal penile casws were almost similar. Skin necrosis rate was higher in dortos group than TVF group.

CONCLUSION- Tunica vaginalis flap reduces the fistula rate and is superior to dartos flap as a waterproofing layer for TIP repair in midshaft and proximal penile hypospadias.

KEYWORDS

Hypospadias, Tubularised incised plate urethroplasty, Dartos flap, Tunica vaginalis flap

INTRODUCTION

Hypospadias is one of the most common malformations of male genitalia, with a traditionally quoted incidence of 1 in 300 male births. However, epidemiological evidence suggests that in developed Western countries the incidence is increasing [1], and may be as high as 8 in 1000 male births. Both genetic and environmental factors are implicated in the cause and numerous theories have been proposed about both the cause and the changing prevalence[2-4]. There is no single satisfactory way of classifying hypospadias. Despite obvious limitations, preoperative meatal position remains the most commonly used criterion. By classification at least 70% of hypospadias is either glanular or distal penile, 10% mid- penile, and 20% the more severe proximal types. The commonest complication of hypospadias surgery is fistula formation which requires re-operation. Several techniques of providing vascularised soft tissue cover to neourethra have been described. They include de-epithelized skin, corpus spongiosum, dartos fascia[5] and tunica vaginalis[6, 7]. Both dartos fascia and tunica vaginalis provide robust cover to the urethra and act as a barrier between the sutures lines. Dartos fascia harvested from the dorsal penile skin, is most frequently used. The outer skin when transposed ventrally to provide skin cover may consequently devitalise leading to skin necrosis. The tunica vaginalis flap has sound vascularity, as it has a separate blood supply and does not depend on the vascularity of penile skin, unlike the dartos fascia. Use of TVF has been suggested as an additional vascularised cover in TIP urethroplasty and is effective in reducing the UCF rates. The purpose of our study was to compare outcomes of standard tubularised incised plate urethroplasty (TIP) repair using dartos flap and TVF in distal, mid penile and proximal penile type of hypospadias particularly in relation to the occurrence of UCF and other complications.

MATERIALAND METHODS

This study was carried out in the Department of Surgery (Paediatric Surgery Division) of Pt. J. N. M. Medical College and associated Dr. B. R. A. M. Hospital, Raipur (C.G.) in patients diagnosed to had distal, mid penile and proximal penile type of hypospadias. The study was carried out during the period from February 2016 to September 2017. Total no of cases studied were 55.

INCLUSION CRITERIA:-

- Patients with hypospadias (distal, mid penile and proximal penile) suitable for primary Snodgrass repair.
- Patients who were willing to participate in study and would be willing to submit to postoperative follow-up and evaluations
- Age group 12 months to 14 years of male patients.

EXCLUSION CRITERIA

- Patients not suitable for primary TIP repair.
- Patients with only flap repair, redo cases and previous inguinoscrotal surgery i.e. hernia, hydrocele or orchidopexy.
- Patients with penoscrotal, scrotal and perineal type of hypospadias.
- Patients with deep chordee requiring division of urethral plate.

METHODOLOGY

All admitted patients for primary Snodgrass repair were randomized into two groups by Simple Random method to avoid selection bias.Group A of 27 patients were prospectively selected for repair using TVF for soft tissue cover. Group B of 28 Patients, comparable in age and type of hypospadias, who underwent TIP repair using dartos flap as soft tissue cover. One patient with particular age group and type of hypospadias was allotted in group A and next patient with similar

age group and type of hypospadias was allotted in group B. Patients were similar in terms of chordee present in both group and preoperative hormonal therapy given to rule out confounding factor. All surgeries were performed by same surgeon.

The demographic details of all patients were noted. Detailed history and physical examination were done in all patients and noted in case record sheet. Penile anthropometry were noted in case record sheet. All patients were explained about operative risk and postoperative complications. Informed and written consent were taken from all patients. All patients were kept nil by mouth for 6 hours before surgery. Enema application was given to all patients evening before surgery. Lower abdomen, genitalia and upper thighs were thoroughly scrubbed with betadine scrub night before surgery. Both the operative procedure were performed as per standard protocol. Patients were followed for 1 month postoperatively in wards and OPD. All postoperative complications were noted. Intravenous antibiotics were given for 3 days, followed by oral antibiotics. Dressing was done at 5th day. Catheter was removed at 10th day. Later the children were followed periodically. Descriptive statistics were employed to characterize the data. Fischer exact test was used for categorical data. A *P* value of <0.05 was considered statistically significant. The analysis was carried out using the Statistical Package for the Social Sciences (SPSS 12.0 version; SPSS, Inc., Chicago, IL, USA).

RESULTS

TABLE-1. AGEWISE DISTRIBUTION OF HYPOSPADIAS CASES

AGE GROUP	NO. OF PATIENTS	TYPE OF HYPOSPADIAS		
		DISTAL	MID PENILE	PROXIMAL PENILE
<2 years	8	6	0	2
2 - <4 years	17	7	6	4
4 - <6 years	12	6	4	2
6 - <8 years	6	2	2	2
8 - 10 years	6	4	2	0
10 -12 years	4	0	2	2
12 <14 years	2	0	2	0

Patients were randomly assigned into group by simple random method. A next patient with similar type of hypospadias was assigned in other flap group. There were almost equal numbers of patients in both groups of flap. Both groups were comparable in terms of age and type of hypospadias. Maximum number of patients belongs to age group 2 years - < 4 years (i.e., 14.5 %). Next common group being 4 - <6 years (11%). **[Table-1]**

TABLE-2. PREOPERATIVE HORMONAL STIMULATION

TYPE OF HYPOSPADIAS	TVF	DARTOS
DISTAL	4	4
MID PENILE	3	3
PROXIMAL	1	1
TOTAL	8	8

Preoperative hormonal stimulation given to 18 number of patients (32.7 %). Injection Testosterone enanthate 2mg/kg was given for 3 times 3weeks apart and last dose 3 weeks prior to surgery. 8 patients with distal hypospadias, 6 patients with mid penile hypospadias and 2 patients with proximal penile hypospadias were given preoperative hormonal stimulation. Each group had equal number of patients with both the type of flap. **[Table-2]**

TABLE-3. TYPE OF CHORDEE PRESENT

TYPE OF HYPOSPADIAS	NO CHORDEE	SUPERFICIAL CHORDEE	DEEP CHORDEE
DISTAL	15	10	0
MID PENILE	6	12	0
PROXIMAL PENILE	0	10	2

Out of 55 patients, 21 patients (31.18 %) had no chordee, 32 patients (58.18%) had superficial chordee and 2 patients (3.64%) had deep chordee. In distal hypospadias patients, 15 patients (60%) had no chordee and 10 patients (40%) had superficial chordee. In mid penile hypospadias patients, 6 patients (33.3 %) had no chordee and 12 patients (66.7%) had superficial chordee. In proximal penile hypospadias patients, 10 patients (83.33%) had superficial chordee and 2 patients (16.67%) had deep chordee. **[Table-3]**

TABLE- 4. TYPE OF FLAP USED

TYPE OF HYPOSPADIAS	TVF	DARTOS
DISTAL	12	13
MID PENILE	9	9
PROXIMAL PENILE	6	6

In distal hypospadias group, 12 patients underwent TVF flap repair and 13 patients underwent dartos flap repair. In mid shaft hypospadias group, 9 patients underwent TVF flap and 9 patients underwent dartos flap. In proximal penile hypospadias, 6 patients underwent TVF flap and 6 patients underwent dartos flap. **[Table-4]**

TABLE-5. URETHROCUTANEOUS FISTULA FORMATION RATE

TYPE OF HYPOSPADIAS	DARTOS	TVF
DISTAL	3(23%)	3(25%)
MID PENILE	5(55.5%)	2 (22.2%)
PROXIMAL PENILE	4(66.67%)	0(0%)
TOTAL	12 (42.86%)	5(17.86%)

In distal hypospadias group, dartos flap had 23% rate of urethrocutaneous fistula formation and TVF flap had 25% rate of urethrocutaneous fistula formation. In mid penile hypospadias group, dartos flap had 55.55% rate of urethrocutaneous fistula formation and TVF flap had 22.2% rate of urethrocutaneous fistula formation. In proximal penile hypospadias group, dartos flap had 66.67% of urethrocutaneous fistula formation and TVF flap had 0% rate of urethrocutaneous fistula formation. **[Table-5]**

TABLE-6. MEATAL STENOSIS/ NEOURETHRAL STRICTURE RATE

TYPE OF HYPOSPADIAS	DARTOS	TVF
DISTAL	1/13 (7.7%)	1/12 (8.3%)
MID PENILE	1/9 (11.1%)	2/9 (22.2%)
PROXIMAL PENILE	1/6 (16.67%)	1/6 (16.7%)
TOTAL	3/28 (10.7%)	4/27 (14.8%)

In distal hypospadias group, dartos flap had 7.7% rate of meatal stenosis/ neourethral stricture formation and TVF had 8.3% rate of meatal stenosis/ neourethral stricture formation. In mid penile hypospadias group, dartos flap had 11.1% rate of meatal stenosis/ neourethral stricture formation and TVF had 22.2% rate of meatal stenosis/ neourethral stricture formation. In proximal penile hypospadias group, dartos flap had 16.67% of meatal stenosis/ neourethral stricture formation and TVF had 16.7% rate of meatal stenosis/ neourethral stricture formation. Overall, dartos flap group had10.7% rate of meatal stenosis/ neourethral stricture formation and tunica vaginalis flap had14.8% rate of meatal stenosis/ neourethral stricture formation. **[Table-6]**

TABLE-7. NEOURETHRAL DIVERTICULA/ ACQUIRED MEGALOURETHRA RATE

TYPE OF HYPOSPADIAS	TVF	DARTOS
DISTAL	0 (0%)	0 (0%)
MID PENILE	0(0%)	0 (0%)
PROXIMAL PENILE	1 (16.7%)	1 (16.67%)
Total	1(3.7%)	1 (3.57%)

Both group had similar rate of neourethral diverticula formation distal (0%), Mid (0%) & proximal penile cases (16.7%).**[Table-7]**

TABLE-8. WOUND INFECTION RATE

TYPE OF HYPOSPADIAS	MILD	MODERATE	SEVERE
Distal	6	1	1
Mid Penile	5	3	0
Proximal Penile	4	0	0

In Dartos flap group, 35.7% patients developed mild infection (superficial skin discharge) which was managed by dressing and antibiotics as per culture sensitivity, 10.7% patient developed moderate wound infection (leading to partial wound dehiscence and ultimately urethrocutaneous fistula), 3.57% of patients developed severe wound infection (complete wound dehiscence ultimately leading to urethrocutaneous fistula formation).

In TVF group, 18.5% patients developed mild infection (superficial skin discharge) which was managed by dressing and antibiotics as per culture sensitivity, 3.7% patient developed moderate wound infection (leading to partial wound dehiscence and ultimately urethrocutaneous fistula), 0% of patients developed severe wound infection. **[Table-8]**

EFFECT OF PROLONGED CATHETER STAY IN CASE OF WOUND INFECTION TO PREVENT URETHROCUTANEOUS FISTULA FORMATION

All patients developing wound infection were kept on longer catheter stay (18 days) instead of usual removal of catheter at 10th day. In 16 patients with mild wound infection, prolonged catheter stay till 18th day lead to healing in 3 patients (18.75%). Rest 13 patients were discharged and planned for second surgery. In 4 patients with moderate infection, all developed urethrocutaneous fistula and planned for second surgery. Similarly, in 1 patient with severe wound infection developed UCF and planned for second surgery.

TABLE-9. SKIN NECROSIS RATE

TYPE OF HYPOSPADIAS	TVF	DARTOS
DISTAL	0	1
MID PENILE	1	2
PROXIMAL PENILE	0	2

Skin necrosis rate was higher in dartos group in proximal and mid penile hypospadias cases. **[Table-9]**

TABLE-10. WOUND DEHISCENCE RATE

TYPE OF HYPOSPADIAS	MILD	PARTIAL	COMPLETE
DISTAL	5(20%)	1 (4%)	2 (8%)
MID PENILE	4(22.2%)	2(11.1%)	1 (5.5%)
PROXIMAL PENILE	3(25%)	1(8.3%)	0 (0%)

In Dartos flap group, 25% patients developed mild wound dehiscence (1-2 sutures) which was managed by dressing and antibiotics as per culture sensitivity, 10.7% patient developed partial wound dehiscence (leading to ultimately urethrocutaneous fistula), 7.1% of patients developed complete wound dehiscence (ultimately leading to urethrocutaneous fistula formation).

In TVF group, 18.5% patients developed mild wound dehiscence (1 -2 sutures) which was managed by dressing and antibiotics as per culture and sensitivity, 3.7% patient developed partial wound dehiscence (ultimately leading to urethrocutaneous fistula), 3.7% of patients developed complete wound dehiscence (ultimately leading to urethrocutaneous fistula). **[Table-10]**

Overall dartos group had higher incidence of dehiscence rate but not significantly different in groups according to type of hypospadias.

EFFECT OF PROLONGED CATHETER STAY IN CASE OF WOUND DEHISCENCE TO PREVENT URETHROCUTANEOUS FISTULA FORMATION

All patients developing wound infection were kept on longer catheter stay (18 days) instead of usual removal of catheter at 10th day. In 12 patients with mild wound dehiscence, prolonged catheter stay till 18th day lead to healing in 4 patients (33.3%). Rest 8 patients were discharged and planned for second surgery. In 4 patients with partial wound dehiscence, all developed urethrocutaneous fistula and planned for second surgery. Similarly, in 1 patient with complete wound dehiscence developed UCF and planned for second surgery.

TABLE-11. RESIDUAL CHORDEE RATE

TYPE OF HYPOSPADIAS	TVF	DARTOS
DISTAL	1	0
MID PENILE	1	0
PROXIMAL PENILE	0	2

In distal hypospadias group 1 patient (16%), in mid penile hypospadias group 1 patient (11.1%) and in proximal penile hypospadias group 2 patients (25%) had residual chordee. **[Table-11]**

Both Dartos group and TVF group had similar number of patients (2) with residual chordee.

TABLE-12- RESIDUAL TORSION RATE

TYPE OF HYPOSPADIAS	TVF	DARTOS
DISTAL	1	0
MID PENILE	0	0
PROXIMAL PENILE	0	1

One patient with distal hypospadias and one patient with proximal penile hypospadias had residual torsion. Both TVF group and Dartos group had one patient with residual torsion. **[Table-12]**

DISCUSSION

Most patients who came to attend paediatric surgery OPD and underwent primary Snodgrass repair were ranging from 1 years to 13 years. 4 years being most common age. Mean age at time of surgery was 4.69 +- 3.15 years. In our study, 45.5% patients belong to distal hypospadias group (most common). 32.7% patients and 21.8% patients belong to mid penile and proximal penile group respectively.

In our study, 18 patients were given preoperative hormonal therapy in form of Testosterone enanthate injection 2mg/kg 3 doses at the interval of 3 weeks and last dose 3 weeks prior to their surgery. 8 patients (distal), 6 patients (mid penile) and 2 patients (proximal penile) were given injection testosterone and equitably distributed in both flap groups. **Babu R, Chakravarthi[8] S et al (2017)** showed preoperative testosterone significantly increases the glans width thereby reducing the complications and requirement for reoperation. It also improves the cosmetic outcomes and parental satisfaction. In **K T Tabassi[9] S Mohammadiet al (2010)** similar study 5 patients were given preoperative testosterone out of 33 patients.

Out of 55 patients, 21 patients -15 distal, 6 mid penile (31.18 %) had no chordee, 32 patients- 10 distal, 12 mid penile,10 proximal penile (58.18%) had superficial chordee and 2 patients- 2 proximal penile (3.64%) had deep chordee. In **K T Tabassi[9] S Mohammadiet al (2010)** similar study, no patients had chordee. In **A K Dhua[10] S K Agarwal, S K Ratan et al (2012)** similar study 20 patients in TVF group (25 patients) and 19 patients in Dartos flap group (25 patients) had chordee. In **R Hamid[11] AA Baba AS Ahmad (2015)** similar study 10 patients out of 35 patients had mild to moderate chordee.

In distal hypospadias group, dartos flap had 23% rate of urethrocutaneous fistula formation and TVF flap had 25% rate of urethrocutaneous fistula formation. In mid penile hypospadias group, dartos flap had 55.55% rate of urethrocutaneous fistula formation and TVF flap had 22.2% rate of urethrocutaneous fistula formation. In proximal penile hypospadias group, dartos flap had 66.67% of urethrocutaneous fistula formation and TVF flap had 0% rate of urethrocutaneous fistula formation. This shows that TVF flap has definite role in lowering fistula rates in proximal and mid penile hypospadias cases.

The causes of fistulae formation remain unknown although it is likely that local infection, local ischemia and an inadequate procedure, poor tissue healing, and distal obstruction due to meatal stenosis/ encrustation, anatomical factor like severity of hypospadias and satisfaction of surgeon after surgery has significant impact on the outcome of surgery. **(Uygur[12] MC, Unal D, Tan MO, Germiyanoglu C, Erol D. et al 2002)**

Beginning of fistula formation occurs early in the healing process after ventral urethral repair. Incorporation of urethral mucosa in the ventral repair is a substrate for fistula formation with rapid migration of urethral mucosa and skin epithelium into suture tracts. Whether the mucosal or dermal migration along suture tracts can be attenuated or prevented by changing the biochemical environment awaits further investigation.**(Edney[13] MT, Lopes JF, Schned A, Ellsworth PI, Cendron M. et al 2004).**

Snow[14] *et al*., in 1995, were the first to report the use of tunica vaginalis as interposition graft. The fistula rate reported was 9%. It is a dependable soft tissue cover for redo cases and posterior hypospadias surgery[380]. In his recent experience, **Snodgrass[15]** could reduce the fistula rate to 0% with the use of TVF.

In distal hypospadias group, dartos flap had 8.3% rate of meatal stenosis/ neourethral stricture formation and TVF had 7.7% rate of meatal stenosis/ neourethral stricture formation. In mid penile

hypospadias group, dartos flap had 11.1% rate of meatal stenosis/ neourethral stricture formation and TVF had 22.2% rate of meatal stenosis/ neourethral stricture formation. In proximal penile hypospadias group, dartos flap had 16.67% of meatal stenosis/ neourethral stricture formation and TVF had 16.67% rate of meatal stenosis/ neourethral stricture formation. Overall, dartos flap group had 10.7% rate of meatal stenosis/ neourethral stricture formation and tunica vaginalis flap had 14.8% rate of meatal stenosis/ neourethral stricture formation. By applying Fischer exact test p value = 0.99999which is more than 0.05 hence statistically not significant. Patients with meatal stenosis or neourethral strictures were managed with meatal and urethral calibration at an outpatient attendance. In **R Hamid[11] AA Baba AS Ahmad (2015)** similar study only 1 patient (2.85%) developed meatal stenosis undergoing TIP with TVF. The study by **Shimotakahara[16] et al (2012)** evaluated urethral complications in patients undergoing tubularized incised plate (TIP) urethroplasty vs TIP with inlay grafting. They recommended dorsal inlay graft be peformed in snograss tubularised incised plate urethroplasty to prevent urethroplasty complications like meatal stenosis or stricture. **Arshadi[17] H, Sabetkish S, Kajbafzadeh AM** el al (2017) showed that one-stage TIP urethroplasty (modified Snodgrass technique repair) using 2-3 of three covering layers (corpus spongiosum, dartos, and tunica vaginalis) reduces fistula and meatal stenosis.

In distal hypospadias group, 1 patient with TVF flap and 1 patient with dartos flap developed neourethral diverticula. Both patients had developed meatal stenosis prior to neourethral diverticula formation and reported late in clinic. Diverticula are reported in 4 -12% of patients after preputial island flap urethroplasty and onlay flap uehtroplasty (**Aigen[18] et al. 1987; Castanon[19] et al.2000; Elder and Duckett[20] 1987**), but are extremely rare after tubularised incised plate urethroplasty (0-0.6%) according to **De Badiola[21] et al. (1991) and Kass and Chung[22] (2000)** due to proper spongioplasty back up.

In TVF group only one patient (3.7%) developed skin necrosis while in Dartos group 5 patients (17.86%) developed skin necrosis. In dartos group skin necrosis rate was higher in patients with proximal and midpenile type of hypospadias than the distal type. Using dartos flap may result in shortage of skin or skin necrosis from damage to the intrinsic blood supply to the outer skin leading to more necrosis rate. Since TVF does not depend on the skin, the ventral skin cover is never compromised. In **K T Tabassi[9] S Mohammadiet al (2010)** similar study showed no patient developed skin necrosis.

Infection, edema, hematoma, erections, diminished blood supply, weakened suture material, tension at suture line, and vigorous removal of dressing may lead to wound dehiscence**(Elbakry[23] A, Shamaa M, Al-Atrash G 1998).** Good surgical technique, opposing the dartos fascia over the urethroplasty and everting the skin edges and proper postoperative management can prevent it. Resuturing of the raw area is not advisable. Devitalized, necrotic tissue requires removal regardless of etiology of breakdown before going for any surgical repair **(Horton[24] CE, Horton CE Jr. 1988)**

In 16 patients with mild wound infection, prolonged catheter stay till 18th day lead to healing in 3 patients (18.75%). Rest 13 patients were discharged and planned for second surgery. In 12 patients with mild wound dehiscence, prolonged catheter stay till 18th day lead to healing in 4 patients (33.3%). Rest 8 patients were discharged and planned for second surgery. **Hadidi[25] et al. (2003)** conducted a prospective randomised study to evaluate the role of stenting in hypospadias. The study included 100 patients suffering from different degrees of hypospadias. The operations were performed by a single surgeon (A.H.) who was notified only at the end of the operation whether to insert a stent or not. The incidence of complications in the form of failure of repair, fistula formation or meatal stenosis was higher in group B with stenting (10%) than in group A without stenting (2%). The difference in complication rate was not statistically significant (p=0.092). However, the incidence of morbidity in the form of oedema, stent block or urinary retention was statistically significantly higher in group B with stenting (44%) than in group A without stenting (18%; p=0.005). **Li X[26], Xu N, Xue X, Wei Y, Zheng Q, Sun X, Cai H, Jiang T.** et al (2014) showed that One-stage nonstented TIP is suitable for distal and mid-shaft hypospadias and could reduce postoperative pain and complications compared with the traditional postoperative indwelling urethral catheter and indwelling urethral stent. In **2016 VV Chandrasekharam[27]** presented that the simple technique of urethral re-catheterization may allow spontaneous healing of some early fistulas after hypospadias repair.

Out of 55 patients, 2 patients had catheter blockage and both of them developed urethrocutaneous fistula. In **A K Dhua[10] S K Agarwal, S K Ratan et al (2012)** study showed that 1 patients developed catheter related problems (severe bladder spasms) followed by catheter removal at day 3 followed by uneventful recovery. The mechanism of knotting appears to result from excessive intravesical catheter coiling and as the bladder decompresses the catheter tip can migrate through a coil thereby creating a knot or postoperative bladder spasms may be the cause of knotting of the catheter. There are more chances of bladder spasm and knotting of catheter with longer catheterization. Over-catheterization must be avoided to prevent both knotting and troublesome bladder spasms **(Mayer[28] E, Ankem MK, Hartanto VH, Barone JG 2012).**

In **R Hamid[11] AA Baba AS Ahmad (2015)** similar study showed 1 patient with residual chordee out of 35 patients (2.81%) in TVF group. There are more chances of torsion in single dartos flap (mild glanular torsion 90.7% and moderate glanular torsion 9.3%) as compared to double dartos flap (0%).The problem arises due to inadequate mobilization of vascular pedicle and traction on the pedicle. This can be prevented by adequate mobilization of vascular pedicle/dartos flap up to root of penis and proper adjustment of skin flaps during skin closure. Torsion of <30° does not require any corrective treatment **(Kamal[29] BA 2005).**

Overall chordee and tortion rate was not significantly different between both groups of flaps

CONCLUSION

1. TIP repair using dartos flap has higher complications like fistula formation and skin necrosis when used for mid shaft and proximal penile hypospadias.
2. Tunica vaginalis flap reduces the fistula rate and is superior to dartos flap as a waterproofing layer for TIP repair in midshaft and proximal penile hypospadias.

Tunica vaginalis flap definitely have an edge over preputial dartos flap and we would recommend its use as waterproofing second layer in hypospadias cases.

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