

Hypospadias surgeries - A single tertiary care center experience

¹Akshat Sudhanshu, Assistant Professor, department of General Surgery, Acharya Shri Chander College of Medical Sciences and hospital Jammu.

²Samia Mohan, Assistant Professor, Department of Surgery Acharya Shri Chander College of Medical Sciences and hospital Jammu.

³Priyanka Sharma, Lecturer, Department of Microbiology Government medical college Jammu.

Corresponding Author: Samia Mohan, Assistant Professor, Department of Surgery Acharya Shri Chander College of Medical Sciences and hospital Jammu.

How to citation this article: Akshat Sudhanshu, Samia Mohan, Priyanka Sharma, “Hypospadias surgeries - A single tertiary care center experience”, IJMACR- January - 2023, Volume – 6, Issue - 1, P. No. 150 – 165.

Open Access Article: © 2023, Samia Mohan, et al. This is an open access journal and article distributed under the terms of the creative commons attribution license (<http://creativecommons.org/licenses/by/4.0>). Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: The exact etiology of hypospadias is still unclear. Different theories have been described which include genetic, maternal, hormonal and environmental influences. Familial clustering is seen with 7% of cases.

⁽¹⁾Chromosomal abnormality is present in 5-6% of cases.

Material and methods: In this study we evaluated the long-term results of both single and two staged urethroplasty used for repair of distal and severe proximal hypospadias respectively in our institute. Single stage urethroplasties included Snodgrass urethroplasty with Buck's fascia/Dartos fascia as intermediate layer, Thiersch duplay urethroplasty, Meatal advancement with glanuloplasty incorporated (MAGPI); While two staged procedures included BRACKA and Byar's staged urethra plasties.

Result: In distal hypospadias surgeries Snodgrass urethroplasty with Buck's Fascia repair is a technique with acceptable long-term results. For proximal hypospadias with severe chordee we prefer Bracka staged procedure as it has good long-term outcomes in terms of complications.

Introduction

Hypospadias can be associated with other anomalies. Between 8-10% have cryptorchid testes and 9-15% have inguinal hernias. ^(2,3) It can be associated with intersex disorders particularly with proximal types and in association with undescended testis. The incidence of intersex in children with hypospadias, cryptorchidism and nonambiguous genitalia has been reported 27% with incidence more common in nonpalpable than palpable cryptorchid testes. ⁽⁴⁾

Typically, Hypospadias can be classified as

- glanular,
- sub coronal,
- distal penile,
- proximal penile,
- penoscrotal.

Classically location of meatus is used to define the type of hypospadias. According to Duckett Hypospadias can be Anterior which includes- Glanular, Coronal, Subcornal and Distal penile hypospadias; And Posterior which includes Proximal penile and Penoscrotal hypospadias⁽⁵⁾.

Horton et al. recorded that 90% of hypospadias can be classified as distal, where the urethral meatus ends in the distal shaft or glans penis and only 10% of all hypospadias cases are in the midshaft or more proximally in the penoscrotal or scrotal area⁽⁶⁾. Gibbon also noted that over 70% of hypospadias are distal⁽⁷⁾. Majority of hypospadias in boys are distal (~70-85%), And Proximal are present in only (10-25%).

There have been many operations described for hypospadias. The earliest record of surgery for hypospadias was in 100–200 AD by Heliodorus and Antyllus, where the end distal to the abnormal meatus was amputated⁽⁸⁾. Since then there have been many operations described in the General Surgical, Urological, Pediatric Surgical and Plastic Surgical literature. This reflects the difficulty in getting optimum results from the surgery for this condition. Horton, Devine and Baran traced the pictorial history of Hypospadias repair⁽⁹⁾.

Urethroplasty has always been considered a technically difficult operation. This is shown by the number of operations described in the literature on the surgical treatment of this congenital deformity. The earliest known record of this operation was in the literature in the 1st Century AD⁽⁶⁾. Over the years, so many

techniques have evolved and these range from a one stage technique, where correction of chordee and creation of neo-urethra is done simultaneously to a two-stage operation, where creation of the new urethra is performed as a second stage procedure after an earlier operation for chordee correction. Creation of this urethral tube ranges from using buried skin strip as in the Dennis Brown operation to using skin graft either from preputial skin or thick split thickness skin graft⁽⁹⁾. Other techniques use vascularized skin flaps either pedicled on the subcutaneous adventitial tissue of the penis or as a transposed skin flap as in Byar's operation.

Thiersch in 1869 and Duplay in 1874 described tabularization of the urethra. Skin coverage with flaps was described by Lauenstein in 1892. The use of vascularized preputial flaps was explained by Van Hook in 1896 by Rochet in 1899 and later by others. Buccal mucosa was used in urethral reconstruction in 1941 by Humbly. Most of the techniques used today are modifications or variants of methods described earlier.⁽¹⁰⁾ Rich introduced concept of incising urethral plate⁽¹¹⁾ Snodgrass developed this procedure by extending the urethral plate incision from the ectopic meatus to the tip of the glans in order to construct a new urethra from the already existing urethral plate.⁽¹²⁾

The ultimate aim of the above procedures is to produce a straight phallus with meatus at a functionally and anatomically acceptable location, with normal urinary stream, without and redundant skin and ability to have a normal erection.

The reported incidence of complications ranges from 6 to 30%, varying with the severity of the hypospadias. In order of frequency postoperative fistula is the commonest with reported incidence of 0-23%.⁽¹³⁾ Other

complications are meatal stenosis, stricture, diverticulum, residual chordee, torsion, etc.

Urethrocutaneous fistula (UCF) is one of the most common complications of hypospadias repair, followed by meatal stenosis, glans dehiscence, poor urinary flow and need for urethral calibration.

Potential long-term sequelae of hypospadias and subsequent surgical correction includes difficulty in voiding, poor cosmetic outcomes, potential sexual and psychosexual dysfunction. Knowledge of these potential difficulties is especially important for patient and parent counselling at the time of initial surgery as well as improving functional and psychosexual results and overall patient satisfaction.

We described a technique of urethroplasty using Buck's fascia as intermediate layer and glanuloplasty, with excellent results. We observed that Buck's fascia overlying the corpora spongiosum which is deficient ventrally in hypospadias, is not completely absent and can be easily used to cover the neourethra. It needs minimal dissection and hence vascularity of tissues is preserved. We used this Buck's fascia as a second protective layer over the neourethra in an attempt to decrease UCF formation, and compared it with use of Dartos fascia. We recommended that the native Buck's fascia lateral to spongiosum is a more appropriate, natural, and strong layer to cover the Neourethra. We had recommended the use of Buck's fascia as an intermediate layer to cover the neourethra to reduce incidence of postoperative complications and improve results. (16)

Relevant clinical data about the long-term sequelae after hypospadias repair is scarce. In our study we evaluated the long-term results of both single and two staged urethroplasty used for repair of distal and severe

proximal hypospadias respectively in our institute. Single stage urethroplasties included Snodgrass urethroplasty with Buck's fascia/Dartos fascia as intermediate layer, Thiersch duplay urethroplasty, Meatal advancement with glanuloplasty incorporated (MAGPI); While two staged procedures included BRACKA and Byar's staged urethroplasties.

Aims and objective

1. To evaluate the long-term outcomes of different hypospadias surgeries like
2. Uroflowmetry after hypospadias repair.

Materials and methods

- The study was conducted in Department of Pediatric Surgery SKIMS. Pediatric age patients up to 14 years of age presenting with hypospadias to our department who have been operated from March 2011 to March 2021 were included in the study. The study was both retrospective and prospective. In retrospective cases, clinical details were obtained from medical records section, the patients were called for evaluation in Out Patient department, they were subjected to examination and uroflowmetry. The Prospective patients on at least one year of follow-up in Out Patient department underwent complete physical and systemic examination including a local urogenital examination. On follow-up the patients were subjected to uroflowmetry, patients with abnormal flow were subjected to MCU/RGU. The pre-operative workup included baseline investigations and serology. All the children were operated under caudal and general anesthesia. Distal hypospadias patients underwent Snodgrass urethroplasty with Buck's fascia/dartos as intermediate layer or MAGPI or Thiersch duplay urethroplasty; while proximal hypospadias patients underwent

Bracka/ Byar's Two staged Urethroplasty. The results were analyzed and conclusions drawn.

- In prospective group the patients were followed up after an average period of 1 year while in retrospective group patients who were previously operated were contacted telephonically and examined in Out Patient department, those who were not able to come were questioned telephonically about their complaints. The patients were observed for any of the following complications:

Formation of Urethrocutaneous fistula (UCF).

- Meatal stenosis.
- Any residual chordee.
- Glanular dehiscence.
- Stricture formation.
- Urinary stream abnormality.
- Diverticulum.
- Overall cosmetic satisfaction.

Then the patients were subjected to uroflowmetry.

In retrospective group, at follow up examination patients were enquired about urination and any thinning of urinary stream or difficulty with micturition. On examination meatal stenosis, residual chordee, excess scarring or fresh Urethrocutaneous fistula(UCF) was noted. Finally, patients/parents were enquired about their cosmetic satisfaction of repaired phallus. After completing clinical examination, patients were advised to undergo uroflowmetry.

Uroflowmetry was done on MMS uroflow meter with gravimetric method of urine volume estimation uroflow meter, with preloaded software. Before undertaking uroflowmetry, child was asked to take adequate fluids before the procedure till he had full bladder and some urge to void. Then the child was asked to void, while recordings were done. If uroflowmetry was normal and

child was asymptomatic, uroflowmetry was not repeated. When there was hesitancy in voiding or in case of abnormal readings repeat tests were done. Uroflowmetry values were analyzed using predefined Miskolicks nomograms⁽¹⁷⁾ for children provided with machine. The results was compiled and analyzed and conclusions drawn.

Observations

From March 2011 to March 2021 a total of 743 patients were operated, out of which 136 patients were operated from March 2019 to March 2021 and 607 patients were operated from March 2011 to January 2021, however from the latter group only the data of 312 could be traced/ contacted, hence our study included 448 patients.

Table 1: Distribution of prospective and retrospective patients.

Study population	Number	Percentage
Prospective	136	30.4
Retrospective	312	69.6
Total	448	100

We observe that from a total of 448 study patients; (69.6%) belonged to retrospective group and (30.4%) belonged to prospective group of patients.

Graph 1:

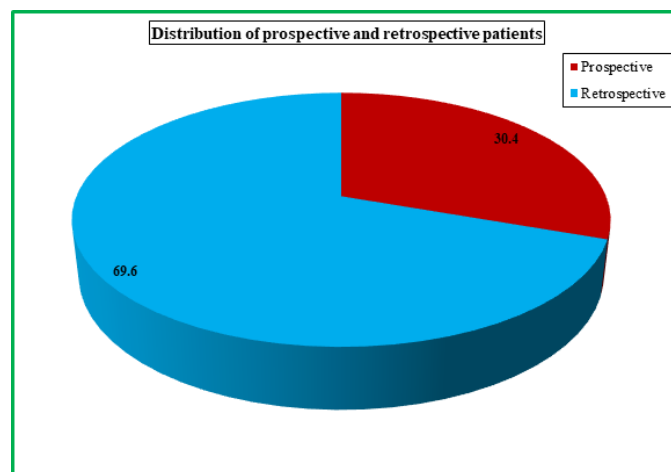


Table 2: Age distribution of study patients

Age (Years)	Number	Percentage
1-3 Years	253	56.5
3-6 Years	117	26.1
6-12 Years	52	11.6
> 12 Years	26	5.8
Total	448	100
Mean±SD=3.9±1.78		

We observed that the average age of studied patients was (3.9±1.78) years, with majority of them were belonging to the age interval group of (1-3) years followed by (26.1%) belonging to the age group of (3-6) years. Around (11.6%) patients were from 6 to 12 years of age and only (5.8%) patients were above 12 years of age.

Graph 2:

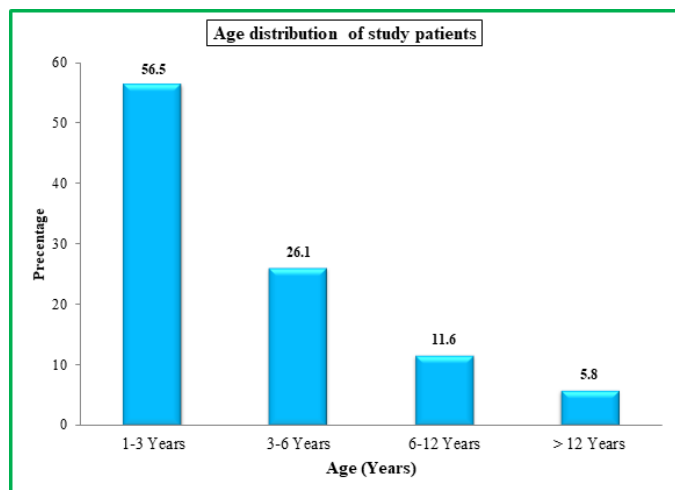


Table 3: Type of hypospadias among study patients

Type of hypospadias	Number	Percentage
Proximal	76	17.0
Distal	372	83.0
Total	448	100

Table 3 reflects the type of hypospadias among studied patients wherein we observe that (83%) patients had distal and (17%) had proximal hypospadias.

Graph 3:

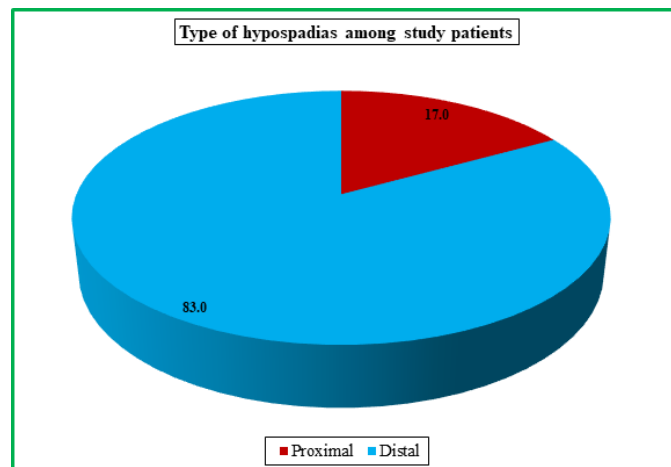


Table 4: Site wise distribution of meatus in distal hypospadias

Site	Number	Percentage
Granular	63	16.9
Coronal/Subcoronal	167	44.9
Distal penile	93	25.0
Midpenile	49	13.2
Total	372	100

We observed that among distal hypospadias majority were coronal/sub coronal accounting for (44.9%) followed by distal penile (25%), (16.9%) were granular and only (13.2%) had midpenile hypospadias.

Graph 4:

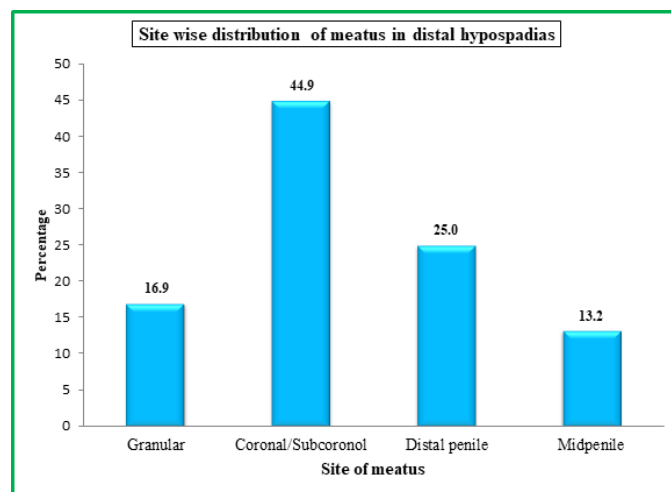


Table 5: Surgical intervention among patients with distal and mid-penile hypospadias without severe chordee

Surgical intervention	Number	Percentage
Snodgrass Urethroplasty	344	92.5
MAGPI	15	4.0
Thiersch Duplay Urethroplasty	13	3.5
Total	372	100

Table 5, displays the surgical intervention among patients with distal and mid-penile hypospadias without severe chordee wherein we observed that (92.5%) were managed with Snodgrass Urethroplasty, (4%) had undergone MAGPI, and only 3.5% underwent Thiersch Duplay Urethroplasty.

Graph 5:

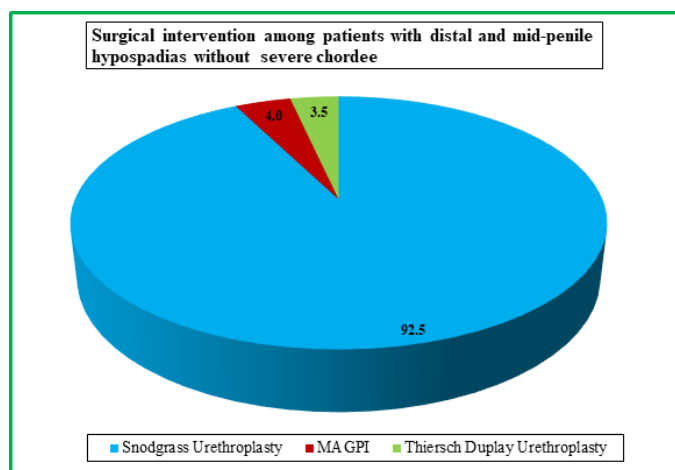


Table 6: Surgical intervention among patients with proximal hypospadias with severe chordee.

Surgical intervention	Number	Percentage
Bracka	64	84.2
Byar's	12	15.8
Total	76	100

Table 6, shows the type of surgical intervention among patients with proximal hypospadias with severe chordee wherein we observe that (84.2%) underwent Bracka staged procedure and (15.8%) were managed with Byar's staged procedure.

Graph 6:

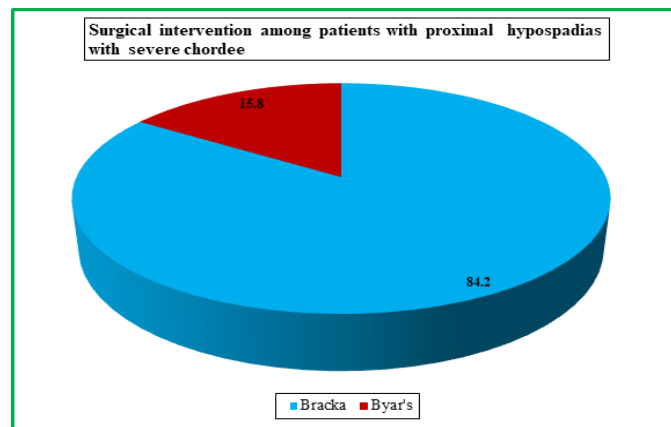


Table 7: Complications of patients who underwent Snodgrass urethroplasty procedure [n=372]

Complications	Number	Percentage
Urethrocutaneous fistula (UCF)	10	2.7
Meatal stenosis	8	2.2
Residual chordee	0	0.0
Glanular dehiscence	9	2.4
Urethral stricture	4	1.1
Thin stream	16	4.3
Diverticulum	1	0.3

We observed that out of 372 Snodgrass urethroplasty procedures; (4.3%) had thin stream complication, (2.7%) had UCF complication, (2.4%) had glanular dehiscence, (2.2%) had meatal stenosis, (0.3%) had diverticulum complication and (1.1%) had urethral stricture.

Graph 7:

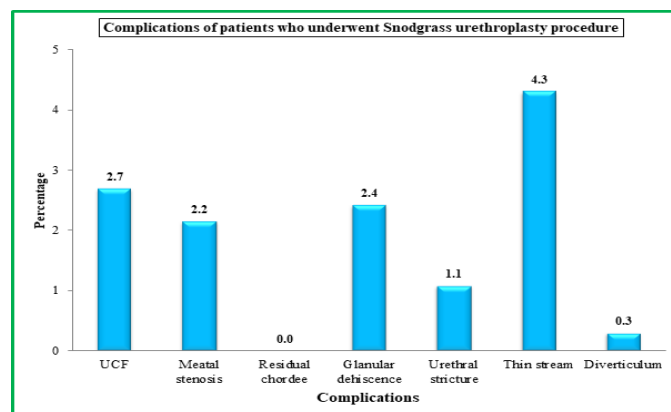


Table 8: Complications of patients who underwent MAGPI procedure [n=15]

Complications	Number
Urethrocutaneous fistula (UCF)	0
Meatal stenosis	2
Residual chordee	0
Dehiscence	0
Stricture	0
Thin stream	2
Diverticulum	0

From a total of 15 MAGPI procedures; 2 patients had meatal stenosis and 2 patients had thin stream. No other complication was evident among such patients.

Graph 9:

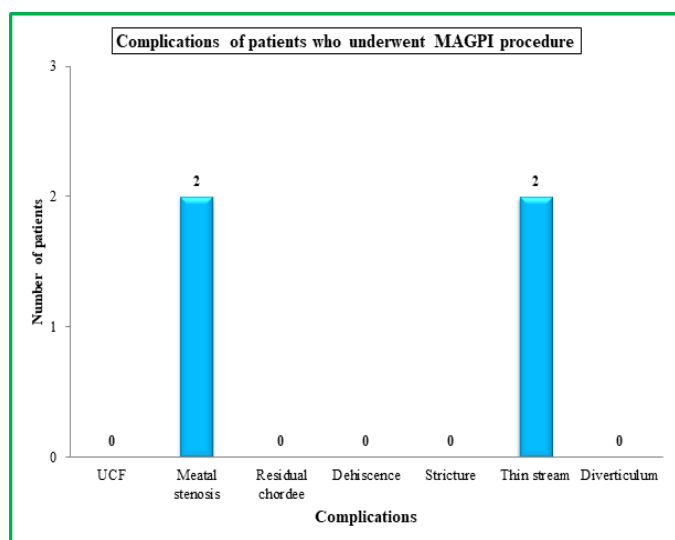


Table 9: Complications of patients who underwent Bracka staged procedure [n=64]

Complications	Number	Percentage
Urethrocutaneous fistula (UCF)	8	12.5
Meatal stenosis	3	4.7
Residual chordee	0	0.0
Dehiscence	4	6.3
Stricture	3	4.7

Thin stream	5	7.8
Diverticulum	5	7.8

We observe that out of 64 Bracka staged procedures; (12.5%) had UCF complication, (7.8%) thin stream, (7.8%) had diverticulum complication, (6.3%) had dehiscence, (4.7%) had meatal stenosis and (4.7%) had stricture.

Graph 10:

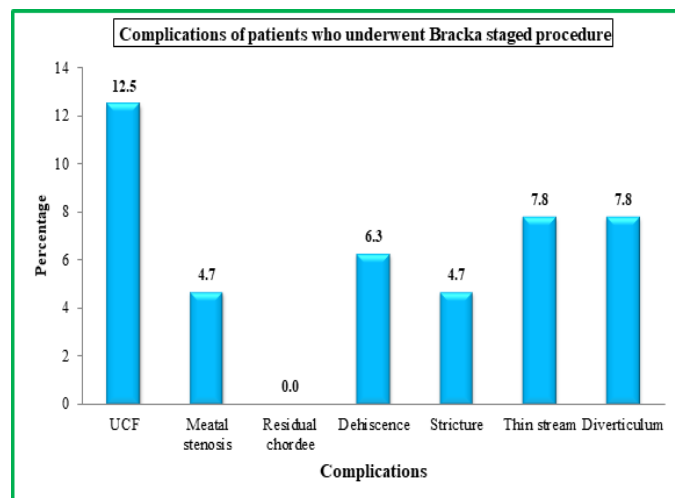


Table 10: Complications of patients who underwent Byar's staged procedure [n=12]

Complications	Number
UCF	2
Meatal stenosis	1
Residual chordee	0
Dehiscence	1
Stricture	2
Thin stream	2
Diverticulum	2

We observe that out of 12 Byar's staged procedures; 2 patients developed UCF complication, 2 patients developed diverticulum, 2 had thin stream, 1 patient developed meatal stenosis and 1 had dehiscence complication.

Graph 11:

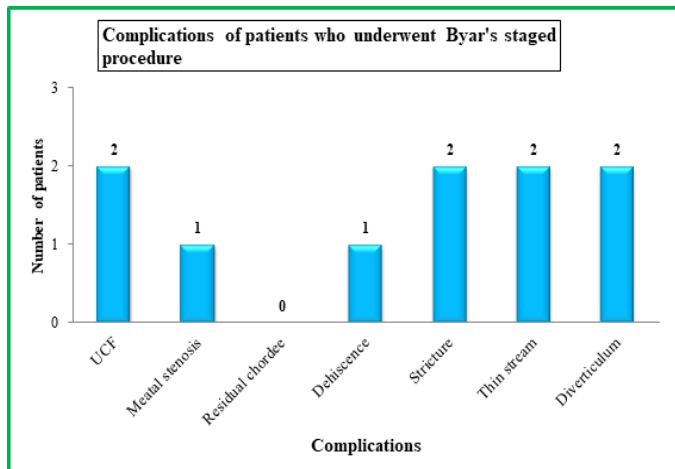


Table 11: Overall cosmetic satisfaction as per type of procedure

Type of procedure	N	Cosmetic satisfaction	
		Number	% Age
Snodgrass urethroplasty	372	350	94.1
MAGPI	15	14	93.3
Thiersch Duplay Urethroplasty	13	12	92.3
Bracka	64	59	92.2
Byar's	12	11	91.7

Graph 12:

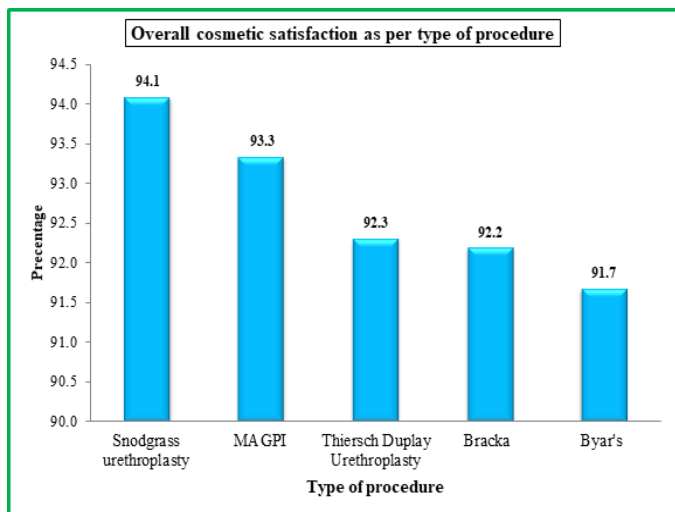
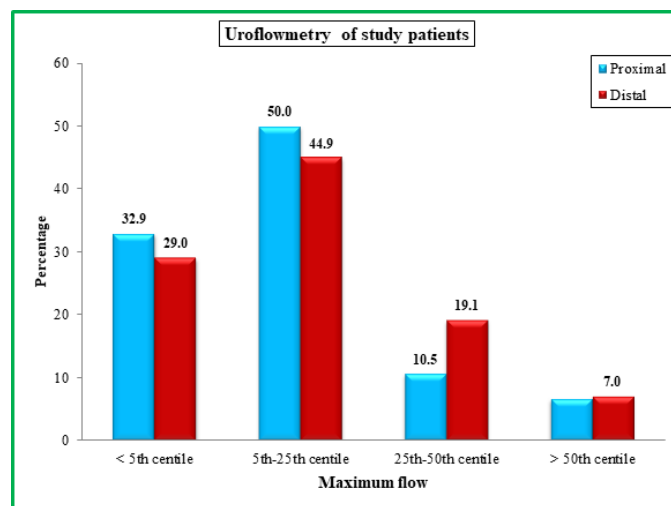


Table 12A: Uroflowmetry of study patients

Maximum flow	Proximal		Distal	
	Number	%age	Number	%age
< 5th centile	25	32.9	108	29.0
5th-25th centile	38	50.0	167	44.9
25th-50th centile	8	10.5	71	19.1
> 50th centile	5	6.6	26	7.0

We analyzed the uroflowmetry among proximal and distal hypospadias whereby we observed that out of 76 operated proximal hypospadias; (50%) patients had maximum flow with (5th-25th centile) followed by (32.9%) patients with < 5th centile maximum flow, (10.5%) had (25th-50th) centile maximum flow and only (6.6%) had > 50th centile maximum flow. And out of 372 operated distal hypospadias; (44.9%) had (5th-25th) centile maximum flow, (29%) had maximum flow with < 5th centile, (19.1%) had (25th-50th) centile maximum flow and (7%) had maximum flow with > 50th centile.

Graph 13:



The average uroflowmetry among proximal and distal hypospadias was observed whereby we found that out of 76 operated proximal hypospadias; majority of patients constituting about (44.7%) had average flow Q_{av} with (5th-25th) centile followed by (30.3%) patients with average flow < 5th centile, (19.7%) with average flow

(25th-50th) centile and (5.3%) patients with average flow > 50th centile. On the other hand, out of 372 operated distal hypospadias; majority of patients accounting for (48.1%) had average uroflowmetry flow with (5th-25th centile), (23.9%) had average flow with < 5th centile, (19.1%) had (25th-50th) centile average uroflowmetry flow and only (8.9%) patients had average flow with > 50th centile.

Table 12B: Uroflowmetry of study patients

Average flow	Proximal [n=76]		Distal [n=372]	
	Number	% age	Number	% age
< 5th centile	23	30.3	89	23.9
5th-25th centile	34	44.7	179	48.1
25th-50th centile	15	19.7	71	19.1
> 50th centile	4	5.3	33	8.9

Graph 14:

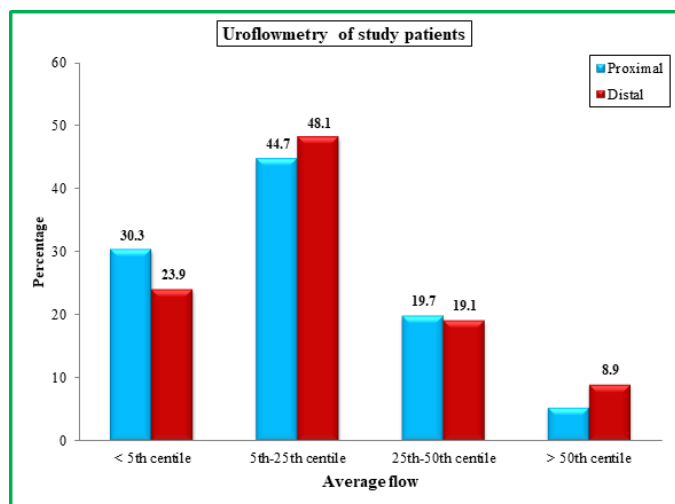


Table 13: Need for redo surgery

		Number
Snodgrass Urethroplasty	UCF closure	9
	Meatoplasty	2
	Glanuloplasty	3
	Redo urethroplasty for stricture	1
Bracka Staged	UCF closure	8

Urethroplasty	Meatoplasty	1
	Glanuloplasty	2
	Redo urethroplasty for stricture	2
Byar's Staged Procedure	Fistula closure	2
	Glanuloplasty	1
	Redo procedure for stricture	1
	Redo procedure for diverticulum	2

Statistical Methods

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA).

Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages.

Graphically the data was presented by bar and pie diagrams.



Figure 1: BRACA stage 1



Figure 2: good graft take post stage I Bracka



Figure 3:



Figure 4: Snodgrass urethroplasty with buck's fascia as intermediate layer



Figure 5: one year post operative

Discussion

Majority of our patients belonged to age group 1-3 years constituting 56 % of subjects. Mean age at surgery was 3.8 years (range 1-16 years) which was also similar to LeiliMohajerzadeh,⁽¹⁷⁾ Sarah Krull⁽¹⁸⁾ and S. Pramod.⁽¹⁹⁾ Our series consisted of 83.1% of patients with distal penile hypospadias (DPH) coronal, sub coronal and distal penile of mid penile without significant chordee. This distribution is consistent with that recorded by Sugarman,⁽²⁰⁾ Bath,⁽²¹⁾ and Cheng.⁽²²⁾ Since its first description by Snodgrass for repair of hypospadias in 1994, TIPU has gained widespread acceptance due to its versatility, low complication rate and reliable creation of vertically oriented meatus, with excellent cosmetic outcome. A survey of pediatric urologists identified the TIPU technique was used more than 90% of the time for distal hypospadias repairs and 80% of the time for

midshaft repairs (Cook et al).⁽²³⁾ Some authors recommend TIPU as the technique to be considered as procedure of choice for primary and re-operative repair of distal and some midshaft hypospadias cases with selected proximal ones.

In cases of Proximal penile hypospadias with severe chordee many authors have reported single and two staged procedures with varying complication rates, However the complication rates of such procedures remained high owing to the nature of disease. In proximal hypospadias the urethral plate is often poorly defined and when short and tethered it may contribute to relatively high incidence of chordee seen in these severe forms of hypospadias. For severe degree of hypospadias many surgeons prefer to transect a short-tethered plate and create a longer, wider new urethral plate using and inner preputial graft as an initial first stage procedure. For Graft options inner prepuce is considered to be the most reliable graft as it is designed to be moist, is expandable and has no potential for hair growth.

One of the major advantages of staged repairs is the possibility to achieve a good cosmetic result with placement of the urethra deep in the glans and creation of a natural slit-like meatus. Accordingly, most of the series report an excellent cosmetic results and patient satisfaction. It should be noted, however, that Bracka et al⁽⁹⁾ reported a 5.5% of cases requiring additional revisional surgery after second-stage for cosmetic adjustments.

The common long-term complications of staged urethroplasty included Urethrocutaneous fistula formation, meatal stenosis, glanular dehiscence, stricture formation. The reported complication rates varied very from 7 to 33%.

Post op UCF is most common complication of any hypospadias surgery. The fistula rate in large series of hypospadias repairs varies from 0% to 33%. (Kassaby et al. report that various studies using dartos based flaps, tunica vaginalis and subcutaneous tissue flaps have a fistula rate of 2-33%.⁽²⁴⁾

It had been suggested that several factors affect the formation of UCF after hypospadias surgery. The main factors are the type of surgical procedure, patient age, severity of hypospadias, surgeon experience, tissue handling, presence and degree of chordee, and construction of waterproof urethroplasty. Different surgeons attempted different techniques mainly consisting of reinforcing the neourethra with a second layer to reduce the incidence of UCF. Over the course of time it was observed that one of the most important factors in reducing fistula formation with the TIP technique is the introduction of a protective intermediate layer between the neourethra and the skin.

Snodgrass has recommended two-layer urethral palate closures to decrease the fistula formation from 33% to 11%. Snodgrass later added that the incidence of fistula can be reduced to nearly 0% when the two-layer urethroplasty was covered with a tunica vaginalis flap instead of dartos flap.

Durham Smith first reported skin de-epithelialization harvested from the penile skin and double breasting to provide additional cover to the neourethra with varying degrees of success⁽¹²⁾. Ross and Kay also described their technique of TIP modification to prevent fistula that involved the use of de-epithelialized skin flap to cover the urethra⁽²⁵⁾. Because of edema, necrosis of skin, hematoma and torque with mobilization of the dorsal dartos flap, its role as an interposing tissue has been questioned.

In quest for reducing complications particularly UCF, we initiated the use of Buck's fascia with glanuloplasty as intermediate layer in Snodgrass urethroplasty and compared it with dartos fascia in 80 patients. Significant improvement in terms of complications were found with UCF fistula occurring in 2.5% of Buck's fascia compared to 10% of dartos subgroup. In order to further examine the results of technique and observe long term results of previously operated patients, we conducted the study involving a larger series.

Buck's fascia is deep fascial layer of penis. Anteriorly it splits to cover the whole corpus spongiosum along with urethra. In case of hypospadias, it covers the dorsal aspect of spongiosum but is splayed anteriorly with edges lying laterally along the urethral plate and spongiosum. We have observed that the Buck's fascia over the corpora spongiosum which is deficient ventrally is not completely absent is easily identified proximally over the intact spongiosum and then traced distally and is freely mobile if carefully identified and easily brought in midline and can be used to cover the neourethra. We have used this layer to cover the neourethra without lateral mobilization and alone without suturing the spongiosum which can interfere with its vascularity. No glanular wings are created and the glans is approximated with excision of triangular area on either side of the urethra. This differs from the spongioplasty technique described in the literature in that no lateral incisions are made and only fascia is sutured without spongiosum. The fascia is easily available in nearly all cases and needs no separate dissection as is needed in spongioplasty or other intermediate layers. This results in less operative time, less tissue dissection, minimal edema and less hematoma resulting in less postoperative infection and tissue breakdown.

The repair of Buck's fascia brings the underlying spongiosum together in midline over the neourethra without disrupting its blood supply. While every repair tries to restore the epithelium, corpus spongiosum, dartos, and skin, little attention is paid to the Buck's fascia, which we consider the most important layer in hypospadias repair. It has more tensile strength and is comparable with rectus sheath in abdominal wall closure. Use of this Buck's fascia as a second intermediate layer between the neourethra and the skin is very effective in prevention of UCF.

An essential component of our modified repair is the glanuloplasty without creating glanular wings, which we think may interfere with its vascularity, cause lot of tissue dissection, edema hematoma excessive bleeding and may lead to ischemia. This is achieved by excising triangular areas of skin on either side of the urethral plate at the glans and corona. This helps to approximate the glans to cover the distal part of the repair.

The incidence of post-op UCF in cases of distal hypospadias was 2.8% with ten patients forming UCF. This is well below the recent suggested accepted standard of 5%^{for} anterior hypospadias as well compares favorably with previous mentioned studies above. This also compares favorably with studies of Hardwicke JT who in his large systemic review of literature found fistulae rate in 44 studies comprising 6603 to be 5.8% for anterior hypospadias as well as review series of K.L.M. Pfister muller who had UCF rate of 5.7% for primary distal hypospadias.

We reported a low incidence of meatal stenosis in operated distal hypospadias in our series. Eight patients comprising 2.24% developed meatal stenosis which was mild and responded to calibration and dilation only. No patient needed surgical correction. Meatal stenosis after

corrective hypospadias surgery is usually due technical reasons. Alshabaini R and Khairi A concluded that extending the plate incision to the neomeatus site is a predisposing factor for meatal stenosis. They found that when a shorter urethral plate incision to the mid-glans is adapted and when neo meatus was not included in the urethral plate incision, the rate of meatal stenosis will be reduced.

We noted low incidence of urethral stricture in our study. Only four patients with incidence of 1.1%, had suspected urethral stricture in view of thin stream and obstructive pattern on uroflowmetry and resistance on calibration. Both patients were subsequently managed with serial calibrations only which resulted in improvement of urinary stream. The low rate of urethral stricture after Snodgrass operation could be explained according to Bluestein et al by the fact that the healing of midline incision of urethral plate occurred by re-epithelization with normal tissue in-growth without scarring or stricture. Snodgrass had shown in his series that the re-epithelization occurs by second intention after incision of urethral plate, so that the meatal stenosis and urethral strictures is unlikely to occur after TIP repair especially for distal type of hypospadias.

Our rates of UCF in cases of Bracka staged urethroplasty was 12.5% with a total of 8 patients having Urethrocutaneous fistula and in case of Byar's staged urethroplasty two patients out of twelve operated developed fistula.

Meatal stenosis is another common complication of urethroplasty. It may result from poor distal vascularity, wound contracture, technical errors in meatoplasty (small and oval meatus). With Bracka staged repair, meatal stenosis has been reported in 0–30% of patients by different authors. In our study, meatal stenosis

occurred in 4.6% in Bracka and one out of twelve patients in Byar's staged procedure.

Glans dehiscence is a recognized complication of the two-stage repair. It is 3.6 times more common in proximal than distal repair. In our patients, partial glans was seen in 6.25% in Bracka staged urethroplasty and one patient who underwent Byar's procedure.

Urethral stricture is another concern and most commonly occurs at the level of the original meatus. Strictures discovered within 3 months of surgery have been reported more responsive to dilation or direct vision internal urethrotomy (DIVU) than those found subsequently. In our study, urethral stricture was seen in 4.6% in Bracka urethroplasty. Shukla et al. ⁽²⁶⁾ and Saafan ⁽²⁷⁾ reported urethral stricture in none of the patient with Byar's staged repair. In the present study two patients had urethral stricture in Byar's urethroplasty. In the present study, 7.8% patients had diverticulum in Bracka group.

In our series we also found that 33% patients had Qmax below 5th percentile in proximal hypospadias and 29% in distal hypospadias with plateau pattern in 80 % of them which is in agreement with above mentioned studies. The average flow rates were comparable to max flow rates, however more patients in distal hypospadias had a flow rate reaching upto 50th centile. Faure et al analyzed the uroflow data of boys who underwent a two-stage graft urethroplasty for proximal and complicated hypospadias. They found 11/15 toilet-trained boys asymptomatic but with flow rates below the normal range (median Qmax = 7mL/s, range 3.5–16.7). Only one boy with a low flow rate was confirmed to have urethral stenosis under general anesthesia, and low flow rates after repair most likely reflect relative inelasticity and luminal irregularity of the neourethra.

18 Hereafter, many authors assumed that in repair of proximal hypospadias with severe chordee, two-stage free graft repair should be used as the technique of choice, and consequently, inner preputial and buccal mucosa graft had been widely used for free grafts. Despite the Qmax values after hypospadias repair (using different techniques) when normal, the majority of these cases had curves below the 50th percentile, implying that the reconstructed urethra is not functioning as a normal urethra. Nevertheless, staged repair for proximal hypospadias is preferable than a heroic one-stage procedure. Patient and parent cosmetic satisfaction in distal hypospadias repair was 98%. Our observations are similar to cosmetic satisfaction in studies of Abdel-Wahab El-Kassaby (96%), Al-Kahansa'a center study (92.6%), and Inayat-ur-Rehman et al. (94%).^(28,29,30)

The overall cosmetic satisfaction in cases of proximal hypospadias repair was 92% which are similar to results published by Bracka et al., Ramanathan et al. and Ferro et al.

In Snodgrass urethroplasty repair 9 out of 10 UCF patients required closure of UCF, 2 patients required meatoplasty, 3 pts. required glanuloplasty for glans dehiscence, 1 patient required redo urethroplasty for stricture.

In BRACKA staged urethroplasty 8 patients required UCF closure, 1 required meatoplasty, 2 required glanuloplasty, 2 required redo surgery for diverticulum.

In BYAR'S staged procedure 2 patients required fistula closure, 1 required glanuloplasty and 1 each required redo procedure for stricture and diverticulum resp.

Conclusion

The present prospective cum retrospective study on the evaluation of the long-term outcomes of different hypospadias surgeries was conducted at the Post

Graduate Department of Pediatrics, SKIMS, Soura. A total of 448 patients who were operated from March 2011 to March 2021 and who qualified the inclusion criteria were included in the study. We observed the following:

- The average age of studied patients was (3.9 ± 1.78) years, with majority of them were belonging to the age interval group of (1-3) years followed by (26.1%) belonging to the age group of (3-6) years. Around (11.6%) patients had their age from 6 to 12 years and only (5.8%) patients were above 12 years of age.
- (83%) patients had distal and (17%) had proximal hypospadias
- (92.5%) of distal hypospadias patients underwent Snodgrass urethroplasty, 4% underwent MAGPI, and 3.5% underwent Thiersch Duplay urethroplasty
- (84.2%) of Proximal Hypospadias patient with severe chordee underwent Bracka staged procedure and (15.8%) were managed with Byar's staged urethroplasty.
- Out of 372 Snodgrass urethroplasty procedures; (4.3%) had thin stream complication, (2.7%) had UCF complication, (2.4%) had glanular dehiscence, (2.2%) had meatal stenosis, (1.9%) had diverticulum complication and (1.1%) had urethral stricture complication.
- Out of 15 MAGPI procedures; 2 patients had meatal stenosis and 2 patients had thin stream. No other complication was evident among such patients.
- Out of 64 Bracka staged procedures; (12.5%) had UCF complication, (7.8%) thin stream, (7.8%) had diverticulum complication, (6.3%) had dehiscence, (4.7%) had meatal stenosis and (4.7%) had stricture
- Out of 12 Byar's staged procedures; 2 patients developed UCF complication, 2 patients developed

diverticulum, 2 had thin stream, 1 patient developed meatal stenosis and 1 had dehiscence complication

➤ (94.1%) had cosmetic satisfaction with Snodgrass urethroplasty, (93.3%) had satisfaction with MAGPI procedure, (92.2%) were satisfied with Bracka staged intervention and (91.7%) had satisfaction with Byar's staged procedure.

➤ Out of 76 proximal hypospadias; majority of patients constituting about (44.7%) had Q_{av} with (5th-25th) centile followed by (30.3%) patients with average flow (Q_{av}) < 5th centile, (19.7%) with Q_{av} (25th-50th) centile and (5.3%) patients with Q_{av} > 50th centile.

➤ Out of 372 distal hypospadias; majority of patients accounting for (48.1%) had average uroflowmetry flow with (5th-25th centile), (23.9%) had average flow with < 5th centile, (19.1%) had (25th-50th) centile average uroflowmetry flow and only (8.9%) patients had average flow with > 50th centile.

Conclusion

➤ In distal hypospadias surgeries Snodgrass urethroplasty with Buck's Fascia repair is a technique with acceptable long-term results. For proximal hypospadias with severe chordee we prefer BRACKA staged procedure as it has good long-term outcomes in terms of complications. Most of the patients had distal hypospadias and Snodgrass urethroplasty was the most common procedure performed in our series. Most of the patients with proximal underwent BRACKA staged procedure. Two third of distal hypospadias patients had Buck's fascia as intermediate layer. Outcome of urethroplasties in distal hypospadias was acceptable with a very low fistula rate (lowest with Buck's fascia as intermediate layer). Long term results in proximal hypospadias were also acceptable.

References

1. Van der Horst HJR & De Wall LL :Hypospadias, all there is to know. Eur J Pediatr 2017; 176:435–441.
2. Khuri FJ, HardyBE, Churchill BM.: Urological anomalies associated with hypospadias. Urol Clin North Am 1981; 8: 565-71.
3. Sorber M, Feitz WF, de Vries JD.: Short and mid-term outcome of different types of one stage hypospadias corrections. Eur Urol 1997; 32:475-9.
4. Kaefer M, Diamond D, Hendren W H, et al.: The incidence of intersexuality in children with cryptorchidism and hypospadias: stratification based on gonadal palpability and meatal position. J Urol. 1999; 163 :1003-1007.
5. Duckett JW: Hypospadias. In: Gillen water JY, Gray hack JT, Howards SS, Duckett JW. Adult and Pediatric Urology, 3rd ed. Mosby Year Book, 1996; P 2550.
6. Horton, C.E., Sa dove, R.C., and Devine, C.J.: Reconstruction of male genital defects: congenital. in: J.G. McCarthy (Ed.) Plastic surgery vol. 6WB Saunders, London; 1990: 4153-4179.
7. Gibbons, M.D. Nuances of distal hypospadias. : WB Saunders, London, ; 1985 (p. 169–174.
8. Horton, C.E., Devine, C.J., and Baran, N.: Pictorial history of hypospadias repair techniques. in: C.E. Horton (Ed.) Plastic and reconstructive surgery of the genital area Little, Brown and Company, Boston, MA; 1973: 237-248.
9. Bracka, A. Hypospadias repair: the two-stage alternative. Br J Urol. 1995; 76: 31-41.
10. J F van der Werff, J Ultee : Long-term Follow-Up of Hypospadias RepairBr J Plast Surg 2000 Oct;53(7):588-92.

11. Stein R.: Hypospadias Eur. Urol. Suppl. 2012; 11: 33- 45.
12. Snodgrass W.: Tabularized incised plate urethroplasty for distal hypospadias. J Urol 1994; 151:464-5.
13. Bhat A and Manda AK. : Acute postoperative complications of hypospadias repair. Indian J Urol. 2008; 24(2): 241–248.
14. Smith D.A. De-epithelialized overlap flap techniques in repair of hypospadias. Br .J. Plast surg 1973; 26 (2): 106-114.
15. Aslam R, Campbell K, Wharton S, et al. : Medium to long term results following single stage Snodgrass hypospadias repair. Journal of Plastic, Reconstructive & Aesthetic Surgery 2013; 66: 1591-1595.
16. Baba AA, Wani SA, Bhat NA, Mufti GN, et al. : Buck's fascia repair with glanuloplasty in hypospadias surgery: A simple approach with excellent outcome. J Pediatr Urol 2017; 13(6): 633-1-633-5.
17. Mohajerzadeh L, Ghoroubi J, Roshan Zamir F, et al. : Outcome of tabularized incised plate (TIP) urethroplasty: A single-center experience with 307 cases. Iran J Pediatr Surg 2015; 1(1): 22-27.
18. Krull S, Rissmann A, Krause H, , et al. : Outcome after Hypospadias Repair: Evaluation Using the Hypospadias Objective Penile Evaluation Score. Eur J Pediatr Surg 2018; 28(3):268-72.
19. Pramod S, Prakash GS. Outcome of anterior hypospadias repair: A single center experience. Arch Int Surg 2018; 8:10-15.
20. Sugarman ID, Trevett J, Malone PS. : Tubularization of the incised urethral plate (Snodgrass procedure) for primary hypospadias surgery. BJU Int. 1999; 83:88-90.
21. Bath AS, Bhandari PS, Mukherje MK.: Repair of distal hypospadias. Tabularized incised plate urethroplasty: a simple versatile technique. Indian J Plast Surg 2003; 36:23-25.
22. Cheng EY, Vemula Pali SN, Kropp BP, et al. Snodgrass hypospadias repair with vascularized dartos flap: The perfect repair of virgin cases of hypospadias. J Urol. 2002; 168:1723-1726.
23. Cook A, Khoury AE, Neville C, et al.: A multicenter evaluation of technical preferences for primary hypospadias repair. J Urol. 2005; 174:2354–7.
24. El-Kassaby AW, Al-Kandari AM, Elzayat T, et al.: Modified tabularized incised plate urethroplasty for hypospadias repair: long-term results of 764 patients. Urology 2008; 71: 611-615.
25. Ross JH, Kay R.: Use of a de-epithelialized local skin flap in hypospadias repairs accomplished by tabularization of the incised urethral plate. Urology 1997; 50:110-2.
26. Erin RM, Anthony JS, Tanya L, et al.: Management of proximal hypospadias with 2-stage repair: 20 year experience. J Urol 2005 194:1080–1085.
27. Johal NS, Nitkunan T, Malley KO, et al.: The two-stage repair for severe primary hypospadias. Eur Urol 2006 50:366–371.
28. El-Kassaby AW, Al-Kandari AM, Elzayat T, et al.: Modified tabularized incised plate urethroplasty for hypospadias repair: long-term results of 764 patients. Urology 2008; 71: 611-615.
29. Sulaiman AA.: Repair of hypospadias in Al-Khansa'a Mosul pediatric surgery center (analysis of 125 cases). Ann. Coll. Med. Mosul 2008; 34:109-117.
30. Inayat-Ur-Rehman.: Tabularized incised plate urethroplasty for the repair of distal and mid penile hypospadias. J Med Sci 2010; 18: 114-116.