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Snodgrass Hypospadius Repair, One Stage Urethroplasty for Mid-Shaft and Distal Hypospadias. Clinical Experience and outcome of 44 Patients

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Abstract

Background : Hypospadias is a common anomaly of male external gentalia. Most cases of hypospadias are distal type. Snodgrass procedure or tubularized incised plate urethroplasty has become the preferable and optimal treatment for primary and distal cases of hypospadias. The aim of this study was to study the effectiveness and evaluate the outcome of Snodgrass procedure presented for 44 patients with distal and mid-shaft hypospadias. Patients and method; from April 2011 to May 2014; 36 patients with distal hypospadias and 8 patients with mid-shaft hypospadias, (total 44 patients) had been submitted to corrective surgery foe their hypospdias by single stage Snodgrass TIP technique. Results: mean age of patients and mean operative time in this study were 2.8±1.8, 52.7±9.4 respectively. The functional and cosmetic results were excellent. The overall complications rate recorded was 13.6

Index terms— hypospadias, snodgrass operation, tabularized incised plate urethroplasty.

1 Snodgrass Hypospadius Repair, One Stage

Urethroplasty for Mid-Shaft and Distal Hypospadias. Clinical Experience and outcome of 44 Patients

2 Introduction

Hypospadias is defined as abnormal ventrally placed external urethral meatus. It is typically consisted of three abnormalities. These are: first, ectopic site of urethral meatus, second, ventral curvature of penis, known as chordate and finally hooded foreskin resulting in excess foreskin on the dorsum of penis more than the ventrum [1]. Some or all of these abnormalities may occur. Hypospadius may occur in isolation, or be a part of sexual development disorders. It is very important to address the isolated cases of hypospadius than those cases associated with sexual developmental anomalies. [2] Hypospadias are among the most common birth anomaly of male genitalia, second only to maldesended testes [3]. The incidence of hypospadius is approximately 1 of every 300 live male births and in some families with disorders of sexual differentiation, may be as high as 1 in every 80-100 lives male births. The incidence of hypospadias had been doubled over the last century mainly in the western countries [4].

The exact etiology of hypospadius is still unclear [5]. Many theories were put to explain the occurrence of hypospadius. These include increased level of androgens or estrogens during embryogenesis or could be a genetic component. The severity of hypospadius is different among patients. It classically classified as proximal, midshaft and distal [6]. With proximal hypospadius, the severity of chordee will be more than in distal hypospadias when the extent of chordee, if present, will be very minimal. Distal hypospadias represents the vast majority of the cases. Proximal hypospadias occurs in less than 10% of the cases [7].

Despite its etiology, the treatment of hypospadius in all cases is the same, which is surgical repair. There have been over 200 different operations for correction of hypospadias [8]. Most of these surgeries can be categorized

into one to three types of surgeries. These include correction of chordee (orthoplasty), reconstruction of the missing piece of distal urethra (urethroplasty)and reconstruction of the ventral side of penis (meatoplasty and glanuloplasty). The most commonly practiced surgical procedures for hypospadias repair are MAGPI (Meatal advancement and glanuloplasty) for glanular hypospadias, Thiersch Duplay Mathieu, and Snodgrass (TIP procedure) [9]. In this study, we discuss and evaluate our experience regarding the functional and cosmetic outcomes of TIP repair (Tubularized incised plate) or Snodgrass repair done for 44 patients with distal and mid shaft hyospadias, in addition to the rate of main complications. The vast majority of the hypospadias in this study were distal type (36 patients) and only 8 patients have midshaft hypospasias. All patients in this study were examined preoperatively for the presence of chordee which was further confirmed during surgical repair by inducing artificial erection. Primary hypospadias only were included in this study. Children with history of previous failed hypospadias corrective surgery, those with concomitant urogenital anomalies and history of prior circum cision were excluded. All the operations had been done by same surgeon. The hospital stay in this study ranged from 2 to 5 days (average 3.5 days). Patients after discharge were followed week after surgery, then every 2 weeks for the first 2 months and every month for the first year to assess the functional and cosmetic outcome and to detect any complications.

3 II.

4 Patients and Methods

5 Operative technique

The operative procedure of Snodgrass TIP hypospadias repair can be summarized by the following steps: first, the appropriate set-up and fine instruments and equipment is essential to a successful hypospadias surgery. The main set-up and equipments include fine pickups and needle drivers such as a Castroviejo type, fine knife such as Weck knife, fine sutures such as 5-0, 6-0 Vicryl and PDS sutures and flexible feeding catheter of appropriate size.

The operation is carried out under general anesthesia. Initially, the penis is prepped and draped in sterile fashion. Adhesions between the dorsal hood and glans are broken down and re-prepped again with povidone iodine. The presence of significant chordee after the adhesion is taken down becomes clear and evident. The presence of significant chordee is usually caused by shortage of skin on the ventral side or it may result from fibrous band which extends from the base of the penis along the lateral side and rarely, due to urethral plate tethering the penis or due to corporal body disproportion. The first step in TIP Snodgrass procedure is to put a traction suture in the glans penis. Traction suture allows the penis to be placed on ample tension so the tissue can be divided accurately. After that, hypospadias repair is mapped out. The urethral plate is first mapped out, next, marking is extended proximally and laterally to form firlit collar, the marking is extended onto dorsum of penis in circumferential manner. A soft catheter is inserted through the ectopic urethral opening to visualize the location and quality of the urethral meatus.

The operation began by degloving of penis. The more distal portion of the urethral meatus is usually very hypoplastic. Therefore, the meatus has to be cut back to site of adequate corpos spongiosm tissue covering the urethra. Tourniquet is placed at the base of penis to control the blood loss for better visualization of surgical field. The tourniquet used is a rubber band placed over gauze to prevent excessive compression of the urethra but allow adequate haemostasis.

The next step of procedure is isolation of urethral plate by making a U-shaped incision using a very sharp and fine knife like a Weck knife extending along the edges of urethral plate to healthy skin 2 mm proximal to meatus and the incision should be made perpendicular to the urethral plate down into glans while the glans is placed on traction to allow for a straight and vertical incision rather than a skiving incision that may affect the quality of urethral plate. The incision of urethral plate should not be extended too distal in the glans as it may result in meatal stenosis. After the incisions are made on both sides of urethral plate, it is extended circumferentially on the dorsum of penis. The incision is carried along the firlit collar to develop 3mm mucosal cuff that can be re-approximated over the tubularized urethra and to give a penis a more normal circumcised appearance. The circumferential incision should be sharp and all subcutaneous tissue is left with the dorsal foreskin, so it will be harvested as a sub-dartos flap.

The process of dissection and degloving should be continued to the peno-scrotal junction both on the ventral and dorsal side. The urethra should be carefully seen during dissection to avoid its injury proximally. Laterally, the fibrous bands, if present, must be taken down to correct the chordee. The presence of chordee is confirmed operatively by inducing artificial erection with normal saline infusion of corpus spongiosus.The incisions lateral to the urethral plate is deepened to form glans wings, which can be rotated ventrally and reapproximated and sutured in the midline.

Next in the procedure, is the tubularization of urethral plate which begins by making a midline incision in the urethral plate to increase the circumference and allow tubularization of the urethral plate easily with 6-0PDS or Vycril over appropriate size and flexible catheter, usually of 6 to 8 Fr. size. The midline plate incision should not extend beyond the mid of glans penis to avoid meatal stenosis and to give the neomeatus more vertical and slit-like shape. All sutures should be in subcuticular fashion to ensure good approximation and healing. The

second layer of the dartos pedicle flap is then obtained from the subcutaneous tissue of the dorsal preputial skin and transported ventrally through a buttonhole in the dartos flap which is sutured over the neourethra.

Glans wings are then approximated for galnuloplasty. Lastly Byars flap is made for ventral skin cover with creation of midline skin raphe and the access skin is cut and trimmed to give the penis the circumcised appearance. At the end of the procedure, gauze dressing was applied. Catheter and dressing removed 7 to 10 days post-operatively.

6 III. Results

All 44 patients underwent Snodgrass TIP repair. The positions of the ectopic urethral meatus were coronal in 15 The functional and cosmetic results with a normal looking slit-like vertical shaped meatus at the tip of glans were achieved in all 44 patients. The overall complication rate in this study was 13.6 %(6 patients).

Urethrocutaneous fistula was recorded in 3 patients (6.8%) in this study. The location of these fistulas was midshaft in 2 patients and subcoronal (distal) in one patient. Reoperation was needed for only one midshaft fistula 3 months after the first surgery and the operation was successful with good results. The other 2 cases were managed conservatively by urethral dilatation and insertion of urethral catheter which was fixed and kept for 2 weeks and the fistula closed spontaneously.

Meatal stenosis in this study was occurred in 2 patients (4.5%) manifested as poor urinary stream 4 to 6 weeks postoperatively. These stenoses were managed conservatively by serial and regular dilatation of urethra and meatoplasty was not needed.

Skin dehiscence and disruption was recorded in 3 patients (6.8%), two of them was associated with fistula formation and one cases due to wound infection. The dehiscence however was small and partial and treated conservatively by treatment of associated fistula and infection.

Penile torsion was not encountered in any patients in this study. Regarding the cosmetic outcomes 3 months was very satisfactory. The external urethral meatus was vertical, slit-like and centrally located in all patients.

7 Discussion

Hypospadia is very common congenital abnormalties of external genitalia in males. The severity of this disorder varies among boys according to the position of ectopic urethral meatus, on which, it is mainly classified in to proximal, midshaft and distal types. About 90% 0f children have the distal type of hypospadias **??**10]. The surgical aims of any hypospadias surgery are complete straightening of penis during erection, creation of neourethra which should be hairless and of adequate size and lumen, slitlike, vertical and centrally located urethral neomeatus, urination with a straight normal flow, well aimed stream, cosmetically acceptable penile appearance and lastly the surgery should be with few complications [11]. More than 200 operations or their modifications had been described for correction of hypospadias but none of these operations have met the above criteria or considered as gold standared for all patients and for all types of hypospadias, thus hypospadias surgery still one of urosurgical [12].

The tabularized incised plate (TIP) repair was introduced by Snodgrass 1994 [13]. It depends on previous principle of urethral plate tubularization which is known as the Thiersch-duplay operation. The main limitation of this type of hypospadias repair was the narrow width of the urethral plate, so that the urethral groove was not wide enough for insitu tubularization. The Snodgrass repair is based on the fact that the midline incision into the urethral plate will widen it sufficiently allowing for urethroplasty without stricture Snodgrass TIP urethroplasty is a single stage corrective procedure with excellent short-term and longterm functional and cosmetic outcomes with relatively few complications [14].

The age of most patients in this study were below 3 years (mean age 2.8±1.8 years) which was comparable to the age reported by Saleem et al [15] and Anwar-ul-haq et al [16] and less than the age reported by Raashid H et al [17] in their comparative study of Snodgrass and Mathieus procedure for primary hypospadias repair. The position of ectopic urethral meatus was distal in the majority of our patients, 36 patients (81.8%) in this study presented with coronal and subcoronal (distal) type and only 8 patients presented with midshaft hypospadias. These findings were consistent with that recorded by Sugerman et al [18], Cheng et al [19] and Bath et al [20].

Chordee in this study was noted in 12 patients (27.3%). The degree of chordee, however, was minimal in all cases. Patients with severe chordee were not included in this study. The incidence of associated chordee with hypospadias was different in various similar studies. It ranged from 100% in the study of Tonvichien and Niramis [21] to 0% in similar study of Snodgrass procedure for various types of hypospadias conducted by Hombalkar et al [22]. The presence of chordee was noted in 19.9% in Singh et al study [23] and was recorded in 35% in Sweet et al series [24]. We believe that the peresence of severe degree of chordee is associated with increased risk of urethrocutaneous fistulas postoperatively and so, patients with such findings should be excluded for Snodgrass repair.

The complications of hypospadias surgery are not infrequent. These include urethrocutaneous fistula, meatal stenosis, urethral strictures, wound infection and dehiscence, penile torsion, and cosmetically unacceptable penile appearance. The most feared and undesirable complication is the formation of urethrocutaneous fistula.Selection of the patients is very important for successful hypospadias surgery. Since the introduction the principle of

incising the urethral plate by Rich et al ??25] in 1989, it was mostly used for distal type and less commonly the midshaft hypospadias for better cosmetic results of hypospadias repair.

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. Presently, this procedure has gained popularity and wide acceptance among surgeons for correction of distal type of hypospadias because of its simplicity, versatility, less complications rate,and reliability to form vertical slit-like meatus. Although this procedure can be applied for patients with proximal type of hypospadias, it is better to be avoided in these patients with proximal type and also in those with significant and severe chordee in order to decrease the incidence of complications.

The overall complications rate in this study was 13.6%. Certain precautions had been adapted in this study to decease the incidence of unwanted complications. These include: delicate and gentle tissue handling, preservation of periurethral vascular supply which is very essential for procedure success by avoiding the use of cautery, but instead, we applied a rubber tourniquet over a piece of gauze at the base of penis in order to achieve relatively bloodless field, avoidance any tension, usage of magnification loupe, the use adequate length and well vascularized dorsal subdartos to avoid tension and necrosis of the flap and the use of appropriate size and flexible catheter to stent the neourethra and prevent obstruction and stenosis. By using these measured in our series, we obtained satisfactory results and acceptable complications rate of 6 in 44 patients which was less than the complications rate reported by Shanberg et al [26] and Borer et al [27] which were 15% and 24% respectively.

The incidence of urethrocutaneous fistula after Snodgrass repair in this study was 6.8%. Zhou et al [28] recorded 12.5% urethrocutaneous fistula after Snodgrass TIP repair. The rate of urethrocutaneous fistula noted by Cheng et al [19] and Akmal et al [29] Volume XIV Issue VI Version I was ranging from 0.6% to 16% while Jayanthi VR [30] and Ikramuddin et al [31] reported a fistula rate of 1% and 2% respectively. Uzair M et al [32] reported post Snodgrass repair urethrocutaneous fistula rate of 9.6%. It had been suggested that several factors affect the formation of urethrocutaneous fistula 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. Snodgrass [13] has recommended two layer urethral palate closures to decease the fistula formation. He found that the incidence of urethrocutanous fistula decrease from 33% to 11% or even less when two layer urethroplasty was performed. Snodgrass also 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. Willcox et al [33] suggested in his study that the incidence if fistula formation will be reduced when a second layer of well vascularized pedicle subcutaneous layer from dorsal hooded prepuce to cover the neourethra.

Alsharbaini R et al [34] noted in his series of 320 cases of distal and midshaft hypospadias treated by Snodgrass urethroplasty that the rate of fistula formation is related to the extent of urethral plate incision with lower incidence of fistula in those patients in whom the the incision extended to mid-glans than in those patients with incision extended to tip of glans. On the other hand, Khairi A et al [35] showed in his series that the thickness of the flap was an important factor in fistula prevention. They found that the flap when thick, nontransparent, allowing bulky vascular flap to be laid over the neourethra decreased the incidence of fistula.

Perlumutter et al [36] have been suggested that age at operation has an effect on the development of fistula. He noted that the fistula formation was significantly lower in patients less than 6 months than in older patients. In our study, all children who developed urethrocutaneous fistula were more than 2 year old.

Meatal stenosis after corrective hypospadias surgery is usually due technical reasons. The incidence of meatal stenosis in this study was 4.5% (2 patients only) which was treated conservatively by regular dilatation. Snodgrass [7,8,13] recorded meatal stenosis rate less than 1% and the lumen of neourethra was adequate which allow the introduction of 10 Fr easily. O´Connor et al [37] reported a high rate of meatal stenosis in their similar study. About 21% of their patients developed meatal stenosis which required correction under general anesthesia. Bath et al [20] noted that 6% of their patients had meatal stenossis post Snodgrass repair. Raashid H et al [17] reported that meatal stenosis rate of 5.3% in their series of TIP hypospadias repair. Holland et al [38] in their study of 59 patients submitted to Snodgrass repair reported meatal stenosis rate of 5%in Gurdal et al [39] study of 70 patients, only one patient developed meatal stenosis who required meatomy.

Alshabaini R et al [34] and Khairi A et al [35] 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 neomeatus was not included in the urethral plate incision, the rate of meatal stenosis will be reduced. Besides, the appearance of the neomeatus was cosmetically better as vertical slit-like shape.

The rate of urethral stricture reported by many authors {7, 40,41,42, ??3,44] after Snodgrass repair were low. The longitudinal incision in the urethral plate described by Snodgrass is important invention of hypospdias corrective surgery. It permits urethral plate preservation and facilitate the formation of tension free tubularization of narrow urethral plate to form a neouretha of good size. The low rate of urethral stricture after Snodgrass operation could be explained according to Bluestein et al [45] by the fact that the healing of midline incision of urethral plate occurred by reepitheliazation with normal tissue in-growth without scaring 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.

Penile torsion was not recorded in our study. This could be explained by the fact that patients with sever chordee were excluded. The chordee in our patients was absent or of minimal degree. Other factor which prevents the development of torsion was the way by which the dorsal preputial flap is transferred ventrally. This way entailed formation of window in the midline of the flap through which the penile shaft transferred to pull and transfer the dartos flap ventrally over neourethra. The rates of penile torsion in Al-Hunayan et al [46] and Soygur et al [47] studies of Snodgrass TIP repair were similar to our results. The extent effect of penile degloving on the rate of penile torsion is an issue of controversy. Degloving in our study was complete and extended to penoscrotal junction and induction of artificial erection was done to prevent postoperative torsion. Same trend was recommended by Snodgrass [13] and Sozubir [48], while Turialis et al [49] advised limited extent of degloving to decrease the length of the covering dorsal flap of the neourethra.

The functional and cosmetic results of Snodgrass repair in our study were excellent (100%). Re-operation was needed for one patient only who developed wound dehiscence and fistula formation. Our results were in agreement with those of Bath et al [20], Jayanthi VR [30], and Stehr et al [50]. There are two important criteria in order to obtain good functional and cosmetic results: the urethra plate should not be less than 1 cm wide and there should be no associated severe chordee. Furthermore, the cosmetic and functional results in a study conducted by Abolyosor [51], all 156 boys with distal and midshaft hypospadias repaired by Snodgrass repair had satisfied with the cosmetic and functional outcomes. Aslam R et al [52] who conducted a single-stage Snodgrass hyposadias repair for 74 patients with distal hypospadias recorded that only 2 patients showed residual bulkiness of skin around the corona with additional 2 patients developed meatal stenosis but with no functional symptoms.

Lastly, several studies were conducted to compare between Snodgrass and Mathieu technique regarding the outcomes and complications. Anwar-ulhaq et al [16], Oswald J et al [41], Guo Y et al [53], Hashem M et al [54] and Moradi M et al [42] noted that in their comparative studies that Snodgrass repair technique were superior on Mathieu technique, while in other 2 studies done by Germiyanoglu C et al [55] and Ververidis M et al **??**43]showed no difference between the two techniques in respect to complications but the cosmetic and functional results were better In Snodgrass repair.

8 Conclusion

Since the introduction of Snodgrass tabularized incised plate urethroplasty in 1994, this operation had gained a wide acceptance and popularity. It is simple, versatile and effective corrective surgery for patients with distal and mid-shaft hypospadias which constitute the vast majority of patients. The functional and cosmetic results of this technique which are the main concern to parents and patients are usually excellent. The rate of the main postoperative complications, namely, urethracutaneous fistula and meatal stenosis is usually low and acceptable. We advise Snodgrass TIP repair as first choice operation for all boys with distal and mid-shaft hypospadias.

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Figure 1:

[1]

[1]Snodgrass Hypospadius Repair, One Stage Urethroplasty for Mid-Shaft and Distal Hypospadias. Clinical Experience and outcome of 44 Patients

surgery for their hypospadias by Snodgrass TIP procedure.

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This is a prospective study conducted
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major hospital in Basra, Iraq from Apr
2011 to May
2014, in which 44 consecutive male chi
dren presented
with primary hypospadias submitted
correction

Figure 2:

1

P Patients characters and site of ectopic urethral meatus	No	Mean, %
Patient age (mean)	8 months-12 years	2.8±1.8 years
Presence of chordee	11	27.3
Coronal	15	34.1
Sub-coronal or distal	21	47.7
Mid-shaft	8	18.2

Figure 3: Table 1 :

2

mid-shaft in 8 cases. Mean age in this study was

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Operative details Operative time Hospital stay	mints. 2-5	Mean ,%	Global
Overall complications Urethra-cutaneous fistula Meatal steanosis 2 : t t i i E e ails s	days 6 3 2	52.7±9.4 3.5 days 13.6 6.8 4.5 mints.	Journal of Medical Research
Wound dehiscence	3	6.8	
Penile torsion	0	0	
Position and shape of neomeatus.	Central, vertical and slit-like	100	
Functional and cosmetic outcome	Very satisfactory-excellent	100	

[Note: 21Volume XIV Issue VI Version I © 2014 Global Journals Inc. (US)]

Figure 4: Table 2 :

3

O Operative outcomes Literature	Sample size No	Mean age (months)	Overall complications (%)	Fistula formation (%)	Meatal stenosis (%)	Shape of neo-meatus	Cosmesis outcome
Samuel [4]	65	14 m.	6	5	0	Slit-like	Excellent
Anwar-ul-haq [16]	45	36 m.	5	0	3	Slit-like	Excellent
Cheng[19]	414	_	0.2	0	0.2	Slit-like	Excellent
Rashid [17]	52	6.2 y.	11.5	5.76	5.3	Slit-like	Good
Bath[20]	16	2.6	12	6	6	Slit-like	Excellent
Jayanthi [30]	110	9.5m.	2	0.9	0	Slit-like	Excellent
Alsharbaini[34]	320	18m	14.1	2.5	3.1	Slit-like	Excellent
Moradi [42]	33	7.06	12.6	13.3	6.6	Slit-like	Excellent
Sozubir [48}	75	20	4	4	0	Slit-like	Excellent
Aslam[52]	74	3.5y.	7	2.7	2.7	Vertical	Good
Gue [53]	36	_	22.2	8.3	5.6	Vertical	Good
Ours	44	2.8	13.6	6.8	4.5	Slit-like	Excellent

V.

Figure 5: Table 3 :

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