



Bracka versus Byar's two-stage repair in proximal hypospadias associated with severe chordee: a randomized comparative study

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Abstract

Introduction Proximal hypospadias associated with severe chordee represents a major surgical challenge and the debate over its optimal treatment is ongoing. The objective of this study is to compare the outcome of two-stage Bracka and Byar's repair in proximal hypospadias.

Materials and methods This study was conducted from January 2013 to February 2018 in a tertiary care centre. Patients of hypospadias with severe chordee who required urethral plate transection were included in the study. Patients were randomly divided into two groups by simple randomization method. Bracka staged repair was done in Group A and Byar's staged repair in Group B. Postoperatively complications including graft loss, flap necrosis, fistula formation, meatal stenosis, stricture, diverticula formation, residual chordee were noted in both the groups and compared. *p* value of <0.05 was considered statistically significant.

Results Over a period of 5 years, 74 patients in group A and 68 patients in group B were operated. Fistula occurred in 6.8% and 10.2% in group A and group B, respectively (*p* value 0.629). Meatal stenosis was seen in 4% in group A and 3% in group B (*p* value 0.731). Stricture was seen in 1% in each group (*p* value 0.339). Diverticula formation was seen in 2% in group B and none of the patient in group A (*p* value 0.960). None of the patient had recurrence of chordee in either group.

Conclusion Bracka and Byar's two-stage repair have similar postoperative outcome and the choice between the two depends up on the surgeon's choice and experience rather than scientific evidence.

Keywords Proximal hypospadias · Severe chordee · Bracka two-stage repair · Byar's two-stage repair

Introduction

Hypospadias is one of the most common congenital defects of male external genitalia, occurring in approximately 1 in 250 live male new born of which proximal hypospadias account for 20% of all cases [1, 2]. In proximal hypospadias, the urethral plate is often poorly defined, short, fibrotic and tethered, contributing to the high incidence of more severe chordee. Chordee is formed by residual fibrous tissue of the

corpus spongiosum and is located distal to the urethral meatus, in close contact with the tunica albuginea. The prepuce in proximal hypospadias is asymmetric, accumulating on the dorsum of the penis and being deficient on the ventral segment.

Repair of proximal hypospadias with significant chordee is a major challenge to the Pediatric surgeons and urologists. Despite many innovations and much progress, there are still many controversies in choice of urethroplasty and surgery can fail. Two-stage approach for correction of proximal hypospadias remains a reliable solution for these patients that continue to be used [3–6]. Many surgeons remain unhappy with limitations and drawbacks of one-stage repair and continue to practice two-stage repair [7, 8]. A review of the recent literature suggested that these repairs achieve excellent cosmetic and functional results [9, 10]. However, the debate over the optimal treatment in such patients is ongoing.

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It is a significant surgical challenge to achieve a cosmetically and functionally acceptable straight penis in such patients. Most surgeons are gravitating towards two-stage repair for proximal hypospadias with good cosmetic and functional results with relatively fewer complications [11, 12]. Both Bracka and Byar's two-staged repair have been reported in the literature, but to the best of our knowledge, no study has compared the two-stage Bracka and Byar's repair in proximal hypospadias associated with severe chordee. The objective of this study is to compare the outcome of two-stage Bracka and Byar's repair in proximal hypospadias associated with severe chordee.

Materials and methods

This study was conducted in the Department of Paediatric Surgery Sher-I-Kashmir Institute of Medical Science, Srinagar, Kashmir, India from January 2013 to February 2018. Patients with severe chordee (ventral curvature $> 30^\circ$ after degloving of penis) with fibrotic urethral plate, corporal disproportion and urethral tethering, who required urethral plate transection and staged procedure were included in the study in both the groups. Circumcised patients and revision (previously operated) cases were excluded from the study. Patients were operated by two surgeons at one centre having more than 10 years of experience in hypospadias repair.

With an approval from the Institutional Ethics Committee and informed consent from the parents, patients were divided into two groups by simple randomization through computer generated sequence. Bracka-staged repair (Fig. 1a–e) was done in Group A (Bracka group) and Byar's staged repair (Fig. 2a–f) was done in Group B (Byar's group).

After degloving of penis, the degree of chordee was assessed by artificial erection test. If there was significant chordee, correction was done by a transection of urethral plate and excision of fibrotic tissue. Artificial erection was repeated to assess the degree of chordee correction. If there was some residual chordee, it was corrected by Nesbit plication.

The second stage was carried out about 6 months later when complete healing has occurred. Incision lines were marked for tubing of the neourethra, designing a 12–14-mm-wide strip that extended from the ectopic meatus up to the proposed new meatus. Tubularization was done over the 8F or 10F catheter with subcuticular continuous Vicryl sutures taken around 2–3 mm apart and inverting the edges. Glanoplasty was performed in two layers by thick subcuticular interrupted suturing technique using Vicryl. This was followed by the skin closure. In both the groups, tunica vaginalis flap was used as second layer in most of the patients.

Dressing was removed after 5–6 postoperative day and wound was kept open. The patient was given IV antibiotics

for 5 days and then oral antibiotics till the removal of catheter. The urinary catheter was removed after 9–10 postoperative day and the patient discharged home after voiding urine satisfactorily which was observed.

Postoperatively in both the groups, complications including graft take/loss, flap take/necrosis, fistula formation, meatal stenosis, stricture, diverticula formation, residual chordee were noted. After the discharge, patients were advised to attend the follow-up clinic at weekly intervals for 4 weeks, thereafter at monthly intervals for 6 months and after that, 3–6 monthly for minimum 2 years. Patients were reviewed at follow-up clinic by the team including operating surgeon, assistant and third nonoperating surgeon. Results of both the groups were formulated and analysis was carried out using chi-square test with Yates correction (two-tailed p value) and Graph pad Prism version 8. p value of < 0.05 was considered statistically significant.

Follow-up period ranged from 16 months to 6 years (mean follow-up of 27.4 months).

Results

Over a period of 5 years, a total of 142 patients were included in the study with 74 patients in group A and 68 patients in group B. Age of patients ranged from 8 months to 4.6 years with mean age of 2.3 years in group A. In group B, age of patients ranged from 11 months to 5.2 years with mean age of 2.6 years. Distribution, type of hypospadias and outcome in both the groups are shown in Table 1.

In Bracka group, graft take was 100% and in Byar's group, flap necrosis in one patient into which a buccal graft was put after 3 weeks (p value 0.960). Fistula occurred in five (6.8%) patients and seven (10.2%) patients in group A (Bracka group) and group B (Byar's group), respectively (p value 0.629). Fistula was seen after removal of catheter in two patients in group A and one patient in group B. Rest of the patients in both the groups have fistula formation within 3 months after surgery except one patient in group B, in which fistula was seen 6 months after surgery. Fistula underwent repair 6 months postoperatively. All five patients in group A and six patients in group B were cured with a single procedure and one patient in group B needed fistula closure twice. Meatal stenosis was seen in three (4%) patients in group A and two (3%) patients in group B (p value 0.731). These were managed by serial dilatations except one patient in group A in which meatotomy was done. Stricture was seen in one (1%) patient in group A (2 months after surgery) and none of the patient in group B (p value 0.339). Diverticula formation (4 months after surgery) was seen in 1 (2%) patient in group B in which reduction of the diverticula was done. None of the patient had recurrence of chordee in either group.



Fig. 1 **a** Penoscrotal hypospadias with severe chordee. **b** Raw area (after correction of chordee) covered with preputial graft. **c** Incision for neourethra marked. **d** Tubularization completed over 8F catheter. **e** Post-operative view with catheter in situ

Discussion

The ultimate surgical goal of hypospadias repair is to achieve a normal or near normal appearance of penis, to have a water-proof neourethra with adequate calibre, to have a vertical slit like meatus and adequate glans, to create a straight penis adequate for sexual function and to have a good urinary stream [13]. The debate on two-stage versus single-stage repair for proximal hypospadias is ongoing and no procedure is ideal and universally accepted. However, there is resurgence of the two-stage procedure in repairing the proximal hypospadias [12, 14–17].

Many hypospadias surgeons think that in hypospadias with severe chordee, it is necessary to transect or excise the

urethra or urethral plate and creating a full circumference defect in patients with proximal hypospadias associated with severe chordee and thus necessitating a two-stage repair [18–20]. Bracka two-stage repair involves the reconstruction of urethra from preputial, buccal mucosal or post-auricular graft. Inner preputial graft is an ideal urethral substitute, because it is androgen sensitive, very thin and flexible, takes reliably, is designed to be moist, has no potential for hair growth and the donor site is both convenient and expendable.

Byar's two-stage operation is also a common operation performed in patients, who need urethral plate transection and staged repair. In Byar's staged repair, flaps are created and mobilized ventrally to cover the raw area on ventral shaft of the penis.



Fig. 2 a Penoscrotal hypospadias with poor urethral plate and severe chordee. b Creation of Byars Flaps. c Suturing of the flaps. d Complete healing of flaps. e Completed tubularization and skin closure. f Urinary stream after removal of urinary catheter

Table 1 Demographic data

Meatal location				Outcome					
Group A (n=74)	Group B (n=68)		p value	Group A (n=74)	Group B (n=68)	p value			
Proximal penile	30 (40.5%)	Proximal penile	28 (41.2%)	0.880	Graft loss	0	Flap loss	1 (1.4%)	0.960
Penoscrotal	24 (32.4)	Penoscrotal	23 (33.8%)	0.952	Fistula	5 (6.8%)	Fistula	7 (10.2%)	0.629
					Meatal stenosis	3 (4%)	Meatal stenosis	2 (3%)	0.731
Scrotal	15 (20.3%)	Scrotal	14 (20.6%)	0.897	Partial glans dehiscence	2 (2.7%)	Partial glans dehiscence	3 (4.4%)	0.909
					Stricture	1 (1%)	Stricture	0	0.339
Perineal	5 (6.8%)	Perineal	3 (4.4%)	0.826	Diverticula formation	0	Diverticula formation	1 (2%)	0.960
					Residual chordee	0	Residual chordee	0	
					Total	11 (14.5%)	Total	14 (21%)	0.474

In Bracka group, we have used inner preputial graft in all patients and graft was slightly larger than required, as contraction of 20% grafted area usually occurs between the two stages [21]. We have achieved 100% graft take. Other authors [11, 12, 22, 23] also reported 100% graft take. In Byar's group, flap take was seen in 98.6% of patients. Shukla et al. [3], Arshid [24] and Yang et al. [25] reported 100% flap take.

Complications of hypospadias repair are flap necrosis, graft loss, fistula formation, meatal stenosis, diverticulae, urethral stricture, recurrence of chordee. Most of the complications tend to occur in the first 6–12 months after the second stage. The most common complication after the second stage remains fistula formation. Several factors have been implicated for fistula formation, which include apposing suture lines distal obstruction from meatal stenosis or urethral stricture, turbulent urine flow in diverticulum, infection and locally impaired vascularity. Some close spontaneously, but most require surgical correction. In our study, fistula was seen in 6.8% in group A and 10.2% in group B. Joshi et al. [11], Ferro et al. [22], Ramanathan [23], Zheng et al. [26] and Sajjad et al. [27] have reported 10%, 11.7%, 10%, 20.5%, 5% fistula rate in their respective studies with Bracka-staged repair. Arshad [23], Yang et al. [25], Shukla et al. [3], Erin et al. [28], Saafan [29] have reported 18%, 5.5%, 3%, 29%, 24% fistula rate with Byar's staged repair.

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 [11–13, 22, 23, 27, 30]. In our study, meatal stenosis occurred in 4% in Bracka group and 3% in Byar's group. Saafan [29] reported meatal stenosis in 9.1% of patients and Shukla et al. [3] reported meatal stenosis in none of the patient with Byar's staged repair.

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 2.7% in Bracka group and 4.4% in Byar's group. Other authors have reported glans dehiscence from 5 to 25% with Bracka two-stage repair [12, 13, 22, 26]. Erin et al. [28] and Yang et al. [25] reported 3% and 3.9% of glans dehiscence with Byar's two-stage repair.

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. The reported incidence of stricture with Bracka two-stage repair is 0–9% [9, 12, 16, 22]. In our study, urethral stricture was seen in 1% in Bracka group. Yang et al. [25] reported urethral stricture in 1.6% of patients with Byar's staged repair. Shukla et al.

[3] and Saafan [29] reported urethral stricture in none of the patient with Byar's staged repair. In the present study also, none of the patient had urethral stricture in Byar's group.

Ballooning of the neourethra is a documented drawback of the two-stage repair. It may occur as an independent complication or as a secondary consequence of meatal stenosis. With Byar's two-stage repair, the reported incidence of diverticula formation ranges from 0 to 14% [9, 16, 22, 31]. In the present study, none of the patient had diverticula formation in Bracka group. In Byar's group, diverticula formation was seen in 2% of patients. Saafan [29], Shukla et al. [3] and Yang et al. [25] reported diverticula formation in none of the patients in their respective studies.

From the observations of present study, Bracka and Byar's staged repair have similar postoperative outcome. Thus, the choice between the two depends up on the surgeon's choice and experience rather than scientific evidence. In our experience, we are more comfortable with Bracka staged procedure, because we believe that the tubularized urethra in second stage looks smoother in its length in comparison to urethra in Byar's staged procedure which has a suture line along its length. The limitations of our study were lack of uroflow and use of postoperative objective scoring system.

Conclusion

Two-stage repair is a reliable approach in patients with proximal hypospadias associated with severe chordee or poor urethral plate in which urethral plate cannot be incorporated in the repair and requires substitution. Bracka and Byar's two-stage repair achieve excellent cosmetic and functional results with low complication rate. Both the repairs have equal rate of fistula formation, stenosis, stricture, disruption, diverticula formation and residual chordee and the choice between the two depends up on the surgeon's choice and experience rather than scientific evidence.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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