

Efficacy of Single-Stage Surgery (Island Tube Hypospadias Repair) in the Treatment of Proximal Hypospadias: A Comparative Retrospective Study

Proksimal Hipospadias Tedavisinde Tek Aşamalı Cerrahinin (Ada Tüp Hipospadias Onarımı) Etkinliği: Karşılaştırmalı Retrospektif Bir Çalışma

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ABSTRACT Objective: The complexity of hypospadias surgery and the risk of complications increase as the location of the opening moves proximally. In some cases, single-session surgical techniques are sufficient, whereas in others, complementary surgical techniques performed at different times are required. In this study, we aimed to evaluate the efficacy of single-stage surgery [island tube hypospadias repair (ITHR)] in the treatment of proximal hypospadias through a comparative retrospective analysis. **Material and Methods:** The data of 139 patients who underwent surgery for proximal hypospadias between 2011-2020 in our practice were analyzed retrospectively. A total of 76 patients underwent ITHR and 63 patients underwent two-stage hypospadias surgery (TSHS). All operated patients were followed up for 2 years to detect urethrocutaneous fistula, urethral stenosis, meatal stenosis, urethral diverticulum development, tissue dehiscence (wound dehiscence), residual chordee, and final cosmetic appearance. **Results:** The median (25.p-75.p) age and operative time of 76 patients who underwent ITHR were 3 (2-4) years and 179 (166.5-195) minutes. The median (25.p-75.p) ages and operative times of 63 patients who underwent TSHS were 4 (3-5) years and 220 (198-245) minutes. Although the median ages were similar, the operative time was longer in TSHS ($p<0.05$). Complications and final cosmetic appearance were similar in ITHR and TSHS cases ($p>0.05$). **Conclusion:** ITHR was found to be an effective technique in the treatment of proximal hypospadias, with complication rates similar to TSHS. The important advantages of ITHR are that it requires only one anesthesia, has shorter operation times, and relieves the burden on families.

ÖZET Amaç: Hipospadias cerrahisinin karmaşıklığı ve komplikasyon riski açıklığın yeri, proksimale doğru ilerledikçe artmaktadır. Bazı durumlarda, tek seanslık cerrahi teknikler yeterli olurken bazı durumlarda ise farklı zamanlarda yapılan tamamlayıcı cerrahi tekniklere ihtiyaç duyulur. Bu çalışmada, proksimal hipospadias tedavisinde tek aşamalı cerrahinin [ada tüp hipospadias onarımı (island tube hypospadias repair "ITHR")] etkinliğini karşılaştırmalı retrospektif analizle değerlendirmeyi amaçladık. **Gereç ve Yöntemler:** Pratiğimizde 2011-2020 yılları arasında proksimal hipospadias nedeniyle ameliyat edilen 139 hastanın verileri, retrospektif olarak incelendi. Toplam 76 hastaya ITHR, 63 hastaya ise iki aşamalı hipospadias ameliyatı [two-stage hypospadias surgery (TSHS)] uygulandı. Ameliyat edilen tüm hastalar; üretrokutanöz fistül, üretral stenoz, meatal stenoz, üretral divertikül gelişimi, doku ayrılması (yara açılması), rezidüel kordi ve son kozmetik görünüm açısından 2 yıl boyunca takip edildi. **Bulgular:** ITHR uygulanan 76 hastanın yaşları ve ameliyat süresi, median (25.p-75.p) olarak 3 (2-4) yıl ve 179 (166.5-195) dk idi. TSHS uygulanan 63 hastanın yaşları ve ameliyat süresi, median (25.p-75.p) olarak 4 (3-5) yıl ve 220 (198-245) dk'dır. Yaşların ortancaları benzer olmakla birlikte, TSHS'de ameliyat süresi daha uzundu ($p<0,05$). ITHR ve TSHS olgularında komplikasyonlar ve son kozmetik görünüm benzerdi ($p>0,05$). **Sonuç:** ITHR'nin proksimal hipospadias tedavisinde TSHS'ye benzer komplikasyon oranlarıyla etkili bir teknik olduğu ortaya konulmuştur. Tek anestezi gerektirmesi, ameliyat süresinin kısa olması ve ailelerin yükünü hafifletmesi ITHR'nin önemli avantajlarıdır.

Keywords: One-stage surgery; hypospadias; proximal; island tube; two-stage surgery

Anahtar Kelimeler: Tek aşamalı cerrahi; hipospadias; proksimal; ada tüpü; iki aşamalı cerrahi

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Proximal hypospadias is defined as the opening of the meatus in the proximal part of the scrotum, in the center of the penis, or close to the perineum.^{1,2} Proximal hypospadias accounts for approximately one in three hypospadias cases.² The complexity of hypospadias surgery and the risk of complications increase as the location of the opening moves proximally.^{1,3} In some cases, single-session surgical techniques are sufficient, whereas in others, complementary surgical techniques performed at different times are required.^{3,4}

As with distal hypospadias, the goal of proximal hypospadias surgery is to achieve a functionally and cosmetically appropriate penile reconstruction. To achieve these goals, patients should be carefully evaluated before surgery, a surgical technique appropriate to the patient's anatomical features should be selected, and patient-centered surgery should be performed in accordance with surgical principles. One-stage surgical reconstruction of distal penile hypospadias is the standard practice for the repair of distal hypospadias. Unfortunately, it is not easy to apply the same principle to proximal hypospadias.³ Proximal hypospadias repair presents many difficulties because releasing the ventral curvature and simultaneously reconstructing the urethra and skin represent an ongoing dilemma. There is no available evidence showing the superiority of one surgical technique over another. There is still no consensus among surgeons on whether a single or multistage operation is the optimal treatment for proximal hypospadias.⁵

Numerous surgical techniques have been described for the repair of proximal hypospadias, which can be broadly classified as single or multistage procedures.^{6,7} The multistage technique has previously been adopted for its simplicity and safety rather than its efficacy, but a single-stage repair is used by many surgeons and is safe and effective with a high success rate.⁶ Although surgery can be accomplished in a single stage, it also has many complications that may require a second and sometimes a third intervention.^{3,7}

In this study, we aimed to evaluate the efficacy of single-stage surgery (island tube hypospadias repair) in the treatment of proximal hypospadias through a comparative retrospective analysis.

MATERIAL AND METHODS

Between 2011 and 2020, 139 single-stage surgery [island tube hypospadias repair (ITHR)] and two-stage hypospadias surgery (TSHS) surgeries for proximal hypospadias were performed in our practice. The files of these patients who underwent surgical intervention were retrospectively analyzed. While recording patient data, patients were informed that these data would be used for scientific purposes, and also written informed consent was obtained from the patients. Patients were 2 years to detect urethrocutaneous fistula, urethral stenosis, meatal stenosis, urethral diverticulum development, tissue dehiscence (wound dehiscence), residual chordee, and final cosmetic appearance. No objective scoring system was used to assess cosmetic appearance. Cosmetic appearance was categorized as satisfied or dissatisfied. All surgical procedures were performed by the same surgeon. The surgeon has over 10 years of experience in hypospadias surgery. The choice of procedure is determined based on the preference of the parents of the patient after informing them of the advantages and disadvantages of the different procedures. The exclusion criteria were patients who had undergone failed urethroplasty procedures and secondary hypospadias or those who had complex urogenital malformations and hermaphroditism.

ETHICS APPROVAL

The study was approved by Tokat Gaziosmanpaşa University Faculty of Medicine Clinical Research Ethics Committee (date: June 6, 2024; no: 24-KAEK-184). It has been stated that all studies involving the "human" element are carried out in accordance with the principles of the Declaration of Helsinki 2008.

OUR SURGICAL TECHNIQUE FOR ITHR

General anesthesia with endotracheal intubation was administered to all cases. All cases received prophylactic third-generation cephalosporin (50-100 mg/kg). The examination of hypospadias of the patients was performed again under anesthesia for preliminary evaluation. Circumcision incision was made and advanced vertically bilaterally, terminating proximal to the meatus, and the urethral plate was dissected from the corporal surface. Chordee was detected by per-

forming artificial erection. After necessary manipulations, the chordee was corrected. A 1.5 cm wide flap, equivalent to the distance between the meatus and neomeatus, was prepared from the inner surface of the preputial skin and tubularized on a 10F catheter. After tubularization of the neourethra, the pedicle was prepared with adequate vascular support and freed from the surrounding tissues. The prepared flap was placed into the glanular groove by rotating the suture line to the corporal face. A proximal anastomosis was made with 7/0 polyglactin or polydioxanone suture at a depth to include the spongiose body. The anastomosis was fixed to the tunica albuginea on the corpora. If excess urethral tissue remained at the distal end, it was excised and fixed to the neomeatus at the glans tip. For a cosmetically favorable meatal appearance, a “V” shaped tissue was removed from the neomeatus, and glanuloplasty was started. The glans leaves were closed with subcuticular or matrees suture technique over the neourethra without creating tension in the midline. Finally, the preputial skin was moved to the ventral surface with a midline incision, and the skin opening was closed. After excision of unnecessary skin tissue causing cosmetic defect, the operation was terminated by closing the circumcision incision (Figure 1).

Images were used in the surgery after signed permission from the patient’s family was obtained.

We did not have a standardized surgical technique for TSHS. Preputial graft, preputial flap, post-auricular graft and buccal graft were used. The buccal graft method constitutes 65.1% of this procedure. Preputial flap, preputial graft, and post-auricular graft approaches were used at rates of 19%, 12.7%, and 3.2%, respectively.

The patients were followed up in the hospital for 10-14 days after the operation. Urethral stents were removed, voiding was observed, and they were discharged with appropriate treatment after 1 week. All patients were followed up at 1 month, 3 months, 12 months, and 24 months postoperatively. Possible early and late complications and cosmetic data were recorded.

STATISTICAL ANALYSIS

Statistical analyses were performed with MedCalc (version 20.009; Ostend, Belgium) statistical pack-

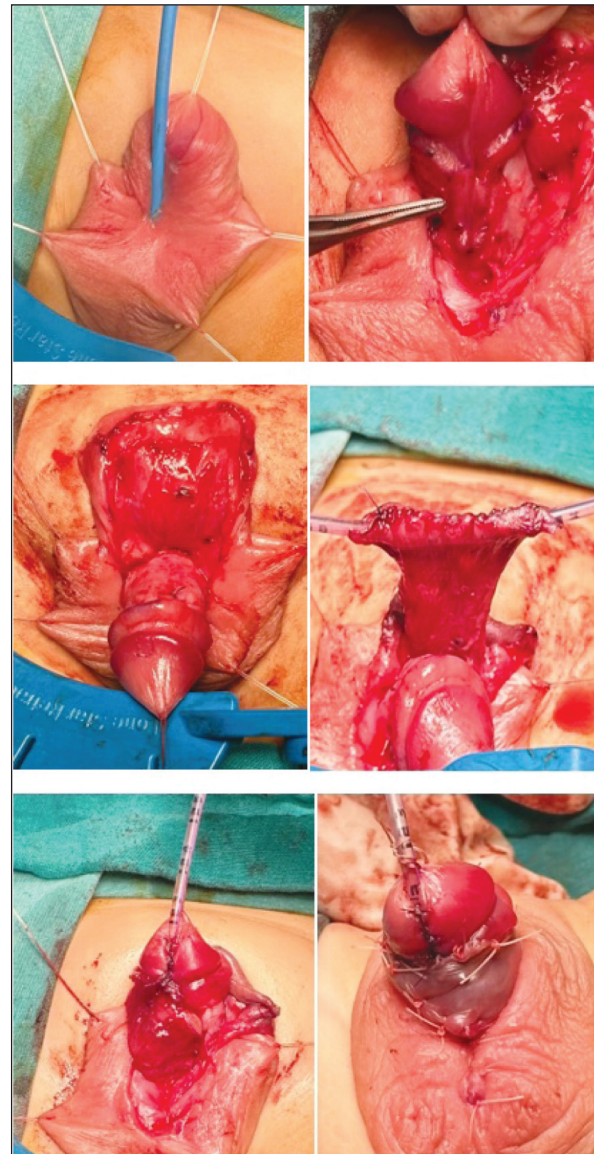


FIGURE 1: Stages of island tube hypospadias repair operation.

age program. Number, frequency, percentage, median, 25th and 75th percentile values were used to describe the data statistically. In the evaluation of the numerical data, Kolmogorov-Smirnov test was used to determine whether the groups conformed to normal distribution. Since the groups did not conform to normal distribution, the Mann-Whitney U test was used to compare the numerical data. Chi-square test was used to evaluate categorical data. Numerical data belonging to the groups were shown with box-whisker graphs, and categorical data were shown as stacked columns. Significance level $p < 0.05$ was taken for the interpretation of the results.

RESULTS

The median (25.p-75.p) age and operation time of 76 patients who underwent ITHR were 3 (2-4) years and 179 (166.5-195) minutes. The median (25.p-75.p) age and operation time of 63 patients who underwent TSHS were 4 (3-5) years and 220 (198-245) minutes. The operation time given for TSHS is the total time of two surgeries. There was a statistically significant difference in operation times between ITHR and TSHS ($p < 0.001$) (Table 1). Among the 76 patients who underwent ITHR, 6 (7.90%) developed urethrocutaneous fistula, 4 (5.30%) experienced urethral stenosis, 9 (11.80%) had meatal stenosis, 1 (1.30%) had tissue dehiscence, and 5 (6.60%) had residual chordee. In the 63 patients who underwent TSHS, 3 (4.80%) developed urethrocutaneous fistula, 3 (4.80%) had urethral stenosis, 6 (9.50%) experienced

meatal stenosis, and 3 (4.80%) had residual chordee. None of the 139 patients developed urethral diverticula. At 2 years, satisfaction with cosmetic appearance was similar (90.80% for ITHR and 90.50% for TSHS). There was no statistical difference in complications and cosmetic appearance between ITHR and TSHS (Table 2).

Urethral stenosis was observed in 7 (5.03%) patients and meatal stenosis in 15 (10.7%) patients across both groups. Intermittent urethral dilatation was performed every 2 weeks in patients with meatal stenosis and urethral stenosis, with no problems observed during follow-up. 9 (6.47%) patients developed urethrocutaneous fistula, which required fistula repair 1 or 2 times in subsequent sessions, and no issues were observed during follow-up. 8 (5.75%) cases, residual chordee was less than 10 degrees, and no increase in chordee was observed during follow-

TABLE 1: Age and operation time data of patients who underwent single and TSHS.

	ITHR				TSHS				p value
	n	Median	25P	75P	n	Median	25P	75P	
Age	76	3.0	2.0	4.0	63	4.0	3.0	5.0	0.102
Operation time (minimum)	76	179	166.5	195	63	220	198	245	<0.001*

*Significant difference at <0.05 level according to Mann-Whitney U test; ITHR: Island tube hypospadias repair; TSHS: Two-stage hypospadias surgery.

TABLE 2: The relationship between the type of hypospadias surgery and complications and final cosmetic appearance.

		Groups				p value
		ITHR		TSHS		
		n		n		
Urethrocutaneous fistula	None	70	92.10%	60	95.20%	0.457
	Existing	6	7.90%	3	4.80%	
Urethral stenosis	None	72	94.70%	60	95.20%	0.893
	Existing	4	5.30%	3	4.80%	
Urethral diverticulum	None	76	100.00%	63	100.00%	-
	Existing	0	0.00%	0	0.00%	
Meatal stenosis	None	67	88.20%	57	90.50%	0.662
	Existing	9	11.80%	6	9.50%	
Tissue dehiscence	None	75	98.70%	63	100.00%	0.363
	Existing	1	1.30%	0	0.00%	
Residual chordee	None	71	93.40%	60	95.20%	0.648
	10 degrees	5	6.60%	3	4.80%	
Cosmetic appearance (2 nd year)	Satisfied	69	90.80%	57	90.50%	0.950
	Not satisfied	7	9.20%	6	9.50%	

*Significant difference at <0.05 level according to chi-square test.

up. In 1 (0.72%) case, tissue dehiscence was observed, and the patient was advised to undergo reoperation after 6 months; However, the patient could not be reached for the operation. At the 2-year mark, 126 (90.64%) families were cosmetically satisfied with the results. These outcomes were considered excellent by both physicians and parents.

DISCUSSION

The aim of hypospadias repair is to obtain a functional urethra and a proper penile appearance with the meatus at the tip of the penis. The most important factor affecting success is the selection of the appropriate surgical technique, which should be based on the localization of the meatus, the presence of chordee, distal urethral hypoplasia, and the configuration of the glans.⁸⁻¹¹ Many one-stage and two-stage techniques have been described as different modifications of similar principles in proximal hypospadias surgery. Single-session methods such as the advancement of the urethra (MAGPI), tubularization of the urethral plate (TIPU and Thiersch-Duplay), and the extension of the urethra using flaps (Mathieu's meatal-based flap method, Onlay island flap, and island tube flap methods) are among the most commonly used standard treatments in the treatment of proximal hypospadias.^{7,9-12}

The dilemma of repairing proximal hypospadias with one-stage or two-stage repair is a long-standing problem. Surgeons who favor single-stage repair believe that it can reduce the burden on patients and their families by shortening operative times. On the other hand, improvements in complication rates and cosmetic results attract surgeons who tend to use staged repair. However, the fact that the patient will undergo at least two operations with staged repair, even with the best results, should also be taken into consideration.¹³ The anesthesia risk and additional financial costs created by this technique should also be considered.¹⁴ In our study, both techniques had similar results in terms of complications and cosmetic appearance. Although operative times were found to be longer in staged surgery. As a result, we can say that the single-stage ITHR yields successful results, with high efficacy, shorter anesthesia duration, and the advantage of a single surgical procedure, making

this method attractive. While the choice of technique with similar results in almost every aspect depends on the surgeon's experience, we believe that an effective and experienced surgeon should prefer one-stage hypospadias repair.

ITHR is a technique that can be used for single-stage repair in cases of proximal hypospadias with advanced penile chordee where the urethral plate must be excised. This technique is a good alternative for proximal hypospadias in terms of neourethral development and chordee repair in a single-stage setting. It is based on the principle of a preputial tube flap formed with its pedicle in place of the excised urethral plate.¹⁵ In the literature, the complication rates of this method are reported to be highly variable, such as 8-61.5%.⁵

With surgical developments over time, cases of proximal hypospadias can now be treated with single-stage methods.^{16,17} Today, the reoperation rate is reported to be similar for the two procedures.⁵ In the clinical study of Defoor and Wacksman., they reported that one-stage repair of penoscrotal hypospadias was a very safe procedure with an overall complication rate of 20%.⁶

In a recent clinical study by Wu et al, they documented that the most common complication of single-stage proximal hypospadias repair was urethral fistula (16.7%).¹⁸ Similarly, Emir et al., reported the single stage repair of proximal hypospadias urethral fistula rate as 20%.¹⁹ In our study, the urethral fistula rate was observed as 7.90%. In another study, Cui et al., reported a 5.2% rate of urinary tract infection in single-stage proximal hypospadias.²⁰ In our study, there is a hypospadias case with urinary infection. We believe that this situation is related to our hospital's high-level sterile operating room conditions and clinical experience. In another clinical study analyzing single-stage surgery in proximal hypospadias, they reported that no fistula was observed in any of the patients, while meatal stenosis was detected in 9.5%.²¹ Similarly, in our study, the most common complication was meatal stenosis (11.80%).

However, the long-term results of proximal hypospadias surgery have been a very interesting topic

recently. Concerns about patients with hypospadias during adolescence include possible recurrence of ventral curvature, meatal stenosis, sexual dysfunction, and lower urinary tract symptoms.^{22,23} Rynja et al. reported that long-term urinary, sexual, and cosmetic outcomes in patients undergoing single-stage transverse preputial island tube for proximal hypospadias were similar to those in patients distal hypospadias repair and controls.²² Similarly, Aslam et al observed that single stage Snodgrass hypospadias repair had a low long-term complication rate in distal and proximal hypospadias.²³ In another study, Patel et al documented that island tube and island onlay flap in proximal hypospadias have excellent long-term cosmetic and functional results in their 14-year clinical experience.²⁴ Unfortunately, our long-term results could not be evaluated in our study.

Hadidi's clinical study, they reported that single-stage repair in proximal hypospadias surgery showed 91% satisfactory results.²⁵ In a similar study, Rigamonti et al. reported that the complication rate was 21% and no residual curvature or voiding problems were observed in any patient.²⁶ In our study, the cosmetic appearance satisfaction rate was more than 90% and the complication rate was less than 50% in patients who underwent ITHR.

LIMITATION

The limitations of the study include the small number of patients, the single-center and retrospective nature of the study, the need to compare more surgical techniques, and the relatively short follow-up period. However, uroflowmetry parameters were not used. Another limitation of our study is that a global scoring system was not used to evaluate cosmetic results.

CONCLUSION

ITHR has been shown to be an effective technique in the treatment of proximal hypospadias, with low complication rates and results similar to those of TSHS. The outcomes of single and multistage repairs of proximal hypospadias are comparable, and no single technique can be considered superior. Therefore, it is more sensible for a surgeon to master several techniques and gain extensive experience with them to achieve the best results, regardless of the technique used.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Kenan Yalçın, Engin Kölükçü, Fatih Fırat, Yunus Emre Kuyucu; **Design:** Kenan Yalçın, Engin Kölükçü, Fatih Fırat; **Control/Supervision:** Kenan Yalçın, Engin Kölükçü, Fatih Fırat, Yunus Emre Kuyucu; **Data Collection and/or Processing:** Kenan Yalçın, Engin Kölükçü, Fatih Fırat, Yunus Emre Kuyucu; **Analysis and/or Interpretation:** Kenan Yalçın, Engin Kölükçü, Fatih Fırat, Yunus Emre Kuyucu; **Literature Review:** Kenan Yalçın, Engin Kölükçü, Fatih Fırat; **Writing the Article:** Kenan Yalçın, Engin Kölükçü, Fatih Fırat, Yunus Emre Kuyucu; **Critical Review:** Kenan Yalçın, Engin Kölükçü, Fatih Fırat, Yunus Emre Kuyucu; **References and Fundings:** Kenan Yalçın, Engin Kölükçü, Fatih Fırat, Yunus Emre Kuyucu; **Materials:** Kenan Yalçın, Engin Kölükçü, Fatih Fırat, Yunus Emre Kuyucu.

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