

Successful salvage urethroplasty with pedicled soft tissue reinforcement for failed hypospadias repair.

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Research Article

Keywords: hypospadias, reoperation, salvage surgery, soft tissue reinforcement, failed urethroplasty

Posted Date: April 7th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1513949/v1>

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Abstract

Purpose:

The high incidence of scarring and vascular compromise after failed hypospadias repair greatly compromises salvage urethroplasty. Pedicled soft tissue reinforcement (STR) is presented for enhancing the potential for success.

Methods:

The impact of lateral reinforcement of the scarred urethral plate to boost thickness and perfusion at the time of curvature correction (called CHARGE by the authors) and covering the neourethra at the time of urethroplasty (NUC) used as STR during salvage tubularized incised plate urethroplasty performed between 2003 and 2019 were assessed by retrospective review of the medical records of 8 cases of failed hypospadias repair.

Results:

Types of hypospadias were perineal/penoscrotal (n=7), and mid-shaft (n=1). Indications for salvage surgery included residual penile curvature (n=5), urethral diverticulum >15mm (n=3), urethral dehiscence (n=1), and urethral stricture (n=1). Salvage surgery was single-stage (urethroplasty at the same of curvature correction; n=1) or multi-stage (n=7; two-stage: n=4, three-stage: n=3). All cases had NUC and 4/8 had CHARGE. All salvage repairs were successful with no incidence of postoperative complications after mean follow-up of 3.9 years (range: 1.6-6.4 years) after the last procedure.

Conclusion:

STR most likely enhanced tissue perfusion/pliability which ensured the success of salvage urethroplasty for failed hypospadias repair.

Introduction

There are more than 250 documented techniques [1] for the surgical correction of hypospadias; an indication of the complexity of treating this condition reliably and successfully. Despite improvements in technology, salvage urethroplasty (UP) for failed hypospadias repair continues to be particularly challenging because of scarring and poor vascular perfusion [2, 3]. The incidence of complications after salvage UP is high, reportedly ranging from 15.0–54.5% [3–7] due to a combination of unreliable blood supply and poor elasticity of thin tissue that hampers successful recovery, post UP complications (PUC) such as stenosis, fistula or diverticulum formation, or urethral dehiscence, and postoperative hypospadias-related issues such as persistent curvature.

Soft tissue reinforcement (STR) techniques devised to improve outcome by eliminating factors contributing to cause complications due to tissue vulnerability after failed hypospadias surgery were introduced in previous reports from the same institute [8,9]. They were: (a) lateral reinforcement of an inadequate or scarred urethral plate that either failed to develop congenitally or had been damaged by previous surgery to boost thickness and perfusion with pedicled grafts capable of reaching the subcoronal area of the penile shaft created by harvesting pericardial fat, scrotal fat, and/or perimeatal connective tissue at the time of curvature correction (referred to as “CHARGE” [8]) and (b) covering and supporting the neourethra with vascularized tissue interposed between the neourethra and the skin at the time of UP to specifically prevent PUC (referred to as “NUC”[9,10]. See Figure 1-f.

In this report, 8 cases treated successfully with CHARGE and NUC were reviewed to illustrate the value of STR for preventing PUC.

Materials And Methods

The medical records of all hypospadias repairs performed at a single institution from 2003 to 2019 (n=217) were reviewed retrospectively for types of hypospadias, indications for surgery, severity of hypospadias at the time of initial surgery, age at initial surgery, and incidence of postoperative complications.

Standard hypospadias repair

Essential for treating hypospadias are correction of curvature, successful neourethroplasty, and prevention of complications to achieve a penis capable of functional urination and sexual intercourse. Curvature is assessed using induced artificial erection before and after degloving the foreskin (Figure 1-b) and is corrected by dorsal plication (if minimal to mild and the ventral shaft is long enough to prevent shortening after plication), or a tunica albuginea incision (TAI) procedure (if curvature is severe, or if the ventral shaft is short, or the penis is likely to shorten too much after dorsal plication). The TAI procedure of choice involves incising the ventral aspect of the penis at its most curved part semi circumferentially from 3 to 9 o'clock to straighten the penis. To facilitate recovery and improve tissue stability, the defect in the tunica albuginea

caused by TAI is usually covered with a pedicled tunica vaginalis flap (Figures 1-d, 1-e). UP is performed after correction of curvature using the Snodgrass tubularized incised plate technique or a modification of the Thiersch-Duplay technique in which a midline longitudinal relaxing incision is made before creating the entire neourethra around a 6 or 8 French urethral stent using 7/0 PDS® single layer interrupted sutures.

Salvage hypospadias repair using STR

Surgical intervention for failed repair cases in this series involved repair of urethral diverticulum >15mm (Figure1-a), redo curvature correction (Figure1-b), and salvage UP incorporating the two STR techniques mentioned (CHARGE and NUC). Urethral diverticulum was laid open (Figure1-c), and after recorection of curvature (Figures1-d, 1-e), CHARGE was used when indicated in cases with an unusable scarred urethral plate and/or thin subcutaneous ventral penile shaft tissue to reinforce the ventral penile shaft prior to UP [8] and NUC was used after redo UP to cover the new neourethra with soft tissue in all cases (Figure1-f). Soft tissue used for NUC was dissected with great care to prevent compromising the blood supply of the pedicle and was secured to cover the new neourethra entirely [9,10] with a few 7/0 absorbable stay sutures. A urethral stent inserted intraoperatively was removed seven days after redo UP/NUC.

Ethics

This study was approved by the Juntendo University School of Medicine Institutional Review Board (IRB#: H20-0309) and complies with the Helsinki Declaration of 1975 (revised 1983).

Results

Of the 217 hypospadias cases reviewed, 8 required salvage hypospadias surgery.

Subject data are summarized in Table. All 8 subjects were Japanese ranging in age at the first salvage repair procedure from 4.2 to 46.5 years old. Hypospadias was perineal/penoscrotal (n=7), and mid-shaft (n=1). Previous surgery was single-stage urethroplasty (SSUP; n=4) and multi-stage urethroplasty (MSUP; n=4). Indications for salvage surgery included residual penile curvature (n=5), urethral diverticulum >15mm (n=3), urethral dehiscence (n=1), and urethral stricture (n=1). Salvage surgery performed using STR was SSUP (n=1) and MSUP (n=7; two-stage: n=4, three-stage: n=3). STR was CHARGE (n=4) and NUC (n=8).

Salvage surgery was successful in all cases with no incidence of PUC after a mean follow-up of 3.9 years (range: 1.6 to 6.4 years) after the last procedure. All STR were harvested easily without injuring surrounding structures such as the vas deferens or testicular vessels even though previous surgery had caused structural damage.

Table 1

Details of salvage hypospadias cases presented in this series (n=8) and soft tissue reinforcement performed

Case	Type of hypospadias	Previous surgery		Age at initial surgery	Indications for salvage surgery	Salvage surgery			Follow-up*	
		Initial treatment	SSUP or MMUP			Number of operations	1st procedure	2nd procedure		3rd procedure
							Tissues used for STR	Tissues used for STR		Tissues used for STR
1	Perineal	Elsewhere	SSUP + reoperations	2.7 yo	Diverticulum Urethral stricture	Lay open	TAI + CHARGE	TIPU	4.0 years	
						None	TVF + scrotal fat	Scrotal fat	2	
						10.2 yo	11.2 yo	12.0 yo	16.0 yo	
2	Penoscrotal	Elsewhere	SSUP	2.1 yo	Curvature	TAI + CHARGE	TIPU	None	3.4 years	
						TVF + scrotal fat	TVF		2	
						4.9 yo	6.6 yo		10.0 yo	
3	Penoscrotal	Elsewhere	MMUP	3.5 yo	Curvature	TAI + DP + CHARGE	TIPU	TIPU	3.5 years	
						TVF + scrotal fat	Subcutaneous tissue	Scrotal fat	3	
						5.2 yo	6.5 yo	7.6 yo	11.1 yo	
4	Penoscrotal	Authors' hospital	MMUP	2.2 yo	Diverticulum	Lay open + CHARGE	TIPU	None	3.7 years	
						Scrotal fat	TVF + scrotal fat		2	
						4.2 yo	5.4 yo		9.1 yo	
5	Penoscrotal	Authors' hospital	MMUP	2.2 yo	Curvature	Chordectomy + DP	TAI	TIPU	3.9 years	
						Subcutaneous tissue	TVF	Scrotal fat	3	
						11.6 yo	13.8 yo	15.4 yo	19.3 yo	
6	Penoscrotal	Elsewhere	SSUP	2.3 yo	Urethral dehiscence	TIPU	None	None	4.5 years	
						ESF + scrotal fat			1	
						14.6 yo			19.1 yo	
7	Penoscrotal	Elsewhere	SSUP + reoperations	1.5 yo	Curvature Diverticulum	Lay open + TAI	TIPU	None	1.6 years	
						TVF	TVF + scrotal fat		2	
						5.7 yo	6.7 yo		8.3 yo	
8	Mid-shaft	Elsewhere	MMUP + reoperations	2.0 yo	Curvature	Scar removal + DP	TIPU	None	6.4 years	
						Subcutaneous tissue	Scrotal fat		2	
						46.5 yo	47.5 yo		53.9 yo	

SSUP: single-stage urethroplasty, MMUP: multi-stage urethroplasty, STR: soft tissue reinforcement, yo: years old, TAI: tunica albuginea incision,

DP: dorsal plication, CHARGE: CHARGE procedure, TIPU: tubularized incised-plate urethroplasty,

TAI: tunica albuginea incision, ESF: external spermatic fascia, TVF: tunica vaginalis flap,

*Since the last procedure

Discussion

There would appear to be no other reports in the English language literature about the success of STR for improving post-salvage repair outcome and preventing PUC. Nguyen and Snodgrass reported 7/31 salvage tubularized incised plate UP patients developed dehiscence (n=2), large fistula (n=1), and small fistula (n=4) to give a complication rate of 22.6% [3]; Emir and Erol reported complications in 14/55 salvage Mathieu UP patients to give a complication rate of 25.6% [11], and Joseph et al reported complications in 6/11 tunica vaginalis onlay flap salvage UP in 10 boys and 1 adult to give a complication rate of 54.5% [6]. In contrast, in a previous study that introduced the CHARGE technique used in this series, there were no PUC documented in 39 cases [8] and in this series, no PUC have developed to date in any of the 8 cases after mean follow-up after salvage UP of 3.9±1.2 years (range: 1.6 to 6.4 years). Given the fact that in a previous study by colleagues of the authors of this series, PUC were noted to develop after a mean of 0.7±0.2 years [8], more than enough time (mean of 3.9 years) has passed for complications to develop, so STR would appear to have prevented PUC in cases at greater risk for their development.

Despite reports of several techniques for reconstructing the urethra during salvage surgery for hypospadias [1-7] the reasons why redo surgery and salvage surgery for failed hypospadias remain so particularly challenging are because scar tissue and poor perfusion hamper recovery [2], contributing to poor outcome and further PUC. During salvage hypospadias surgery, thin, under-perfused tissue of poor flexibility and vascularity tends to leak when sutured because it lacks resilience giving rise to delayed wound healing, infection, and urethrocutaneous fistula formation. CHARGE very effectively improves the thickness, flexibility and vascularity of the urethral plate contributing to better outcome and preventing PUC and is highly recommended for salvage hypospadias surgery. Similarly, NUC is acknowledged as a procedure for preventing postoperative urethrocutaneous fistula [12-14] and in a previous report, the value of a variety of tissues such as foreskin connective tissue, pedicled external spermatic fascia, and tunica vaginalis flap for reinforcing the neourethra during both single- and multi-stage repair of hypospadias urethrocutaneous fistula were discussed

In the cases CHARGE was used in this series (cases 1, 2, 3, and 4; see Figure 2), the skin and subcutaneous tissues were noted to be thick and well perfused when the next procedure was performed (Figure 3); a distinct advantage because during surgery for failed hypospadias repair, the scarred urethral plate, even the neourethra created previously may require revision or removal and working with thin tissue with compromised perfusion is extremely difficult.

While each case of failed hypospadias is unique with a spectrum of compromising factors, CHARGE and NUC are of practical value because they can be applied during all cases requiring salvage surgery. Harvesting tissue for STR may seem daunting because damage from previous surgery causes scarring, poor vascular perfusion, and poor flexibility, but NUC was performed readily by making an incision in the scrotum to harvest intra-scrotal tissue, especially intra-scrotal fat tissue, that provided a thick, well perfused layer of tissue with good flexibility to support the new neourethra physically, and improve perfusion/vascularity. It was easy to harvest, had a good blood supply, and could reach the distal neourethra.

While this study has limitations because it is retrospective and was performed at a single center with only a very small number of subjects and large variation in morbidity (types of hypospadias, types of previous surgery, and indications for salvage surgery), this series demonstrated that STR is beneficial for successful salvage hypospadias surgery and preventing PUC. Longer term follow-up will confirm the efficacy of STR for preventing PUC and a larger study will reinforce the indications for STR. In fact, STR could have potential to be incorporated routinely to improve outcome and prevent PUC in all hypospadias cases.

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Figures

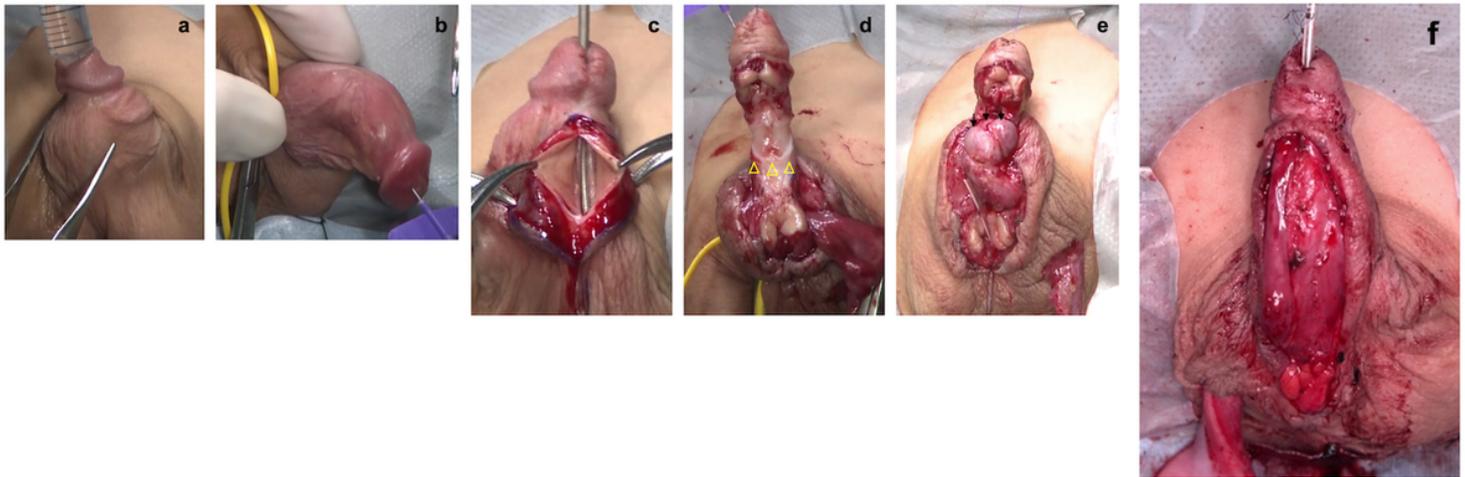


Figure 1

Diverticulum (a), severe penile curvature (b), lay open of diverticulum (c), adequate straightening after tunica albuginea incision (arrowheads) (d) with imposition of a pedicled tunica vaginalis flap (arrows) (e).

Pedicled tunica vaginalis flap covered suture lines in the neourethra during urethroplasty (f).



Figure 2

Appearance at the time of CHARGE using a pedicled scrotal fat graft.

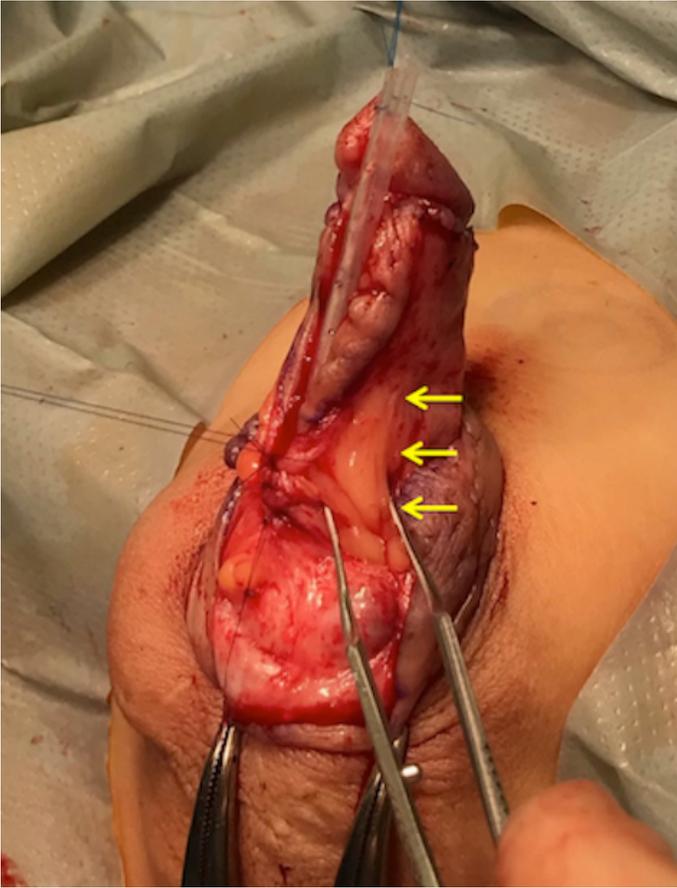


Figure 3

Appearance at the next stage of salvage urethroplasty after CHARGE. Note that subcutaneous tissues are thick (arrows).