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Research Paper

Proximal Hypospadias Repair Straightening and Closure (STAC) vs Straightening and Graft (STAG), Initial Stage Outcome: A Comparative Study

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ABSTRACT:

BACKGROUND:

Proximal hypospadias with severe ventral curvature represent a challenge to surgeons, to correct different degrees of curvature whilst reconstructing the urethra with the best possible aesthetic outcome and least possible number of complications.

OBJECTIVE:

To compare the outcome of straightening and grafting procedure in Straightening and Closure (STAC) vs Straightening and Graft (STAG), in proximal hypospadias repair surgery in terms of recurrent curvature, graft take, and graft contracture.

METHODS:

Twenty-two male patients with proximal hypospadias associated with ventral curvature, undergone staged repair with oral buccal mucosa as a graft, divided randomly into 2 groups; group A, (STAC) repair (9 patients), and group B, (STAG) repair (13 patients), from November 2019 to November 2021. Ventral penile straightening procedure had been performed in form of urethral plate transection and 3 ventral corporotomies. Graft inserted at the 2nd stage in STAC group after healing of corporotomy incisions, while directly inserted over the incisions in STAG group at the 1st stage. Patients were followed up for 6 months for assessment of graft take, graft contracture, and recurrent curvature, which evaluated at beginning of second stage by goniometer.

RESULTS:

All patients in **(**STAC**)** repair group had straight penis with no recurrent curvature, no graft contracture was noted, whereas in **(**STAG**)** group, (2) patients had minor ventral curvature of 15° which is corrected at beginning of the 2nd stage, and (1) patient had partial graft contracture which was managed by local betamethasone. The graft took successfully in all patients of both groups.

CONCLUSION:

STAC and STAG repair for proximal hypospadias achieved successful and adequate straightening of severe ventral curvature degrees, with a slight advantage for STAC repair in terms of graft contracture and recurrent curvature, as the graft inserted over a completely healed smooth corpora in comparison to STAG in which graft inserted over a raw open corporotomies.

KEYWORDS: Hypospadias, Curvature, Straightening, Graft.

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INTRODUCTION:

Hypospadias is a urethral opening proximal to the normal glanular location where this defect was commonly considered as an arrested development. (1)

The only treatment for hypospadias is to repair the anatomical defect surgically, by reconstructing a straight penis with a slit-like meatus on the glans to allow a forward directed stream and normal coitus in future (2,3).

Proximal hypospadias is diagnosed by meatal location on the proximal penile shaft to perineum at the theater, after the penis is degloved and

ventral curvature straightened. "Severe" hypospadias specifically refers to those with ventral curvature ≥30° after degloving [4,5].

A number of factors can result in ventral curvature, including the abnormal tethering of penile shaft skin on to the underlying structures, tethering of urethral plate to corpora cavernosa, or the atretic corpora spongiosum tissue. Finally, the chordee may be attributed to an intrinsic flexion deformity of the corpora cavernosa [6].

To correct the curvature, the fibrous chordee must be excised, short urethral plate should be divided and elongated, and the corporeal disproportion is corrected by corporoplasty [7].

The best approach for repairing severe proximal penile hypospadias is still under debate, surgeons applied

single-stage repair in Onlay or tube fashion, and have switched to using a modified Bracka (STAG) method involving the inner preputial or buccal mucosa staged graft technique. They evaluated the outcomes for repair of proximal hypospadias using the modified Bracka (STAG) method, and hypothesized that adopting STAG repair will help to ensure correct straightening of the penis with proper urethral reconstruction [8].

This approach is effective for straightening but limits urethroplasty options to flap techniques to avoid placing a urethroplasty graft on top of a corporal graft. Dissatisfaction with flap repairs led to the emergence of 3 ventral transverse corporotomies without corporal grafting as a ventral lengthening procedure, to enable first stage urethroplasty grafting [9].

Reports on patients with failed proximal hypospadias repair shown that most of them had ventral curvature at reoperation, significantly more likely after chordee excision or dorsal plication than with ventral lengthening, and when the urethral plate was conserved, which indicate failure of the initial straightening procedure, additionally found that many urethroplasty complications were present in all of those with ventral curvature who had a completed repair, suggest ventral curvature played a role in their occurrence and indicates persistent or recurrent ventral curvature is still the most common finding when proximal hypospadias repair fails [10,11].

AIM OF STUDY:

To compare the outcome of straightening and grafting in three stages proximal hypospadias repair (STAC) vs two stages proximal hypospadias repair (STAG) in terms of recurrent curvature, graft take, and graft contracture.

PATIENTS AND METHODS:

From November 2019 to November 2021, twenty-two (22) male patients (aged from 1 to 12 years) with proximal hypospadias associated with ventral penile curvature, had been assigned randomly into two groups, **group A**, those were operated by **STAC repair** (9) patients, and **group B**, who were operated by **STAG repair** (13) patients, using oral buccal mucosa as a graft during which attention was given to penile straightening. All the surgeries were done by the same surgeon, in surgical specialties hospital, medical city complex, Baghdad. Ethical clearance to conduct the research was obtained from the hospital's and Iraqi's Board for medical specializations. Informed consent was obtained from all participants.

Inclusion criteria

All patients who are candidates for staged repair with:

1-Primary proximal hypospadias with more than 30° ventral curvature.

2-Failed (re-do) proximal hypospadias repair with more than 30° ventral curvature.

Exclusion criteria

1-Primary distal and midshaft hypospadias.

2-Proximal hypospadias with less than 30° curvature that can be repaired by proximal TIP with preservation of urethral plate.

Surgical technique:

The surgical technique of (STAC repair) involves three stages. In the 1st stage: ventral curvature correction and closure of skin. The 2nd stage is for harvesting and grafting the bed after 6 months. And the 3rd stage is for tubularization and completing urethroplasty after 6 months.

While in (STAG repair), The surgical technique consists of two stages. The 1st stage: ventral curvature correction, preparation of bed for grafting, harvesting the graft and transplanting the graft was done. In the 2nd stage: urethroplasty and glansoplasty was completed after 6 months.

Three stages (STAC) repair

First stage STACUnder general anesthesia, in supine position, manual release of preputial adhesion from the glans was done. A 3-0 vicryl suture placed through the tip of the glans as a traction suture. A U-shaped incision around the meatus proximally extending to glans wings distally is done. Dissection in the plane between the buck's fascia and the skin dartos laterally to

separate them from the corpora along its length, and continues on each side of corpora cavernosa until meeting posteriorly for complete degloving of the penis all the way around from side to side behind the corpora without detaching the dorsal skin. (Figure 1)

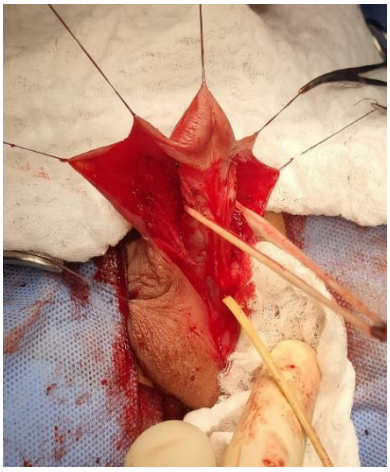

Figure 1: Complete degloving without detaching posterior skin.

Due to significant ventral curvature associated with proximal hypospadias type, complete urethral plate transection and mobilization was done in all cases down till below the penoscrotal junction proximally. (Figure 2)

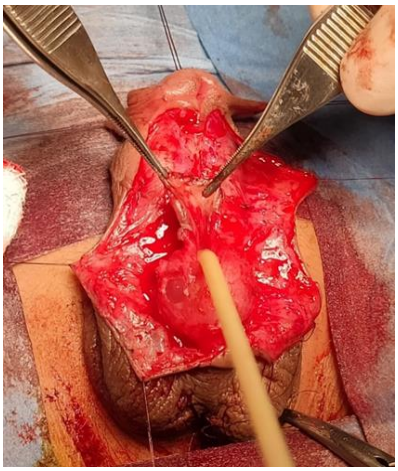

Figure 2: Urethral plate transection.

Ventral curvature was assessed by artificial erection which achieved by injecting normal saline with a small gauge needle (31-gauge) bilaterally into the corpus cavernosum with a tourniquet placed at the base of penis, the degree of curvature measured objectively by a goniometer. (Figure 3)

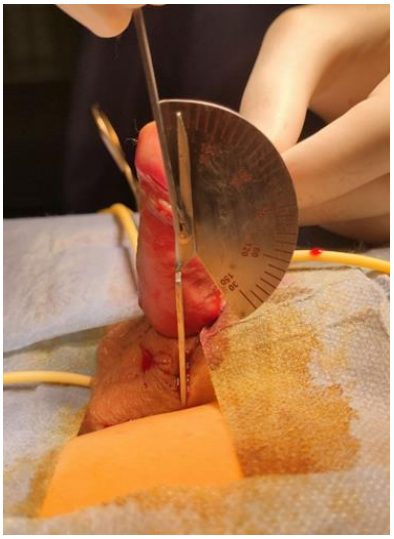

Figure 3: Confirming adequate straightening by using goniometer.

Three transverse ventral corporotomies done, placing the first incision at the maximum bend site from 2 to 10 o'clock ventrally through the tunica albuginea of the corpora without cutting into it, the two other corporotomies placed 4 mm above and below the 1st incision.

Dartos flap taken from ventral penile skin, rotated medially to cover the corporotomies underneath it, and sutured to tunica albuginea of the corpora in interrupted sutures pretty close together, allowing the incisions to heal and contain any bleeding or hematoma postoperatively. (Figure 4)

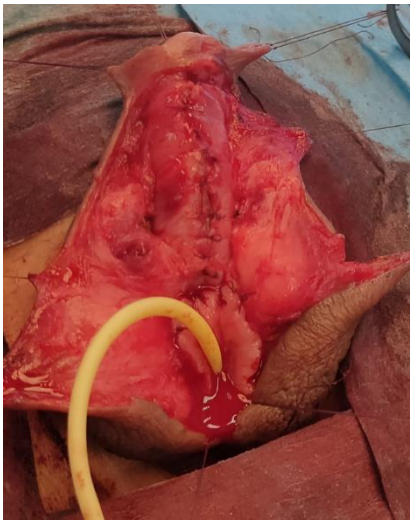

Figure 4: Dartos flap layer to cover the corporotomies.

The mobilized transected urethra then spatulated, repositioned and sutured back over the corpora without tension to the point it reaches, and the penile skin is closed in interrupted fashion using 5-0 Vicryl (polyglyctan) suture allowing the wound to heal.

Second stage STAC

The second stage is performed after 6-month; Artificial erection is done to confirm adequate straightening of the penis before proceed with grafting. Preparing the bed for graft done by midline incision at ventral penile skin, dissection between the corpora and skin dartos on each side.

Oral mucosal graft is harvested from inner side of the cheek after identification of Stenson duct, 4-0 Vicryl stay sutures marking a rectangular graft. Incisions around graft margins were done using #11 scalpel after injecting Normal saline for hydrodistension to facilitate harvesting. The harvested Graft then is de-fatted and placed in saline. Hemostasis at donor site is secured and the oral defect is closed by approximating the edges with 4-0 Vicryl. (Figure 5)

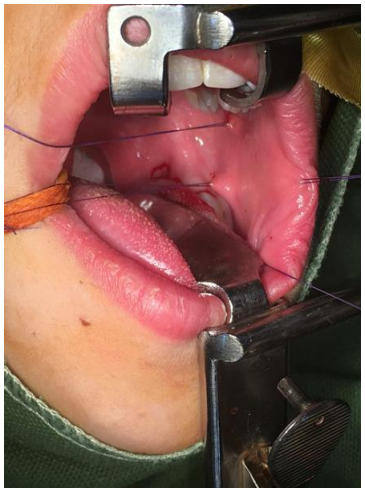

Figure 5: Marking graft borders with 4 stay sutures .

The graft then Placed over the wound bed, and penile skin sutured to the lateral edges of the graft with 6-0 Vicryl at regular intervals. Anchoring stiches were taken through the graft into the corpora to stabilize the graft, facilitate the imbibition of the graft and avoid any possibility of hematoma or seroma formation. (Figure 6)

Figure 6: Fixing the graft to the corpora.

Third stage STACAfter another 6 months. Incision is done along the edge between the graft and skin on each side, to release the skin from the graft. (Figure 7)

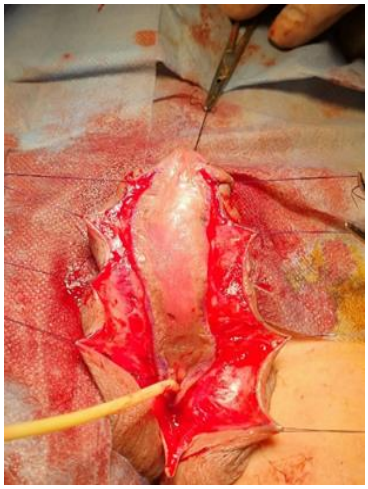

Figure 7: Incision between graft and skin.

Tubularization over 6 Fr catheter was done by subcuticular interrupted suturing using Vicryl 6-0 sutures. (Figure 8)

Figure 8: Tubularization of graft over catheter.

A vascularized preputial dartos flap or tunica flap from testis in circumcised boys was applied as a second barrier layer. Circumcision and glansoplasty accomplished. The wound was sutured in the midline using simple interrupted 6-0 Vicryl. (Figure 9)

Figure 9: Skin closure at the end of the operation.

Two stages (STAG) repair

First stage STAG

Ventral lengthening by three corporotomies and grafting was done at the same stage in STAG repair by the same steps used in first and second stage STAC repair.

Second stage STAG

Tubularizing the graft over a catheter after 6 months by the same procedure steps used in third stage STAC repair**.**

Follow up

In all stages, dressing of the wound with β-silesterol (Mebo™) ointment was applied and changed twice daily. Foley catheter removed after about 5 days postoperatively.

Patients examined daily during the first week, and followed up weekly in the first month and then monthly up to 6 months after discharge. The penis examined if there is a recurrent curvature, parents were asked about satisfaction with the penile length, the graft assessed for graft take and presence of focal or complete graft contracture and fibrosis.

Although no precise parameters for graft contracture have settled yet, we assess the contracture in terms of elasticity, surface smoothness and shrinkage of the graft.

Statistical analysis

Data entry and analysis was performed using SPSS version 28 and variables were presented as frequencies (Numbers) and proportions (percentages).

Chi square test has been used to calculate the P – Value and test the significance of differences.

RESULTS:

A total number of twenty-two (22) patients with proximal hypospadias associated with more than 30-degree ventral curvature were enrolled, divided randomly into two groups:

Group A, were patients for whom STAC repair was used (No.= 9, (40.90%)) while for group B (No.=13, (59.09%)) patients, a STAG repair was used. (Table 1)

Outcome of penile straightening and grafting

During the 1st stage of the repair in both groups, all the patients had undergone a transection of urethral plate along with 3 ventral corporotomies as a part of the straightening procedure.

At the beginning of the 2nd stage in both groups, artificial erection was done intraoperatively and re-measurement by goniometer to confirm successful straightening.

STAC repair group A

No minor (less than 30°) or significant (equal or more than 30°) recurrent ventral curvature is recorded in group A patients (100% straightening) when measured by goniometer during the beginning of the 2nd stage repair.

Graft take was successful in (100%) of the included patients and all of them had very good grafts.

Neither of these patients has experienced significant graft contracture nor have required re-grafting procedures.

None of the patients experienced post-operative hematoma or significant donor site pain. (Table 1)

STAG repair group B

Of group B, (11) patient (84.61%) had successful straightening with no recurrent curvature, two patients (15.38%) had 15° minor recurrent ventral curvature (less than 30 degrees) and further steps were added for correction of it during the 2nd stage surgery.

The graft took successfully in all (100%) of the enrolled patients.

Only one case (7.69%) had partial graft contracture and required application of 0.1% betamethasone cream locally to the graft for 12 weeks, and continued to the 2nd stage without problem.

All the patient had no significant post-operative bleeding, hematoma or donor site pain. (Table 1)

No significant statistical difference between STAC and STAG repair regarding recurrent ventral curvature, graft take, and graft contracture. Table (1)

Table 1: Characteristics of the 1st and the 2nd stage according to type of repair used
***P – Value >0.05 (Statistically not significant)**

	STAC	STAG	P value
Sample Number	9 (41%)	13 (59%)	
Age (Average)	5.32	6.17	
Graft Take	9 (100%)	13 (100%)	-
Graft Contracture	0 (0%)	1 (7.69%)	0.39
Curvature<30	0 (0%)	2 (15.38%)	0.49
Curvature>30	0 (0%)	0 (0%)	-
No curvature	9 (100%)	11 (84.61%)	-
Post op. complications	0 (0%)	0 (0%)	-

DISCUSSION:

Proximal hypospadias repair in primary or re-do cases represent a challenge to the surgeons, despite the varieties of surgical techniques and procedures described, none of them is optimum and free of complications. Staged repair is of favor to many surgeons due to better cosmetic and relatively functional outcomes than single stage repair [12].

In our study, none of the patients experience post-operative hematoma or significant pain at donor site, which are comparable to similar studies enrolled by *Cruz-Diaz et al* [13], and *Leslie et al* [14], and attributed to the delicate dissection, identification and avoidance of Stenson's duct, careful hemostasis and advancement in learning curve.

We had successful curvature correction in all (100%) of group A (STAC) patients, and all but 2 patients in group B (STAG) (15.38%), who had a minor curvature of about 15 degrees at the beginning of second stage and further steps (Nesbit's procedure) was used for correction before continue to the urethroplasty stage, increasing success rate to (100%).

This result was comparable to *Snodgrass et al.* [5] who reported no recurrence of curvature during follow-up in STAG repair (100% success rate of curvature correction and overall success rate of more than 98% when using 3 corporotomies), and better than *Haitham et al.* [8] who saw minor curvature recurrence of less than 30 degrees in two children in whom 3 corporotomies were previously utilized in STAG repair (72.9% success rate).

Although the difference was statistically insignificant between both groups, but we found a minor difference, and we attribute the minor degrees of recurrent curvature that occurred in group B patients (STAG repair) to the fact that the grafted oral mucosa being transplanted directly over open corporotomies which led to scar formation, in comparison to group A (STAC repair) patients, in whom the graft is fixed to a smooth corpus surface in second stage after leaving the corporotomies to completely heal in first stage.

All the patients in both groups had very excellent graft take (100%), which is comparable to both *Johal et al* [15] (100% of oral mucosal graft cases)

and *Faure et al* [16] (100% of oral mucosal graft cases).

These results might be credited to many factors such as, graft bed preparation and removal of all fibrotic tissues, the delicate method of graft harvesting and proper graft defatting, adding multiple quilting sutures and fenestrations in fixing the graft to the corpora, all of those factors had assisted in graft take, and decreased incidence of hematoma collection.

Regarding graft contracture, we reported no graft contracture in group A (STAC) repair, and one case (7.6%) contracture rate in group B (STAG).

Our results were inferior to *snodgrass et al*. [5] who reported no contracture in patients with STAG repair (100% success in oral mucosa group), and better than those in the reports published by *Leslie et al* [14] (13% mucosal graft contracture), *Pfstermuller et al*. [17] (11% of buccal mucosal graft), and *Snodgrass et al* [18] (10% contracture in buccal graft group).

And again, our explanation for graft contracture (7.6%) occurd in group B (STAG repair) is that the graft was inserted over an open corporotomy incisions, which might led to focal fibrosis and minor shrinkage of the graft as the wound heal, opposite to the group A (STAC repair) whom none of them experienced contracture of the graft, as the graft was transplanted 6 months later at second stage into a smooth corporal surface after healing of corporotomy incisions at first stage yielding a (100%) success rate, yet the difference is not statistically significant between both groups.

CONCLUSION:

STAC and STAG repair for proximal hypospadias with 3 ventral corporotomies as a ventral lengthening procedure, achieved a Successful and adequate straightening of severe ventral curvature degrees, The graft took reliably in both procedures, Slight advantage for STAC repair in terms of graft contracture and recurrent minor degrees of curvature, as the graft was inserted after complete healing of the corporotomies in comparison to STAG in which graft inserted over a raw open corporotomies.

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