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Algorithm for Optimal Urethral Coverage in Hypospadias and Fistula Repair: A Systematic Review

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Abstract

Context: Although urethral covering during hypospadias repair minimizes the incidence of fistula, wide variation in results among surgeons has been reported.

Objective: To investigate what type of flap used during Snodgrass or fistula repair reduces the incidence of fistula occurrence.

Evidence acquisition: We systematically reviewed published results for urethral covering during Snodgrass and fistula repair procedures. An initial online search detected 1740 reports. After exclusion of ineligible studies at two stages, we included all patients with clear data on the covering technique used (dartos fascia [DF] vs tunica vaginalis flap [TVF]) and the incidence of postoperative fistula.

Evidence synthesis: A total of 51 reports were identified involving 4550 patients, including 33 series on DF use, 11 series on TVF use, and seven retrospective comparative studies. For distal hypospadias, double-layer DF had the lowest rate of fistula incidence when compared to single-layer DF (5/855 [0.6%] vs 156/3077 [5.1%]; $p = 0.004$) and TVF (5/244, 2.0%), while the incidence was highest for single-layer DF among proximal hypospadias cases (9/102, 8.8%). Among repeat cases, fistula incidence was significantly lower for TVF (3/47, 6.4%) than for DF (26/140, 18.6%; $p = 0.020$). Among patients with fistula after primary repair, the incidence of recurrence was 12.2% (11/90) after DF and 5.1% (5/97) after TVF ($p = 0.39$). The absence of a minimum follow-up time and the lack of information regarding skin complications and rates of urethral stricture are limitations of this study.

Conclusion: A double DF during tubularized incised plate urethroplasty should be considered for all patients with distal hypospadias. In proximal, repeat, and fistula repair cases, TVF should be the first choice. On the basis of these findings, we propose an evidence-based algorithm for surgeons who are still in their learning phase or want to improve their results.

Patient summary: We systematically reviewed the impact of urethral covering in reducing fistula formation after hypospadias repair. We propose an algorithm that might help to maximize success rates for tubularized incised plate urethroplasty.

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1. Introduction

Hypospadias repair is one of the commonest surgical procedures performed by pediatric surgeons. Although a few hundred techniques have been described for correction of this anomaly, tubularized incisional plate (TIP) urethroplasty is currently the most frequently performed technique for single-stage primary hypospadias repair [1]. This technique was first described by Snodgrass for correction of distal hypospadias [2], and its indication was then extended for mid-shaft and proximal penile hypospadias with no or mild curvature [3]. The technique can also be applied with good results in some repeat cases [4]. In general, urethrocutaneous fistula is the commonest complication reported despite wide variability in its incidence (0–28%) [1]. Tissue interpositioning between the neourethra and the skin decreases the incidence of urethrocutaneous fistula and is now performed as a routine step by most surgeons during TIP procedures [3,5]. The wide range in hypospadias types, complexity, associated anomalies, the described procedures and their modifications as well as individual surgical experience, preclude the presence of clear protocols or guidelines for hypospadias correction. As the majority of patients with penile hypospadias undergo TIP urethroplasty [6], our aim was to investigate fistula incidence after different urethral covering techniques during hypospadias repair to provide an evidence-based approach for minimizing the risk of fistula.

2. Evidence acquisition

A systematic search was conducted on PubMed online database for publications between 1994 and 2015 according to the PRISMA Statement. The following English keywords were used in this search: hypospadias repair, dartos fascia, tunica vaginalis, and urethrocutaneous fistula repair. The selection process involved two stages.

In the first stage, all the publications identified were first reviewed according to the title or abstract, or the methodology when the abstract did not include enough information. We excluded all publications with unclear data about urethral coverage after tubularization or reporting on techniques other than TIP.

In the second stage, after detailed review of the full text for selected articles, we further excluded papers with data published in updated series by the same authors or included in multicenter series to avoid publication bias and repetition of data. The articles finally included were subjected to comprehensive analysis as they were not appropriate for meta-analysis. The variables extracted included number of patients, type of surgery, flap technique used, fistula incidence, age range, and follow-up duration. Owing to the absence of complete data, the mean and median for age and follow-up could not be ascertained. Only English language articles were considered for the search with the exception of one Chinese paper with an informative English abstract that was included in the final analysis [41].

Patients were divided into groups according to the reason for surgery (primary TIP, repeat TIP, and fistula

repair) and flap technique (dartos fascia [DF] or tunica vaginalis flap [TVF]). A two-sample *t* test was used to investigate the impact of flap technique on fistula incidence. For further investigation of the impact of hypospadias site and the covering technique, only the primary TIP with DF group could be subdivided according to the hypospadias site (distal or proximal). The distal group was further subdivided into single- or double-layer DF. We calculated *p* values for between-group comparisons using a two-sample *t* test. On the basis of the available data, we propose an algorithm for optimized use of different flap techniques.

3. Evidence synthesis

Figure 1 shows a CONSORT diagram of the study selection process. Our search initially identified 1740 results for the keywords use (“hypospadias repair” = 1252, “dartos flap” = 137, “tunica vaginalis flap” = 83, and “urethrocutaneous fistula repair” = 268). After the first exclusion stage, 61 studies (3.5%) underwent detailed review. After the second stage, the results from 51 articles were subjected to further analysis: 33 DF series [4,5,7–37], 11 TVF series [38–48], and seven retrospective comparative studies [49–55]. Our search revealed no prospective or randomized studies comparing the two flap techniques. In total, 4550 patients aged between 6 mo and 27 yr [10,18] with follow-up ranging from 1 mo to 17 yr [14,54] were involved in our review.

3.1. DF as a second layer

3.1.1. Primary repair

Among 4034 patients in whom DF was used to cover the neourethra, fistula occurred in 170 (4.2%). Of the 3932 cases of distal hypospadias, DF was used as a single layer in 3077 patients (age 6 mo–16 yr, follow-up 1–87 months). Among these, 156 (5.1%) developed urethrocutaneous fistula [5,7,11–18,20–22,24,26,27,29,31,50,53–55]. A significantly lower rate of fistula incidence was observed for double-layer DF coverage in distal hypospadias. Among 855 patients (age 6 mo–22 yr, follow-up 4–106 mo), five (0.6%; $p = 0.004$) developed fistula [23,24,26,28–31,34,36]. Fistula incidence was significantly higher among patients with proximal hypospadias (meatus proximal to the mid-shaft up to the penoscrotal junction): nine of 102 patients (age 6 mo–16 yr, follow-up 2–87 mo) developed fistulas (8.8% vs 5.1% for single-layer DF in distal hypospadias; $p = 0.01$) [7,8,12,13,15,18,21,35].

3.1.2. Repeat TIP

Of 140 patients with failed TIP (aged 13 mo–27 yr, follow-up 6 mo–5 yr), 26 (18.6%) developed fistula when DF was used in the second TIP procedure [4,9,10,15,19,51].

3.1.3. Urethrocutaneous fistula

Of 90 patients (age 1–18 yr; follow-up 3–52 mo) with urethrocutaneous fistula after previous hypospadias surgery, 11 (12.2%) developed recurrent fistula after repair using DF coverage [15,22,32,49,52].

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