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## Primary anterior hypospadias repair: a review of clinical outcomes



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### ABSTRACT

Hypospadias is a common congenital urogenital deformation. Its most frequent form is anterior hypospadias, where the urethral meatus was located at the glans (glandular), just below the glans (sub-coronal), or on the distal shaft. Various surgical procedures can be performed to correct anterior hypospadias. The most common used procedures are meatal advancement and glanduloplasty incorporated (MAGPI), tubularized incised plate (TIP), and Mathieu repair procedures. Choosing which procedure to date there are no guidelines on determining which procedure to perform or which will produce the best results. We conducted a review to compare the outcomes of each procedure, considering cosmetic and functional

aspects, as well as risks of complications. The results showed lack of evidences that perform direct comparison among the different outcomes; therefore, we have to rely on observational and descriptive sources. However, available evidence painted a picture of somewhat comparable outcomes on all aspects between the three procedures for anterior hypospadias. The underlying theme was the importance of selecting the appropriate procedure for each patient, considering each patient's unique anatomical presentation for the best cosmetic outcome, as well as the skill and confidence of each surgeon.

**Keywords:** anterior hypospadias, hypospadias repair technique, complication, evidence

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### INTRODUCTION

Hypospadias is a common urological congenital deformation. It is characterized by proximal displacement of the urethral meatus, deformity in penile curvature, and ventrally deficient foreskin.<sup>1</sup> While those basic characteristics are commonly known, it is hard to put boundaries on what is defined as hypospadias and their various sub-classifications. Meatal displacement alone is usually accepted to estimate the severity of hypospadias roughly. However, definitive assessment should also consider penile size, glans and urethral plate sizes, level of corpus spongiosum division, penile curvature, scrotal anomalies, and tissue dysplasia, and other possible deformities. Definitive assessment can often only be made during or after surgical procedures.<sup>1</sup>

There are conflicting results on the trend of hypospadias epidemiology over the years. A review of studies ranging from 1910 to 2013 reported geographic differences in prevalence and trends in that period. Prevalence was found highest in North America with a mean prevalence of 32.2 cases from 10.000 live birth. Meanwhile, data in Asia was widely diverse among specific countries. In the

Middle East, the mean prevalence was 21.8 cases per 10.000 live birth, while in East Asia, it was as low as 2.3 cases per 10.000 live birth, the lowest among all regions studied. Apart from psychological distress from cosmetic issues arising from the condition, hypospadias also poses patients' risk of urinary tract symptoms. As such, treatment in repair surgery was essential to help people who suffer from the condition. However, around only 70% of patients reported satisfaction with the surgery's cosmetic outcome, and a further 39% reported lingering urinary problems.<sup>1,2</sup>

This review will focus on primary anterior hypospadias, also known as distal hypospadias, a sub-classification of hypospadias where urethral meatus was displaced toward the ventral part penis still being on the glans area (sub-coronal) or near the glandular area.<sup>3-5</sup> It is one of the mildest and most common sub-classification of hypospadias, found in 60-70% of cases.<sup>6</sup> Anterior hypospadias repair involved several possible techniques classified into three main groups: meatal-based, flap based, and tubularization techniques. Each of these techniques has different pros and cons and, in this review, we will discuss recent evidence on clinical outcomes

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of different primary anterior hypospadias surgery techniques.

## DESCRIPTION OF ANTERIOR HYOSPADIAS REPAIR TECHNIQUES

### Meatal-based technique

Meatal advancement and glanuloplasty (MAGPI) has been one of the most performed surgical repair technique for anterior hypospadias. First described by Duckett in 1981, it involved two steps: meatoplasty and glanuloplasty.<sup>7</sup> This procedure's first step involved a circumferential incision proximal to the corona and meatus, followed by the penile shaft's degloving up to the penoscrotal junction. Complete erection was artificially maintained by injection of normal saline. Meatoplasty was initiated by a vertical incision between the native meatus and distal glans groove, extended proximally to reach the dorsal edge of the native meatus. The resulting diamond-shaped defect was closed transversely from the native meatus extended distally, advancing the glans groove's opening.

The further procedure was the glanuloplasty, which was initiated by placing a holding stitch on the ventral edge of the native meatus, elevated forward, positioning the glans in a more conical configuration. Absorbable sutures then approximated glans edges as necessary to achieve cosmetic satisfaction and excess skin excised. Lastly, degloved skin was returned, and the penile shaft recovered.<sup>8,9</sup>

### Flap-based technique

The most commonly used flap-based anterior hypospadias repair technique was the Mathieu procedure. First described in 1932, it was believed that the procedure had been performed far earlier. The procedure's principle involved forming a flap from the skin proximal to the native urethral meatus to form neo-meatus. The procedure itself was initiated by measuring the distance from the native meatus to the glandular ridge at the tip of the penis. Equally, long incision lines were then measured proximally from native meatus. U-shaped incision was then made proximally from the glandular ridge along with the urethral plate as long as the measurement, as mentioned earlier, proximal to the native meatus. Careful degloving process of the incised skin proximal to native meatus followed to create a flap which was folded distally toward the glandular ridge. Stitches were made along the flap and urethral plate edges, creating neo-urethra with the opening at the urethral ridge. Glandular wing flaps, created by initial u-shaped incision was then folded over the neo-urethra, sutured at the midline.<sup>9,10</sup>

### Tubularization technique

Tubularized incised plate (TIP) was the most commonly performed repair from tubularization techniques in anterior hypospadias repair. The procedure was first described by Snodgrass in 1999 with the procedure's principle involved the restoration of the urethra (urethroplasty) helped by placement of a tubular stent, thus 'tubularization'.<sup>11</sup> Similar to the MAGPI technique, the TIP procedure began by circumferential degloving of the penile shaft followed by two incisions along with the urethral plate, starting from native urethral meatus distally toward the glans ridge creating glans wings, separate from the urethral plate. Afterward, the urethral plate was widened and deepened by an incision along the midline of the glans starting from inside the native meatus and extended distally. A 6F catheter was then inserted toward the urethra and covered with tissues from the surrounding urethral plate. Flaps were then created from Dartos pedicle tissues, covering the neo-urethra created from the stented urethral plate. Finally, glans wings, mucosal collar, and the ventral shaft was closed and sutured.<sup>9,11</sup>

## COMPARISON OF CLINICAL OUTCOME

There are several reasons why the comparison between different anterior hypospadias repair technique was challenging. The selection of which procedure to follow was not based on any single guidelines. Each clinician was free to choose which procedure to perform based on clinical findings and judgment.<sup>9,12</sup> Other than that, clinical trials comparing different anterior hypospadias repair techniques were rare. As such, we have a few primary data available to compare these procedures. However, we can rely on data from descriptive studies to form an understanding of the effectiveness and risks of each procedure.

### Cosmetic Satisfaction

Two studies with descriptive results on parental satisfaction after their children underwent MAGPI procedure for anterior hypospadias repair. The results showed overall high satisfaction, with one study reporting 83.3% of parents were satisfied with the result and the other reporting even higher proportion of 95%. Most reported dissatisfaction from parents was found with some form of anatomical complication related to the procedure or the subsequent recovery, such as irregular skin shape or prolapsed mucosal tissue, which can be corrected with further procedures if necessary.<sup>13,16</sup> Another study reported a modified MAGPI procedure without dissection and trimming during glanuloplasty and incorporating the collar and

**Table 1. Summary of cosmesis results from MAGPI, TIP, and Mathieu repair procedures**

MAGPI	TIP	Mathieu
Parental satisfaction rate of 83.3% out of 24 patients. <sup>13</sup>	Post-operative HOSE score: 91% with neo-meatus at distal glans, 98% with vertical shaped neo-meatus. <sup>14</sup>	The overall parental satisfaction rate of 97% out of 848 patients. <sup>15</sup>
The parental overall satisfaction rate of 95% out of 40 patients. <sup>16</sup>	Satisfaction is based on HOPE score with a median score of 9.5 out of a maximum of 10. <sup>17</sup>	
Parental satisfaction overall satisfaction rate of 98% out of 150 patients. <sup>18</sup>	RTC on stented vs. non-stented TIP. Neo-meatus at distal glans results found in 71% of stented TIP and 80% of unstented TIP. Vertical-shaped neo-meatus found in 93% of stented TIP and 97.5% of unstented TIP. <sup>19</sup>	

dorsal prepuce to cover the penile shaft. The result was similarly satisfactory, with 98% of parents of patients who reported satisfaction with the procedure's cosmetic outcome.<sup>18</sup> However, the same study, and several others, noted that the MAGPI procedure tends to cause cosmetic dissatisfaction due to the shape of the reconstructed urethral meatus, which may look 'unnatural' which may cause concerns in patients and/or their parents.<sup>9,18</sup>

Mathieu flap repair procedure is one of the oldest for anterior hypospadias repair; as such many current studies reported one or another modified Mathieu techniques. Hadidi reported one such procedure involving 872 patients in five years. Of that number, 848 or 97% of patients reported satisfactory results.<sup>15</sup> Another study reported cosmetic satisfaction from Mathieu repair procedure utilizing the Penile Perception Score (PPS), which consist of four Likert scale satisfaction measurement for shapes of the meatus, glans, shaft skin, and general appearance. From a maximum score of 12, the result reported a mean score of 8, which indicated adequate satisfaction with the cosmetic outcome. From the aforementioned components of PPS, the highest score was written for the shape of glans with a mean score of 2.32 out of 3, while the lowest score was reported for shaft skin appearance with a mean score of 1.58.<sup>20</sup>

For the TIP procedure, two studies described adequate satisfaction proportion among patients and parents. Egyptian research reported measuring cosmetic satisfaction with the Hypospadias Objective Scoring Evaluation (HOSE), which said a proportion of 98% of parents satisfied with the cosmetic outcome of the TIP procedure.<sup>14</sup> Meanwhile, another study in Europe offered a descriptive TIP cosmetic outcome report utilizing the Hypospadias Objective Penile Evaluation (HOPE) questionnaire. Out of a maximum score of 10, the study reported a median score of 9.5 with a range of 7.6 to 10.0. It showed a relatively high satisfaction rate.<sup>17</sup> A similar favorable result was reported by another

Egyptian study in a prospective study comparing stented and unstented TIP procedures. Measured using the HOSE questionnaire, the proportion of satisfaction among patients was 88% for the combined overall group of patients who underwent stented and unstented procedures. However, a higher satisfaction proportion was reported for stented patients, with 91.3% reported satisfied while only 85.1% reported satisfied for the unstented group. Unsatisfied patients usually reported issues with meatus proximal deviation, circular-shaped meatus, or angulation.<sup>19</sup>

Few studies reported a comparison of cosmetic satisfaction between different anterior hypospadias repair procedures. We managed to identify several of them, and the results showed that all procedures yielded comparable cosmetic satisfaction. Two studies compared TIP and Mathieu repair procedures. An Indian study reported a remarkably different satisfaction rate between patients who underwent Mathieu repair and TIP procedures. In a prospective study that involved a hundred patients, all of 52 patients who underwent TIP procedure were reported satisfied with the resulting cosmetic appearance while only 41.66% of patients who underwent Mathieu repair procedure reported the same. More strikingly, 92.3% of patients who underwent TIP resulted in slit-like meatus, which was associated with more cosmetic satisfaction, as opposed to 91.6% of Mathieu repair procedures, which resulted in less cosmetic rounded and regular meatus.<sup>21</sup> Another Egyptian study reported more comparable results between the two procedures. Using PPS to measure both parents' and urologists' cosmetic satisfaction, the result found no significant difference in cosmetic satisfaction levels between Mathieu and TIP procedures, including in details such as meatus, glans shape, shaft skin, and general appearance. Remarkably, however, there was a difference in the level of confidence reported by parents and urologists. Parents reported higher satisfaction with Mathieu procedure over TIP

while the reverse was true for urologist's evaluation. Regardless, all these differences were not statistically significant.<sup>20</sup>

We did not identify any study comparing the MAGPI procedure with either TIP or Mathieu procedures. This is most likely because both indications for MAGPI were too far off from indications for Mathieu and TIP procedures. MAGPI was more suited for hypospadias with meatus located on the glans (glandular or coronal), while TIP and Mathieu are still appropriate even for sub-coronal and distal shaft hypospadias.<sup>9</sup> This reality also points to the importance of selecting the proper hypospadias repair procedure to obtain an optimal cosmetic outcome.<sup>12</sup>

### Urinary Function

Micturition was one of the primary outcomes of the hypospadias repair procedure, including in anterior hypospadias. One study discovered that disturbance in the micturition process is inherent in around 50% of anterior hypospadias cases.<sup>27</sup> However, an earlier review reported a lower proportion of urinary problems among children with hypospadias. Problems discovered included meatal stenosis accompanied by an obstructed flow pattern with a maximum flow rate only in the 5<sup>th</sup> percentile of the average population.<sup>28</sup> After the repair procedure, patients mostly reported improvement in urinary function parameters. However, the risk of urinary complications, such as meatal or urethral stenosis, with accompanying risk of urinary flow obstruction, persists. One study conducted uroflowmetry at 3 months after the TIP procedure. The result showed improved urinary flow among patients but with a significant proportion of less-than-ideal outcomes. Maximum flow rate ( $Q_{max}$ ) for all patients was found clustered below 50<sup>th</sup> percentile of normal with 15% showed signs of obstructed flow with  $Q_{max}$  under 5<sup>th</sup> percentile. Only 35% of patients showed typical bell-shaped urinary flow curve patterns, while

significant others showed intermittent/interrupted pattern, flattened, or even plateau. Around 15% of patients also showed an angled urinary flow.<sup>14</sup>

Another study that conducted seven years follow-up post-TIP repair procedure found improvement over time of the patients' urinary function as measured by urinary flow and found that the improvement on urinary flow parameters persists past the first few months post-procedure. In the first year after the TIP repair procedure, as much as 49% of patients were still observed with urinary flow problems with maximum flow rate under the 5<sup>th</sup> percentile of the average population. In the seventh year, this percentage was down to 32%, with 28% of them improved to the 25<sup>th</sup> percentile of the average population, a significant improvement.<sup>24</sup> Further, this study's follow-up showed the progress continued past the 7 years initial follow up period. At the first year post-procedure, 37.5% of children were found with the normal urinary flow (at, or above, 25<sup>th</sup> percentile). In the seventh year, the proportion increased to 40% and grew to 95% at puberty.<sup>26</sup>

The TIP procedure's effectiveness in improving urinary flow patterns has been compared with the Mathieu repair procedure with conflicting results. Two studies reported comparable post-procedure uroflowmetry results between patients with TIP and Mathieu repair procedures. One Indian study reported an 8.33% proportion of meatal stenosis and 29.16% plateau uroflow results among patients who underwent the Mathieu repair procedure. The results showed that for patients with TIP procedure, 5.76% had meatal stenosis and 32.69% with plateau uroflow pattern; both parameters were not found with statistically significant difference.<sup>21</sup> Another study showed slightly different results, with 42.11% of patients with TIP procedure was found with the obstructive uroflow pattern. In comparison, only 13.64% patients were found with obstructive patterns among those with Mathieu repair. While

**Table 2. Summary of urinary function outcome from MAGPI, TIP, and Mathieu repair procedures**

MAGPI	TIP	Mathieu
Meatal stenosis occurred in 15% of patients. <sup>22</sup>	At 3 months after the procedure, 15% has obstructed uroflow pattern, 15% with angled urine stream. Around 35% has a typical bell-shaped uroflow design. <sup>14</sup>	Meatal stenosis in 8.33% patients, plateaued uroflow pattern in 29.16%. <sup>21</sup>
Meatal stenosis occurred in 5% of patients. <sup>23</sup>	Continuous improvement over time. As much as 40% has obstructed the uroflow pattern, down to 32% after 7 years. <sup>24</sup>  Continuous improvement, 37.5% with typical uroflow pattern at first-year post-surgery, 40% at seventh year, 95% at puberty. <sup>26</sup>	Meatal stenosis in 13.44% out of 22 patients. <sup>25</sup>

the difference is considerable, it was not considered statistically significant due to the small sample size, 19 for TIP and 22 for Mathieu repair procedures, respectively.<sup>25</sup> A significant statistical difference was found in another study, which reported 15.6% of patients with TIP procedure had meatal stenosis at follow up. In contrast, no patients with the Mathieu procedure were found with the same problem. The same study also reported 18.75% of patients with TIP repair procedure with less-than-ideal micturition pattern with 3.1% reported sprayed stream, and 15.6% reported narrow stream, both indicated partially obstructed urethra or urethral meatus. The same problem was only reported on 5.9% among patients with Mathieu repair procedure, with all of them reported sprayed stream during micturition.<sup>29</sup>

Few recent studies reported on the outcome of the MAGPI procedure. An older study from 2004 said a comparison of outcome between MAGPI and Mathieu repair procedures. The result showed a comparable proportion of meatal stenosis found during follow up of both procedures, with 10% of patients with Mathieu repair procedure found with the condition and 15% of patients with MAGPI.<sup>22</sup> Another earlier study, from 1985, reported meatal stenosis to occur in 5% of patients who underwent the MAGPI procedure.<sup>23</sup> An earlier study reported a comparison of long-term functional outcome between MAGPI, TIP, and Mathieu repair procedures. Patients were followed up until 10 years after repair procedure with uroflow measurement grouped between 2-7 years old, 7-13 years old, and over 13 years old. The result showed improved urinary flow and a diminishing proportion of urinary flow obstruction as defined by  $Q_{max}$  under the 5<sup>th</sup> percentile of normal. At 2-7 years old, urinary flow obstruction was found in around 60% of patients, regardless of which procedure the patient had. At 7-13 years, the proportion was approximately 30%, and at above 13 years old, it was around 20%.<sup>30</sup>

On the comparison between different repair procedures, Mathieu procedure was found with the lowest proportion of urinary flow obstruction for follow up at 2-7 years old, MAGPI was found with the lowest proportion for 7-13 years old, and TIP was found with the lowest proportion for over 13 years old. The pattern of  $Q_{max}$  changes over time was also different with patients who had TIP showed  $Q_{max}$  increase over time with a design that closely aligns with the overall mean from all procedures while patients who had Mathieu showed marked ups and downs. However, all procedure was found with lowered  $Q_{max}$  at 48<sup>th</sup> month post-procedure. However, this difference was not statistically significant.<sup>30</sup>

## COMPLICATIONS

Complications after anterior hypospadias repair procedure included urethral or urethra meatus stenosis, fistula formation, mucosal prolapse, and meatal retraction. In some cases, the complication would require second or further procedures. However, occurrences of such complications were rare. A study that performed 10-years follow-up on anterior hypospadias patients found that around 80% of patients did not have any complications after 10 years of follow-up. A similar proportion of patients (78.7%) also reported only one repair procedure and did not require further reoperation.<sup>31</sup>

MAGPI procedure reported a low rate of complications, although the reported rate seems to vary with different sample size included in the study. One study reported on a modified MAGPI procedure reported zero cases of complication after the procedure. In contrast, another said two cases of complications, one with meatal stenosis and another with meatal dehiscence from 44 patients with MAGPI.<sup>18,37</sup> Another study reported four cases of complications from 24 patients who underwent the MAGPI repair procedure. Of those

**Table 3. Summary of complications from MAGPI, TIP, and Mathieu repair procedures**

MAGPI	TIP	Mathieu
Two cases of complications (meatal stenosis and dehiscence) in 44 patients. <sup>18</sup>	The complication rate of 4% from 551 patients, most frequent being fistula and dehiscence. <sup>32</sup>	The complication rate of 16.3%, with fistula being the most frequent. <sup>33</sup>
Four cases of complications in 24 cases, including two retractions, one dehiscence, and one infection. <sup>13</sup>	The complication rate of 8.9% out of 540 patients. <sup>34</sup>	Of 78 patients, there were 8 complications, including 7 fistula cases. <sup>35</sup>
Two meatal retractions from ten procedures. <sup>36</sup>		

four, two said with meatal retraction, one with glandular dehiscence, and one with surgical wound infection.<sup>13</sup> Another reported a similar proportion of complications with two meatal retraction cases from ten MAGPI procedures performed.<sup>36</sup> All studies that reported complications for the MAGPI procedure seem to concur on a complication rate of zero to twenty percent.

In an eight-year prospective study for TIP hypospadias repair outcome, with over 500 patients, it was reported that complications rate was 4% with 19 cases of complications from 551 patients who had the procedure. Fistula formation and glans dehiscence was tied for the most frequent complications with 9 cases each.<sup>32</sup> A later study reported a higher rate of urethroplasty complications, including fistula, glans dehiscence, stricture, or stenosis. The study reported 540 cases of anterior hypospadias repaired by TIP procedure and 48 of which had urethroplasty complications of all kinds, which put the complications rate of 8.9%.<sup>34</sup> Another study reported a modified TIP procedure, called burrowing technique, where the neo-urethra was created by dissecting into where corpus spongiosum diverged from corporal bodies. The result reported 6 cases of fistula formation and 8 cases of meatal dehiscence from the modified technique, amounting to a complication rate of 14.7%. The same study also reported 11 cases of fistula formation and 14 cases of meatal dehiscence among patients who had standard TIP procedure, a complication rate of 25.5%, higher than the modified technique. However, the difference was not statistically significant.<sup>38</sup> Available evidences showed complication rate for the TIP repair procedure was between 5% to 25%.

Variation was also found on complication rate for Mathieu repair procedure. One study, reporting 20 years of experience performing the procedure, found 54 instances of complications from 331 surgeries performed, putting the complication rate at 16.3%. The most frequent complication found was fistula formation, found in 38 cases, 11% of total surgeries performed or more than half of total complication cases. Other complications included preputium edema (5 cases), stent expulsion (4 cases), tube opening (2 cases), cystotomy failure (2 cases), and one case each of meatal stenosis, bladder irritation, and hematoma.<sup>33</sup> One other study reported a lower rate of complication of 8 cases from 78 procedures performed. Similarly, fistula formation was found to be the most common with 7 cases out of 8 complication cases.<sup>35</sup>

One study reported on the importance of conducting concurrent circumcision while performing the Mathieu repair procedure. In a

clinical trial comparing the outcome of concurrent circumcision and a 6-month delay from the Mathieu procedure, there was a significantly increased risk in the delayed group. There were only 6 cases of complications cases from 43 procedures in the concurrent group, with fistula being the most frequent with 5 cases reported. In the delayed group, however, there were 27 reported complication cases from 43 procedures. While the number of the fistula was similar between the two groups, 6 cases in the delayed group and 5 cases in the concurrent group, the delayed group reported 19 cases of preputium edema and 1 case of preputium necrosis.<sup>39</sup> Regardless, evidence suggests a complication rate for the Mathieu procedure be around 15%, with fistula being the most frequently reported complication.

We identified several studies that compare complications between two or more anterior hypospadias repair procedures. One such study reported a 25% complication rate among patients who had TIP and 15% for those who had Mathieu repair procedure done. In detail, complications among patients with TIP included 8% who had meatal stenosis, 8% with fistula, and 4% with wound dehiscence. Meanwhile, patients with Mathieu repair procedure reported wound dehiscence as the most frequent complication with 10% of procedures while 5% with fistula.<sup>40</sup> Different results from another similar study result with a 44% complication rate for patients with TIP repair procedures, while only 7.7% of patients with Mathieu procedures had complications. TIP patients' most frequent complications were shared by meatal stenosis and fistula, while the single complication among those with Mathieu repair was fistula formation.<sup>41</sup> Inverse results were found by another study, which reported 23% complication rate among patients with TIP and 48% for patients with Mathieu repair.<sup>42</sup>

The various study has been previously analyzed in meta-analyses. One meta-analysis from 2019, which included studies from 2000 to 2016, reported 115 cases of fistula formation and 15 cases of meatal stricture from 862 reported Mathieu procedure performed while among 710 TIP procedures performed; there were 90 cases of fistula formation and 37 cases of stricture. Forest plot analyses identified TIP as having a higher risk of urethral and meatal stricture at around twice the risk than Mathieu procedure. There was no statistical difference in risks of fistula formation.<sup>43</sup> Another meta-analysis reported similar results from 2020. The later meta-analysis also reported a comparable risk of wound dehiscence and flap necrosis between the two procedures.<sup>44</sup>

## LIMITATIONS AND STRENGTH

Our review is limited in data availability. Few clinical researches investigating the outcomes of different anterior hypospadias repair procedures was published in recent years. This is especially true for the older procedure such as MAGPI and Mathieu, and available studies usually reported on modified version of the procedures. Still, fewer studies reported a comparison between different anterior hypospadias repair procedures with the clinical trial or RCT designs, as evident from the fact that the two recent meta-analyses included studies published 20 years earlier.<sup>43,44</sup> Regardless, our review attempted to described recent results on the topic of anterior hypospadias repair. It could help clinicians find best practices in facing such cases and researchers to direct future research on the topic.

## CONCLUSIONS

Anterior hypospadias repair procedures have developed so much over the years. Since Duckett, often dubbed the first “hypospadiologist”, systematically reported and developed the MAGPI report, it has been modified and expanded upon. Other methods have been developed since, such as TIP, and older procedures, such as Mathieu, altered, and improved. Results are generally comparable between the different procedures, except for meta-analyses that concluded that TIP was associated with a higher risk of urethral and meatal stricture compared to the Mathieu repair procedure. Few reports were comparing TIP or Mathieu procedure with MAGPI. The underlying theme from the studies was the necessity to choose which procedure to perform accurately. Surgical repairs are highly personalized procedures. Although surgeons and urologists have tried their best to classify hypospadias, each patient presents themselves with a specific form of anatomical deformity. The selection of which repair procedure to perform should reflect these unique presentations. This is especially true to achieve the best possible cosmetic outcome.

## CONFLICT OF INTEREST

Authors declare no conflict interest regarding the publication of this article.

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## AUTHOR CONTRIBUTION

All of authors are equally contributed to the study/

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