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Mini Review

Update on Proximal Hypospadias Repair Techniques

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ABSTRACT

Hypospadias refers to the incomplete closure of the penis structure during embryonic development and the displacement of the urethral opening along the ventral side of the penis to form a deformity. The incidence rate is the second most common congenital disease in men after cryptorchidism. Studies reported that hypospadias is a multifactorial disease, which is closely related to genetic mutations, endocrine, environmental and chromosomal factors. The main clinical manifestations of children with hypospadias are ectopic urethral orifice, abnormal curvature of the penis and accumulation of dorsal foreskin, and severe cases are often combined with other systemic malformations. Surgery is the only means of treatment. Domestically, it is believed that the operation should be completed before school age. As long as the anesthesia is safe and the local conditions of the penis are good, the operation can be performed at an early stage. No matter what surgical method is chosen for treatment, individual treatment plans must be formulated according to the type and severity of hypospadias, which has a pivotal impact on improving surgical efficacy and reducing postoperative complications.

Keywords: Proximal hypospadias; Repair techniques; Diagnosis

INTRODUCTION

Hypospadias is defined as an insufficient development of the urethral fold and the ventral foreskin, with or without penile curvature, and the urethral opening is located more proximally anywhere between the tip of the penis and the perineum, which is one of the most common congenital malformations of male genitalia [1,2]. Based on the position of the meatus, the hypospadias is classified within three categories: distal or anterior hypospadias with the meatus on the glans penis, at the corona, or sub coronal. Mid-penile hypospadias with a urethral opening located on the distal penile shaft, midshaft, or on the proximal penile shaft [3]. Proximal or posterior hypospadias have a penoscrotal, scrotal, or perineal urethral meatus location. While proximal hypospadias is accounting for 20% to 25% of all hypospadias, which is the most severe manifestation of the hypospadias spectrum and more observed in Asia [4-6].

LITERATURE REVIEW

Etiology and pathogenesis

Male external genital development is main affected by three major pathways include androgen dependence, androgen independence, endocrine and environmental factors, [7] while the etiology of hypospadias is still unclear. Rooij et al. have confirmed that using progesterone during pregnancy may lead to hypospadias for that the progesterone antagonized male hormones and affected the development of the urogenital system of the fetus [8]. In addition, androgen receptor abnormalities, genetic mutations, endocrine disorders, reduced expression of epidermal growth factor and the environment are also closely related to hypospadias [9].

Compared with the normal population, children with hypospadias have significantly higher rates of autosomal and sex chromosomal aberrations. From the perspective of cytogenetics, there may be a certain correlation between the occurrence of hypospadias and chromosomal aberrations [10]. The X and Y

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chromosomes carry sex-related genes, such as sex-determining genes, which genes promote sex differentiation or abnormalities in number or structure level and lead to gonadal dysplasia [11]. Autosomal aberrations can also lead to hypogonadism or hypoplasia of the external genitalia. Current studies have found that proximal hypospadias tend to be a single-gene mutation disease, while the etiology of distal hypospadias is often accompanied by multiple gene mutations or multiple other factors [12]. Hypospadias is associated with a variety of genetic mutations, including androgen receptor genes, sex-determining genes and 5α-reductase genes. Studies showed that penile development-related genes (such as *HOX, FGF, Shh*), testis-determining genes (such as *WT1, SRY*), luteinizing hormone receptor and androgen receptor genes, as well as *SF1, BMP4, BMP7, AR, HSD3B2, SRD5A2, ATF3, MAMLD1, MID1* and *BNC2*, more than 20 genes are associated with the formation of hypospadias [13].

Clinical diagnosis

Hypospadias is the most common urogenital abnormality in male newborns, but it is often missed diagnosis before birth. The anatomical relationship of genitals can be optimally assessed using 3D ultrasound at prenatal examination [14]. Prenatal MRI diagnosis of fetal hypospadias has high clinical application value, can improve the accuracy of hypospadias diagnosis and assess the initially type and severity of the deformity to provide early intervention and treatment for children. Chromosomal analysis should be performed in patients with cryptorchidism or in whom the genitals are not readily discernible. In patients with micropenis should perform pituitary evaluation and treated with testosterone therapy [15].

The criteria used to define and assess hypospadias do not describe the actual situation of the child very well. Usually the location of the urethral orifice alone is a very crude approach to classifying the severity of hypospadias and does not take into account the amount of tissue dysplasia [9]. Factors such as penis size, glans and urethral plate size, level of bifurcation of the corpus cavernosum, presence of curvature, abnormality and location of the scrotum also significantly affect the outcome of surgical correction. Therefore, a definitive classification can only be accomplished during surgery [16].

DISCUSSION

The standard of cure for hypospadias is that the urethral opening located in the right position of the glans penis, the downward curvature of the penis is completely corrected, the appearance of the penis is close to normal, the ability to urinate upright and have the normal sexual life in adulthood. There are as many techniques freeing the chordee tissue satisfactorily as there are surgeons repairing hypospadias, but so far there is no satisfactory surgical method accepted by the majority of urologists.

TIP hypospadias repair, which was first reported by Snodgrass in 1994 [17]. This surgical method is to cut the urethral plate longitudinally in the middle, free and expand it to both sides, widen the urethral plate and finally wrap the stent to form a new urethra. This operation, which with short of the operation time, closes the urethra longitudinally and the healing will not produce annular scar stenosis, so the probability of postoperative urethral stenosis is small and the postoperative penis has a beautiful appearance.

Metal Advancement and Glanuloplasty Incorporated Procedure (MAGPI), was first reported by Dukett in 1981 [18]. The operation is mainly to cut the dorsal side of the scaphoid fossa of the glans penis longitudinally to the distal end of the urethral orifice and suture the incision horizontally, so that the urethral orifice is moved forward and the operation is simple. It is a classic operation for the treatment of glans penis and coronal sulcus.

Flip-flap method, which was reported by Mathieu in 1932, so it is also called Mathieu procedure [18]. In this operation, a tongue-shaped flap is formed at the proximal end of the urethral orifice with the base of the urethral orifice as the vascular pedicle, which is then turned over and sutured to the two wings of the glans. The key to the operation is to preserve the good blood supply of the flap. This procedure is suitable for type I hypospadias with well-developed glans and abundant subcutaneous tissue on the ventral side of the penis and type II hypospadias with the urethral orifice located in the anterior 1/3 of the penis body.

Onlay Island Flap technique, which was improved the Onlay technique by Dukett in 1987 [19]. The use of onlay preputial grafts is possible in cases where the quality of the urethral plate is good and the urethral plate can be preserved. One advantage of the use of onlay grafts, as opposed to pedicled preputial flaps, is the ease of dissection without necessitating mobilisation of the pedicle required for the flap. The lack of the pedicle also creates less bulk, making ventral skin closure easier and producing less risk of penile torsion [20,21].

Duckett's method

Duckett's procedure is a classic procedure for the treatment of proximal hypospadias [22,23]. To cut off the urethral plate, first completely straighten the penis and then cut the pedicled prepuce flap horizontally according to the length of the defected urethra is shorter than the inner plate of the foreskin and transfer it to the ventral rolled tube to form the urethra. The end is sutured to the head of the penis. Duckett's procedure is complicated and has a long learning curve, so it has a high incidence of postoperative complications, such as urethral stricture, urethral fistula and urethral diverticulum, for operators who can't use the procedure proficiently. While multi-layer tissue coverage combined with dislocation suture can effectively reduce the incidence of urethral fistula after hypospadias.

Duckett+Duplay technique: For severe hypospadias with long urethral defect, when the length of the vascularized foreskin tube alone cannot make up for the urethral defect, the skin around the urethral orifice can be used to make a skin tube. The more commonly used method is to make a "U" shape around the urethral opening. Incision, local Duplay urethra shaping and then anastomosis with Duckett skin tube; this is the Duckett

+Duplay surgery [24]. Tiryaki reported that Duckett combined with Duplay operation to complete 34 cases of proximal hypospadias, the total success rate of operation was 74%, the incidence of urethral fistula was 20.5%, and the incidence of urethral stricture was 8.8%.

Koyanagi technique: Koyanagi et al. proposed in 1984 that the urethral plate was released from its bed but not excised. The urethral plate was divided at the level of the corona [25-27]. After separating the two limbs of the "Y", the flaps were flipped over the front side. Then the glans was incised with wide preparation of glans wings in order to position the urethroplasty inside. Koyanagi technique described a procedure whereby lateral flaps of penile shaft skin, in continuity with preputial skin, can be brought ventrally and tubularized allowing a one-stage correction of severe hypospadias.

The use of Koyanagi urethroplasty in severe hypospadias repair gives a complete penile straightening in all cases. With the improvement of surgical techniques and the continuous improvement of Koyanagi surgery, the incidence of postoperative complications is also decreasing [28,29].

Y-Shaped penis foreskin vascular protection technique: The inner plate of the foreskin was cut along the coronal sulcus, and both sides of the urethral plate were cut as deep as Buck's fascia. The "Y"-shaped foreskin flaps on both sides of the mouth that are continuous with the urethral plate were sutured to form a new urethral skin tube. The urethral skin tube was turned to the ventral side, and the foreskin was reshaped and sutured [30]. Proximal hypospadias defects represent the most challenging aspect of maintaining blood supply to the flap, which eventually leads to a high rate of complications. While the Y-shaped penile prepuce flap has sufficient material and further fully protects the blood supply of the flap, which can repair the proximal hypospadias at one-stage. Zu et al. reported that Y-shaped penis foreskin vascular protection surgery one-time success rate of was 87.6% and the incidence of urethral fistula was 12.6% in total 89 children. Y-shaped penis foreskin vascular protection surgery was safer and had a higher operation rate than the traditional hypospadias repair technique [31].

CONCLUSION

Hypospadias is a common congenital abnormal development of the urinary system in children. The causes are complex, the clinical manifestations are diverse and there are often comorbidities. No matter what surgical method is selected for treatment, it must be based on the hypospadias of children. The type and severity of individual treatment plans have a pivotal impact on improving surgical outcomes and reducing postoperative complications.

REFERENCES

1. Hinman F, Baskin LS. Hinman's atlas of pediatric urologic surgery. Elsevier sci. 2009; 2nd ed:653-661.
2. Retik AB, Borer JG. Hyopspadias. In walsh PC: Campell's Urol. 2007.
3. Orkiszewski M. A standardized classification of hypospadias. J Pediatr Urol. 2012;8(4):410-414.
4. Duckett JW. The current hype in hypospadiology. Br J Urol. 1995;76(3):1-7.
5. Baskin LS, Ebbers MB. Hypospadias: Anatomy, etiology, and technique. J Pediatr Surg 2006; 41:463-472.
6. Kraft KH, Shukla AR, Canning DA. Hypospadias. Urol Clin North Am. 2010;37(2):167-181.
7. Nikolaev VV, Solontsov YN. Epidemiology and theories of the origin of hypospadias. Urologiia 2018;3:141-145.
8. van Rooij IA, van der Zanden LF, Brouwers MM, Knoers NV, Feitz WF, Roeleveld N. Risk factors for different phenotypes of hypospadias: results from a D utch case-control study. BJU Int. 2013;112(1):121-128.
9. Riedmiller H, Androulakakis P, Beurton D, Kocvara R, Gerharz E. EAU Guidelines on Paediatric Urology. Eur Urol. 2001;40(5): 589-599.
10. J Joodi M, Amerizadeh F, Hassanian SM, Erfani M, Ghayour-Mobarhan M, Ferns GA, et al. The genetic factors contributing to hypospadias and their clinical utility in its diagnosis. J Cell Physiol. 2019;234(5):5519-5523.
11. Si YM, Dong Y, Wang W, Qi KY, Wang X. Hypospadias in a male infant with an unusual mosaic 45, X/46, X, psu idic (Y)(p11. 32)/46, XY and haploinsufficiency of SHOX: A case report. Mol Med Rep 2017;16(1):202-207.
12. Thorup J, Nordenskjöld A, Hutson JM. Genetic and environmental origins of hypospadias. Curr Opin Endocrinol Diabetes Obes. 2014;21(3):227-232.
13. Van der Zanden LF, Van Rooij IA, Feitz WF, Franke B, Knoers NV, Roeleveld N. Aetiology of hypospadias: a systematic review of genes and environment. Hum reprod update. 2012;18:260-283.
14. Rodríguez Fernández V, López Ramón y Cajal C, Marín Ortiz E, Sarmiento Carrera N. Accurate Diagnosis of Severe Hypospadias Using 2D and 3D Ultrasounds. Case Rep Obstet Gynecol. 2016;2016:2450341.
15. Albert N, Ulrichs C, Glüer S, Hiort O, Sinnecker GH, Mildenberger H, et al. Etiologic classification of severe hypospadias: implications for prognosis and management. J Pediatr. 1997;131:386-392.
16. Snodgrass W, Macedo A, Hoebeke P, Mouriquand PD. Hypospadias dilemmas: a round table. J Pediatr Urol 2011;7:145-157.
17. Snodgrass W, Bush N. TIP hypospadias repair: a pediatric urology indicator operation. J Pediatr Urol 2016;12:11-18.
18. Snodgrass W, Bush N. Primary hypospadias repair techniques: a review of the evidence. Urol Ann 2016;8:403-408.
19. Duckett JW. The island flap technique for hypospadias repair. Urol Clin North Am. 1981;8(3):503-511.
20. Cambareri GM, Yap M, Kaplan GW. Hypospadias repair with onlay preputial graft: a 25-year experience with long-term follow-up. BJU Int. 2016; 118:451-457.
21. Zhou G, Yin J, Sun J, Liu X, Su J, Li S. Urethroplasty for chordee with a paper-thin hypoplastic urethra: A long-term study. Int J Urol 2022;14865. Epub ahead of print.
22. Huang Y, Xie H, Lv Y, Yu L, Sun L, Li X, et al. One-stage repair of proximal hypospadias with severe chordee by in situ tubularization of the transverse preputial island flap. J Pediatr Urol. 2017; 13:296-299.
23. Yunman T, Shaoji C, Yu M, Xuejun W, Mao L. Plate reconstruction and tubularization urethroplasty in the repair of complicated hypospadias. Chin J Pediatr Surg. 2015;36:182-186.
24. Tiryaki T. Combination of tubularized island flap and ventral skin flap techniques in single-stage correction of severe proximal hypospadias. Urol Int. 2010;84:269-274.
25. Koyanagi T, Nonomura K, Yamashita T, Kanagawa K, Kakizaki H. One-stage repair of hypospadias: is there no simple method

universally applicable to all types of hypospadias?. J Urol. 1994;152:1232-1237.

26. Sugita Y, Tanikaze S, Yoshino K, Yamamichi F. Severe hypospadias repair with meatal based paracoronal skin flap: the modified Koyanagi repair. J Urol. 2001;166:1051-1053.
27. Hayashi Y, Kojima Y, Mizuno K, Nakane A, Kurokawa S, Maruyama T, et al. Neo-modified Koyanagi technique for the single-stage repair of proximal hypospadias. J Pediatr Urol 2007;3:239-242.
28. Nerli R, Santhoshi P, Guntaka A, Patil S, Hiremath M. Modified Koyanagi's procedure for proximal hypospadias: our experience. Int J Urol. 2010; 17(3):294-296.
29. Kang L, Huang G, Zeng L, Huang Y, Ma X, Zhang Y, et al. A new modification of the Koyanagi technique for the one-stage repair of severe hypospadias. Urol. 2016;93:175-179.
30. Faustin MT, Makon AN, Kamadjou C, Fossi G, Andze OG, Sosso MA, et al. Proximal hypospadias repair using the koyanagi-hayashi technique. A review of 15 cases. Afr J Paediatr Surg. 2018;15(3): 142-145.
31. Zu J, Chen Y, Liu Y, He T, Wang Y, Zu Y, et al. Neomodified Koyanagi technique for severe hypospadias with one-stage sealed Y-shaped penis foreskin vascular protection surgery. Clin Case Rep. 2022;10(3):e05575.