

## Correlation of Degrees Inflammation Tunica Dartos Chordae with Degrees for Penile Ventral Curvature in Hypospadias Patients

Andy Michael<sup>1\*</sup>, Gede Wirya Kusuma Duarsa<sup>2</sup>, Tjokorda Gde Bagus Mahadewa<sup>3</sup>, Nyoman Golden<sup>3</sup>, Kadek Budi Santosa<sup>2</sup>, and I Wayan Juli Sumadi<sup>4</sup>

<sup>1</sup>Department of General Surgery, Faculty of Medicine, Udayana University, Prof. Dr. IGNG Ngoerah General Hospital, Denpasar, Indonesia (80113)

<sup>2</sup>Division of Urology, Department of Surgery, Faculty of Medicine, Udayana University, Prof. Dr. IGNG Ngoerah General Hospital, Denpasar, Indonesia (80113)

<sup>3</sup>Division of Neuro Surgery, Department of Surgery, Faculty of Medicine, Udayana University, Prof. Dr. IGNG Ngoerah General Hospital, Denpasar, Indonesia (80113)

<sup>4</sup>Department of Anatomical Pathology, Faculty of Medicine, Udayana University, Prof. Dr. IGNG Ngoerah General Hospital, Denpasar, Indonesia (80113)

E-mail: [andymichael91.am@gmail.com](mailto:andymichael91.am@gmail.com); [gwkduarsa@gmail.com](mailto:gwkduarsa@gmail.com); [tjokmahadewa@unud.ac.id](mailto:tjokmahadewa@unud.ac.id); [nyomangolden@yahoo.co.id](mailto:nyomangolden@yahoo.co.id); [busanbsa@gmail.com](mailto:busanbsa@gmail.com); [juli\\_sumadi@unud.ac.id](mailto:juli_sumadi@unud.ac.id)

\*Correspondent author details: Andy Michael; Email: [andymichael91.am@gmail.com](mailto:andymichael91.am@gmail.com)

### ABSTRACT

**Background:** Penile curvature is caused by decreased elasticity of one or more fascial layers, leading to the shortening of one of the corpus cavernosum. The most common cause of penile curvature is chordee, but ventral curvature can also be found in men without hypospadias. The incidence of the ventral type is found to be higher than the other types at around 70-80%. Histopathology of inflammatory cells in the urethral plate (UP) and deep chordee (DC) is often found in hypospadias patients although the association with ventral penile curvature is unknown. **Method:** A cross-sectional study design was conducted by making one observation in each sample to determine the condition of the incidence of increased inflammation with ventral penile curvature. This study was conducted in Denpasar City Bali from May 2021 - May 2022 with the target of all hypospadias patients aged 0-18 years. Data analysis was performed with the help of SPSS for bivariate tests. **Results:** This study involved 100 respondents with hypospadias who had a mean age of  $6.4 \pm 3.8$  years, the most curvature degree was severe  $> 300$  which was 62%, and mild  $\leq 300$  as much as 36%. The degree of inflammation was found to be mild 89% and moderate 11%. Bivariate analysis using chi-square found no statistically significant between the degree of inflammation and the degree of penile ventral curvature in hypospadias patients ( $r=0.144$ ;  $p=0.154$ ). **Conclusion:** No correlation between the degree of inflammation of the tunica dartos chordee and the degree of ventral curvature of the penis in hypospadias patients.

**Keywords:** Hypospadias; pathology; inflammation; penile; curvature

### INTRODUCTION

Hypospadias is a common congenital disorder characterized by the urethral meatus not being at the tip of the glans penis, and the disease is often accompanied by ventral curvature of the penis. The treatment of this case is surgery which requires 5 important stages, namely: orthoplasty, meatoplasty, urethoplasty, scrotoplasty, and penile covering. It is hoped that the results of surgery can improve the size, shape, urethral mouth, and curvature of the penis to normal because this surgery is very important for psychosocial and sexual development in patients.

The prevalence of hypospadias in Indonesia is estimated to be around 591 cases found per year, where this study was conducted in 2017 at 12 referral

hospitals in Indonesia and Asia there is a lower incidence rate compared to Europe and America with an incidence rate of 0.6-69 per 10,000 male live births [1]. Penile curvature is a disorder that is not only associated with hypospadias but can also be found in children with normal meatus, which is about 4-10% of male live births [2]. Most cases of hypospadias (70%) are distal type, followed by medial and proximal type. The proportion is influenced by the pathophysiology of embryonic development of hypospadias [3]. Data from Prof. Dr. IGNG Ngoerah Hospital in 2016 showed that there were 108 hypospadias patients, with 37.9% penoscrotal, 28.7% penile, 11.1% coronal, 7.4% scrotal, 7.4% sub coronal and 5.5% perineal [4].

Most cases of hypospadias are associated with three penile anomalies namely (1) ventral prepuce deficit, (2) urethral meatus located on the ventral side of the penis, and (3) penile curvature towards the ventral side of the penis (chordee). Penile curvature can be classified based on its etiology which consists of skin chordee, tunica dartos and buck fascia, corpora cavernosa disproportion, and short urethra. The most common cause of penile curvature is ventral curvature. [5]. Chordee occurs due to fibrosis in the dartos tissue which disrupts tissue elasticity and results in penile curvature [6].

Penile curvature is caused due to decreased elasticity in one or more fascial layers, leading to the shortening of one of the corpus cavernosum. The most common cause of penile curvature disorders is chordee, however, ventral curvature can also be found in males without hypospadias [7]. A curvature  $>30^\circ$  is considered clinically significant and a curvature  $>60^\circ$  may interfere with satisfactory sexual intercourse as the patient matures and may cause psychic disturbance in the patient [8]. There are many risks that must be considered in correcting curvature, because if not properly taken into account, postoperative penile size can be significantly reduced and curvature can reappear.

In a study conducted by Ekmark et.al., related to the picture histopathology of inflammatory cells on the urethral plate (UP) and deep chordee (DC) in hypospadias patients, 13 samples had the same picture, namely there was connective tissue with inflammatory cells infiltrating. However, this finding is less common than the picture in UP. But unfortunately, similar studies are very rare, this is because there are not many researchers who focus on inflammatory cell infiltration [9].

This makes researchers interested in correlating the degree of inflammation of the tunica dartos chordee with the degree of ventral curvature of the penis in patients with hypospadias.

## METHODS

This study was an analytic observational study with a cross-sectional design. The study began by identifying hypospadias patients in the Denpasar area with complete medical record data. The target population in this study were all hypospadias patients who had performed surgery in the period 2018-2022. Inclusion criteria: 1) Patients aged 0-18 years; 2) Patients with a diagnosis of hypospadias; 3) Hypospadias patients who underwent surgery in Denpasar from 2018 to 2022. Exclusion criteria in this study were patients who had undergone hypospadias surgery outside Denpasar. sampling from medical records of patients who underwent hypospadias surgery in Denpasar from 2018 to 2022 who met the inclusion criteria and did not meet the exclusion criteria. The research method was carried out using SPSS version 26 for bivariate analysis with chi-square and correlation analysis with *Spearman's Rho*.

## RESULTS

In this study, 100 research subjects were obtained, the characteristics of the research subjects are presented in Table 1, ages 1-18 years who meet the inclusion criteria and obtained the mean  $\pm$  SD age of  $6.4 \pm 3.8$  years with age  $\leq 4$  years 37% and  $> 4$  years 63% this division is in accordance with Snodgrass et al. research (2011) [10]. The most common degree of curvature is severe  $> 30^\circ$  which is 62% and mild  $\leq 30^\circ$  36% this division is in accordance with Moschardi et al (2017) [11], who found the presence of a degree of inflammation in the results of the study after being found there are only 2, namely mild 89% and moderate 11%.

**TABLE 1:** Characteristics of research subjects.

Variables	n=100 (%)
Mean age $\pm$ SB	6,4 $\pm$ 3,8
$\leq 4$ years	37 (37)
$> 4$ years	63 (63)
Degree of Curvature	
Lightweight	36 (36)
Weight	62 (62)
Degree of inflammation	
Lightweight	89 (89)
Medium	11 (11)

In this study, bivariate analysis was carried out using chi-square in Table 2. The results of bivariate analysis on age and degree of inflammation were

found to have no statistically significant results with  $p>0.05$  so they were not continued in the multivariate analysis stage.

**TABLE 2:** Bivariate analysis between age, degree of inflammation and degree of ventral curvature of penis.

Variables	Degree of curvature n=100 (%)		PR	CI95%		p-value
	Lightweight	Weight		Lower	Upper	
Age						
≤ 4 years	16 (16)	21 (21)	1,420	0,618	3,261	0,409
> 4 years	22 (22)	41 (41)				
Degree of inflammation						
Lightweight	36 (36)	53 (53)	3.057	0,624	14,982	0,811
Medium	2 (2)	9 (9)				

In this study, in analyzing the correlation between age and the degree of inflammation of the tunica dartos chordae to the degree of ventral curvature of

the penis using the Spearman's rho test because the data obtained is ordinal scale data.

**TABLE 3:** Spearman's rho test between age and degree of inflammation of tunica dartos chordae on the degree of ventral curvature of penis.

Variables	Degree of ventral curvature of the penis	
	r	P*
Age	0,037	0,713
Degree of inflammation	0,144	0,154

\*Spearman's rho

The results of the Spearman's rho test showed that there was no significant correlation between age and degree of inflammation with a value of (p>0.05).

**DISCUSSION**

This study obtained 100 subjects from hospitals in Denpasar Bali. Age results were obtained with a mean ± SD of 6.4 ± 3.8 years with age ≤ 4 years 37% and > 4 years 63%. The age of diabtation in this study used 4 years in accordance with the old literature in 2011 by Snodgrass et al and the new literature states the golden period for surgery in the handling of hypospadias based on the guidelines from Hyspadiology is known to be 6-18 months [13].

The characteristics of the incidence of hypospadias in Indonesia were found to be more pre-school age, namely 5.36 ± 3.35 years, in a study conducted at Sardjito Hospital Yogyakarta found 120 subjects with an age of 4.17 ± 2.35, at Prof. Dr. IGNG Ngoerah General Hospital Bali obtained results with a median age of 7.35 years (2-17 years) [14,15]. The incidence of hypospadias in Indonesia is quite high, but the lack of public knowledge about this disorder causes not many cases to be treated in hospitals, or facilities and health workers are not evenly distributed so that these cases are not detected. The results of data discovery in the world obtained the most visits for hypospadias is the age of toddlers 1-5 years old [16]. Most cases in adolescents and adults who come are aged 14-21 years [17]. In cases of hypospadias with ventral curvature of the penis, 73 patients were found with a median age of 59 months (IQR) 34-118 months [18].

The most common degree of ventral curvature of the penis is severe, namely 62% and mild 36%. This is in accordance with research conducted by Snodgrass and Bush, (2019), obtained 80% of 73 research subjects obtained severe curvature ≥30 °[18].

In research Atmoko et al., (2018) also stated that the severe degree was obtained in > 50% of cases [7]. Similar results in research Bandini et al., (2020) obtained 80.9% of 303 subjects were found to have a degree of curvature ≥30° [19].

The incidence of the ventral type is found to be more than the other types, which is about 70-80% of the incidence [20,21]. Cosmetic problems are the main problem in cases of ventral hypospadias, the results of physical examination found the urethral mouth on the ventral part of the penis. Usually the outer skin in the ventral part is thinner or even absent, where the outer skin in the dorsal part is thickened and sometimes even forms like a hood. In hypospadias, chorda is often found. Chorda is the bending towards the ventral direction of the penis. This is due to atrophy of the corpus spongiosum, fibrosis of the tunica albuginea and fascia above the tunica, tightening of the ventral skin and Buck's fascia, adhesion of the penile skin to surrounding structures, or adhesion of the urethral plate to the corpus cavernosa. Possible complaints are weak urine output during micturition, pain during erection, and interference with sexual intercourse [12,14,22].

The degree of inflammation was mild 89% and severe 11%. In research conducted by Chan et al., (2020) who found 37% of patients with hypospadias had severe inflammation and the rest had mild inflammation [23]. This inflammatory process will indeed be experienced by hypospadias sufferers both acutely and chronically, this risk is obtained due to hygiene problems in the invisible penile environment and also frequent urinary tract infections. Results in the study Mattioli et al., (2002) found that 88% of hypospadias patients had inflammation in the prepuce area and 60% were found in the urethra [24].

The inflammatory process occurs in acute and chronic hypospadias patients, but mild inflammation is not found to affect the degree of severe curvature of the ventral penis [23].

This study was able to provide an overview of hypospadias cases in the Denpasar area, although there was no evidence of an association between age and degree of inflammation with degree of ventral curvature of the penis. This study can be used as a reference for future research with various other factors that affect the degree of ventral curvature of the penis.

The weakness of this study is that it was taken from medical record data so that, incomplete data will be excluded in the study, so there is a possibility that the excluded data can affect the degree of ventral curvature of the penis. In addition, it was not evaluated about the possibility of other than originating from dartos cordae such as skin chordae, corporal disposition, and short urethral plate and corpus spongiosum fibrosis.

### CONCLUSION

The degree of inflammation of the tunica dartos chordae is not associated with the degree of ventral curvature of the penis in patients with hypospadias

### Acknowledgments

All patients, all authors, and all support in paper

### Declarations

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by Udayana University/ Prof. Dr. IGNG Ngoerah General Hospital Bali with number 2773/UN14.2.2.VII.14/LT/2022.

### REFERENCES

- [1] Duarsa GWK, Tirtayasa PMW, Daryanto B, Nurhadi P, Renaldo J, Tarmono T, et al. Common Practice of Hypospadias Management by Pediatric Urologists in Indonesia: A Multi-center Descriptive Study from Referral Hospitals. *Open Access Maced J Med Sci* 2019. <https://doi.org/10.3889/oamjms.2019.628>.
- [2] Moscardi PRM, Gosalbez R, Castellan MA. Management of high-grade penile curvature associated with hypospadias in children. *Front Pediatr* 2017;5:1–8. <https://doi.org/10.3389/fped.2017.00189>.
- [3] van der Horst HJR, de Wall LL. Hypospadias, all there is to know. *Eur J Pediatr* 2017;176:435–41. <https://doi.org/10.1007/s00431-017-2864-5>.
- [4] Duarsa GWK, Nugroho TD. Characteristics of Hypospadias Cases in Sanglah General Hospital, Bali-Indonesia: a Descriptive Study. *Bali Medical Journal* 2016;5:13. <https://doi.org/10.15562/bmj.v5i1.185>.
- [5] Atmoko W, Shalmont G, Situmorang GR, Wahyudi I, Tanurahardja B, Rodjani A. Abnormal dartos fascia in buried penis and hypospadias: Evidence from histopathology. *J Pediatr Urol* 2018;14:536.e1-536.e7. <https://doi.org/10.1016/j.jpuro.2018.04.034>.
- [6] Yuri P, Gunadi, Lestari RP, Fardilla FP, Setyaningsih WAW, Arfian N, et al. The impact of COL1A1 and COL6A1 expression on hypospadias and penile curvature severity. *BMC Urol* 2020;20:1–10. <https://doi.org/10.1186/s12894-020-00760-w>.
- [7] Atmoko W, Shalmont G, Situmorang GR, Wahyudi I, Tanurahardja B, Rodjani A. Abnormal dartos fascia in buried penis and hypospadias: Evidence from histopathology. *J Pediatr Urol* 2018;14:536.e1-536.e7. <https://doi.org/10.1016/j.jpuro.2018.04.034>.
- [8] Radmayr C, Bogaert G, Dogan HS, Koc R, Associates G, Hoen LA. European Association of Urology Guidelines on Paediatric Urology 2018:41.
- [9] Nozohoor Ekmark A, Grelaud D, Hansson E, Svensson H, Arnbjörnsson E, Gisselsson D. The Cellular Architectures of Hypospadias. *Pediatr Dev Pathol* 2020;23:476–8. <https://doi.org/10.1177/1093526620943084>.
- [10] Snodgrass W, MacEdo A, Hoebeke P, Mouriquand PDE. Hypospadias dilemmas: A round table. *J Pediatr Urol* 2011;7:145–57. <https://doi.org/10.1016/j.jpuro.2010.11.009>.
- [11] Moscardi PRM, Gosalbez R, Castellan MA. Management of High-Grade Penile Curvature Associated with Hypospadias in Children. *Front Pediatr* 2017;5. <https://doi.org/10.3389/fped.2017.00189>.
- [12] Hayashi Y, Mizuno K, Kojima Y, Moritoki Y, Nishio H, Kato T, et al. Characterization of the urethral plate and the underlying tissue defined by expression of collagen subtypes and microarchitecture in hypospadias. *International Journal of Urology* 2011;18:317–22. <https://doi.org/10.1111/j.1442-2042.2010.02713.x>.
- [13] Bhat A, Khadelwal N. General Considerations in Hypospadias Surgery. *Hypospadiology Springer, Singapore* 2022;33:1–12.
- [14] Krisna DanielM, Maulana A. Hipospadia: Bagaimana Karakteristik di Indonesia. *Berkala Ilmiah Kedokteran Duta Wacana* 2017;2:325–33.
- [15] Tangkudung FJ, Patria SY, Arguni E. Faktor Risiko Hipospadia pada Anak di RSUP Dr. Sardjito Yogyakarta. *Sari Pediatri* 2016;17:396. <https://doi.org/10.14238/sp17.5.2016.396-400>.

- [16] Donaire AE, Mendez MD. Hypospadias. NCBI Bookshelf 2020.
- [17] Abosena W, Talab SS, Hanna MK. Recurrent chordee in 59 adolescents and young adults following childhood hypospadias repair. *J Pediatr Urol* 2020;16:162.e1-162.e5. <https://doi.org/10.1016/j.jpuro.2019.11.013>.
- [18] Snodgrass W, Bush NC. Persistent or recurrent ventral curvature after failed proximal hypospadias repair. *J Pediatr Urol* 2019;15:344.e1-344.e6. <https://doi.org/10.1016/j.jpuro.2019.03.028>.
- [19] Bandini M, Sekulovic S, Spiridonescu B, Krishnappa P, Dangi AD, Slavkovic M, et al. Prevalence, assessment and surgical correction of penile curvature in hypospadias patients treated at one European Referral Center: description of the technique and surgical outcomes. *World J Urol* 2020;38:2041-8. <https://doi.org/10.1007/s00345-019-02961-x>.
- [20] Haroun HS. Pathoembryology of Hypospadias and Chordee. *MOJ Anat Physiol* 2018;5:6-10. <https://doi.org/10.15406/mojap.2018.05.00155>.
- [21] Ben-David R, Kupershmidt A, Dekalo S, Herzberg H, Mano R, Dubi-Sobol A, et al. Dorsal penile curvature and megameatus intact prepuce hypospadias: A common association in a rare variant of hypospadias. *J Pediatr Urol* 2021;17:517.e1-517.e4. <https://doi.org/10.1016/j.jpuro.2021.04.006>.
- [22] Snodgrass W, Bush N. Recurrent ventral curvature after proximal TIP hypospadias repair. *J Pediatr Urol* 2021;17:222.e1-222.e5. <https://doi.org/10.1016/j.jpuro.2020.11.030>.
- [23] Chan YY, Bury MI, Yura EM, Hofer MD, Cheng EY, Sharma AK. The current state of tissue engineering in the management of hypospadias. *Nat Rev Urol* 2020;17:162-75. <https://doi.org/10.1038/s41585-020-0281-4>.
- [24] Mattioli G, Repetto P, Carlini C, Granata C, Gambini C, Jasonni V. Lichen sclerosus et atrophicus in children with phimosis and hypospadias. *Pediatr Surg Int* 2002;18:273-5. <https://doi.org/10.1007/s003830100699>.