

CORRESPONDENCE

The mystery of Jacob Henle's 'septum glandis'

Dear Editor,

I read with great interest the article recently published in the *Journal of Anatomy* titled 'Ligamentous structures in human glans penis' (Lee et al. 2019). The authors have clearly documented the macroscopic and microscopic morphological features of a central ligamentous structure penetrating the human glans penis by the course of the fossa navicularis. This structure has also been named the 'distal ligament' or 'corporo-glans ligament' (Shafik et al., 2004; Hsu et al., 2005). To my knowledge, Dr Friedrich Gustav Jacob Henle (1809–1885) was first to describe this median fibrous tissue coming from the corpus spongiosum surrounding the fossa navicularis as 'septum glandis', and its extensions as 'upper and lower median septum' (Henle, 1877; Fig. 1). Dr J. Henle, professor of anatomy in Zürich, then in Göttingen, was the first to publish the first descriptions of the fine structures and distribution of human epithelial tissues (such as layers, fissures, membranes, ligaments, sheaths). His name is best known from the loop-shaped portion (Henle ansa) of the nephron named after him. Later on, his descriptions for this fibrous tissue are seen in German language books and atlases. Here is an abstract from the section 'Der Penis' (von Hayek, 1969), describing this connective tissue:

'...At this connective tissue framework, one can distinguish a median septum and a tube comprising the urethra, both of which decrease in strength distally. The connective tissue around the urethra (fossa navicularis), which divides the glans into outer and inner layer (HENLE), is nothing more than a continuation of the albuginea of the corpus cavernosum urethra (corpus spongiosum), and is called 'urethral ring' by EBERTH (1904). It dissolves distally into individual bars around the urethral orifice. The arteries and veins passing from the urethral corpus cavernosum (spongiosum) into the glans lie between these bars. Dorsally, there is a plate of connective tissue (septum glandis, HENLE) which is formed by a continuation of the albuginea of the corpus cavernosum penis. Where this septum passes into the connective tissue around the urethra (fossa navicularis), there is a stronger connective tissue made of collagen and elastic fibers, which is felt like cartilaginous tissue on fixed preparation (STIEVE, 1930). However, in human, as HYRTL (1860) has already emphasized, this body never contains cartilaginous tissue, but a cartilage in the same place in cattle (EBERTH, 1904) and a penile bone in other mammals (STIEVE, 1930). Also on the ventral side, this tubular connective tissue is connected to the albuginea of the glans,

proximally wider, through a slightly high septum' (p. 372, *Der Bau der Glans Penis*).

Recently, we showed the anatomical details of the glanular urethra (fossa navicularis) and its distinct attachments within the glans penis with an MRI study (Özbey & Kumbasar, 2017). We found that the corpus spongiosum covers the urethra and gradually terminates at the mid-glanular level. After that level, a fibrous tissue (septum glandis) surrounds the glanular urethra (fossa navicularis), connects the upper and lower median septum and holds the glanular urethra in the midline as a suspensory ligament. Schematic description of the human glans penis (Özbey, 2018; Fig. 2) corresponds to the historical findings of J. Henle and to the recent findings obtained by microscopic studies (van der Putte, 2007), and scanning electron microscopy and optical projection tomography (Liu et al., 2018). Moreover, these anatomical features of the human glans penis have already inspired our operative technique (the glanular-frenular collar, GFC) for hypospadias repair (Özbey & Etker, 2016).

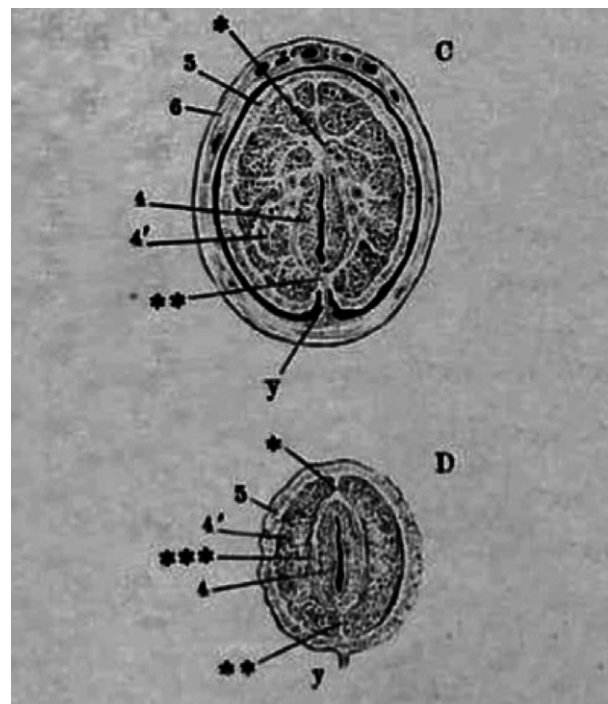


Figure 1 Cross-sections of the glans penis showing the septum and frenulum: (C) mid-glanular level, (D) submeatal level. Upper median septum (*), lower median septum (**), fibrous tissue surrounding the glanular urethra and connecting the upper and lower median septum (***), frenulum (y) (Henle, 1877).

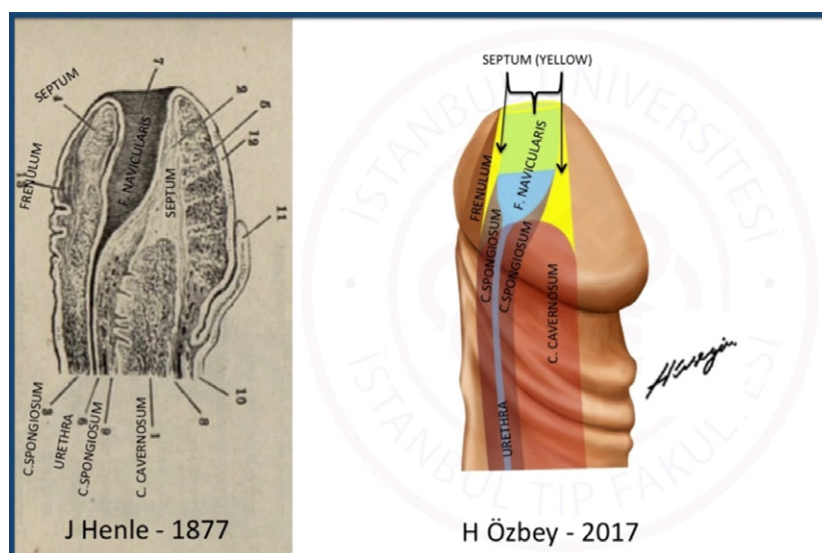


Figure 2 Schematic description of human glans penis showing distinct attachments of the glanular urethra (fossa navicularis) with the 'septum glandis' and the 'frenulum' (Özbey, 2018).

As the authors point out in their conclusion, this fibrous tissue is usually considered to contribute to the flexibility and rigidity of the human glans penis, especially during intercourse. I think this fibrous tissue (septum glandis) has an additional role as a 'flow control valve' or as 'urethral ring', in controlling the flow of the urine exiting the urethra.

Hüseyin Özbey^{1,2} 

¹Department of Pediatric Surgery and Division of Pediatric Urology, Istanbul Medical Faculty, Istanbul University, Istanbul, Turkey

²Department of Pediatric Surgery, Sechenov First Moscow State Medical University, Sechenov University, Moscow, Russia
E-mail: hozbey@istanbul.edu.tr

References

- von Hayek H (1969) Der Penis. In: *Anatomie und Embryologie. Handbuch der Urologie Encyclopedia of Urology Encyclopedie d'Urologie*, Vol. 1. (eds Conrad K, Ferner H, Gisel A, Krause W, Wieser St, Zaki C), p. 372, Springer: Verlag Berlin Heidelberg.
- Henle J (1877) *Anatomischer Hand-Atlas zum Gebrauch im Secirsaal* (Band 6). Eingeweide. Braunschweig: Available via University Library Heidelberg. Available from: <https://digi.ub.uni-heidelberg.de/diglit/henle1877bd6/0093/image>
- Hsu G, Lin C, Hsieh C, et al. (2005) Distal ligament in human glans: a comparative study of penile architecture. *J Androl* **26**, 624–628.
- Lee SH, Ha TJ, Koh KS, et al. (2019) Ligamentous structures in human glans penis. *J Anat* **234**, 83–88.
- Liu X, Liu G, Shen J, et al. (2018) Human glans and preputial development. *Differentiation* **103**, 86–99.
- Özbey H (2018) Response to the comment on 'Hypospadias repair with the glanular-frenular collar (GFC) technique'. *J Pediatr Urol* **14**, 304–305.
- Özbey H, Etker S (2016) Hypospadias repair with the glanular-frenular collar (GFC) technique. *J Pediatr Urol* **13**, 34.e1–34.e6.
- Özbey H, Kumbasar A (2017) Glans wings are separated ventrally by the septum glandis and frenulum penis: MRI documentation and surgical implications. *Turk J Urol* **43**, 525–529.
- van der Putte SCJ (2007) Hypospadias and associated penile anomalies: a histological study and a reconstruction of the pathogenesis. *J Plast Reconstr Aesthet Surg* **60**, 48–60.
- Shafik A, Shafik AA, Asaad S, et al. (2004) The corporo-glans ligament: description and functional significance of a ligament connecting the corpora cavernosa to the glans penis. *Int J Impot Res* **16**, 220–223.