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CORRESPONDENCE

The glans and its connection to the penis shaft

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I read with great interest the article by Dr Wang et al., "Application of glanular decompression and expansion surgery in proximal hypospadias with hypoplastic glans penis" [1]. The authors describe a modified glanuloplasty technique for the treatment of hypospadias in patients with a small glans, in which the glans is divided in the dorsal midline to reduce the tension that complicates closure between the dissected glans wings. I would like to make a few comments to clarify the anatomical aspects of this technique and to point out the risks of damage to the distal ligament, which is the main ligamentous tissue providing stability to the glans penis.

1. The fibrous-ligamentous framework (FLF) of the penis is consisted of the tunica albuginea of the corpora cavernosa and the tunica albuginea of the corpus spongiosum. The FLF of the penis ensures not only the corporal integrity of the penis, but also the stable connection between the glans and the penile shaft [2, 3]. The extensions of the tunica albuginea of the corpora cavernosa and the tunica albuginea of the corpus spongiosum into the glans form two main connective tissues: the *distal ligament* and the *septum glandis*. These two structures provide a stable connection of the glans to the penile shaft on the dorsal and ventral sides of the glans, respectively. We have shown the details of these structures with an MRI study [3] (Fig. 1). I believe it would be very helpful for readers to see how the authors relate their surgical observations to the anatomical information we have previously provided. Hence, as the authors mention, the long-term outcomes of their patients' sexual function should be carefully monitored.
2. Although the authors claim that their technique causes cell proliferation and tissue ingrowth at the incision site, further increasing the glans volume, this claim is controversial and requires histopathological confirmation. Since the authors report this type of glans incision for the first time, it would be helpful if they also explained how they stayed superficial to the tunica albuginea to minimize bleeding.
3. Closure of the glans (glans fusion), as used in the authors' technique, contradicts normal anatomy because the septum glandis runs between and separates the wings of the glans. The septum glandis (lower median septum) forms a loose and fibroelastic ventral wall for the glanular urethra [3]. Therefore, the glans incision and its purpose are conceptually incorrect and reflect a misconception (glans fusion) in hypospadias surgery [4].
4. In the normal anatomy of the penis, the corpus spongiosum gradually ends in the glans where it meets the *navicular fossa*, which forms the body of the glanular urethra and represents the final structural form of the glans penis. The various glans grooves in hypospadias represents incomplete configuration of the navicular fossa and malformation of the glans. Alhough there is no corpus spongiosum distal to the ectopic meatus, all patients with proximal hypospadias have a glans penis. Therefore, it is important to know that the glans penis is not the extended or expanded end of the corpus spongiosum. Hypospadias surgery should consider a dual surgical approach dedicated to the reconstruction of the glanular and the penile urethra [5].

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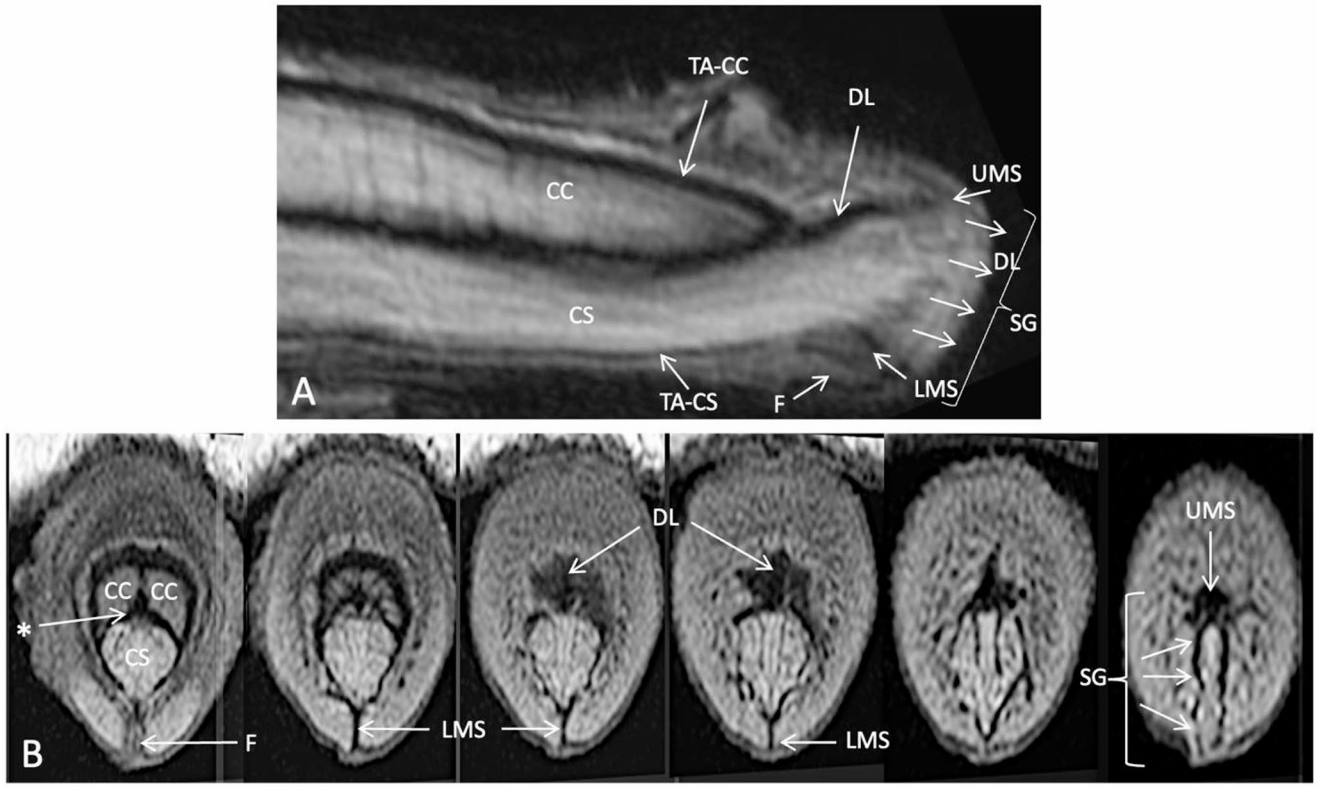

Fig. 1 Topographical anatomy of the penis showing the corpora cavernosa, the corpus spongiosum and the fibrous-ligamentous structures (as extensions of their tunica albuginea) in relation to the glanular and penile urethra. Magnetic resonance imaging (MRI); **A** longitudinal saggital section of the penile shaft and glans, **B** cross sections of the glans from proximal to distal. Note the gradual termination of the corpus spongiosum and how the ventral wall of the glanular urethra is formed with the lower median septum of the septum glandis and frenulum. *TA-CC* tunica albuginea of the corpora cavernosa; *TA-CS* tunica albuginea of the corpus spongiosum; *CC* corpus cavernosum; *CS* corpus spongiosum; *DL* distal ligament; *UMS* upper median septum; *LMS* lower median septum; *SG* septum glandis; *F* frenulum

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Declarations

Conflict of interest The authors declare no competing interests.

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