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TOPOHISTOLOGY OF THE FEMALE PERINEAL MEMBRANE AND CAVERNOUS NERVE: A STUDY USING PELVIC FLOOR SEMISERIAL SECTIONS FROM ELDERLY NULLIPAROUS AND MULTIPAROUS WOMEN

Hypothesis / aims of study

To our knowledge, the perineal membrane (PM), an important fixation of the distal third of the female urethra [1], has not been demonstrated histologically. Consequently, the first aim of the present study was to examine the topohistology of the PM and perineal muscles using adult female specimens. Using human embryos, it was demonstrated that a nerve travelling at the 5 and 7 o'clock positions along the mid- and distal urethra contains nNOS, and on this basis it was defined as the female cavernous nerve [2]. However, the topographical anatomy of the adult female pelvic floor is still unclear. The second aim was to describe the autonomic nerves, including the female cavernous nerve, which are likely to pass through the PM or the anterior half of the female levator hiatus.

Study design, materials and methods

Pelvic floor specimens including the clitoris, urethra, vagina and perineal muscles were obtained from 15 donated female cadavers (64-90 years old; mean, 74.8 years). They included 7 nulliparous and 8 multiparous women. After bisection of the pelvic floor specimens along the midsagittal line, one half was used for frontal sections, while the other half was used for horizontal sections. After routine paraffin embedding procedures for histology, semiserial sections 10-20 micron meter thick were cut at 0.1-0.5-mm intervals. All sections were larger than 5x5 cm, and most were stained with hematoxylin and eosin, although some were used for immunohistochemistry (smooth muscle, tyrosine hydroxylase) or aldehyde-fuchsin staining (elastic fibers).

Results

The thick PM, notably comprising elastic fibers, extended mediolaterally on the immediately inferior side of the rhabdosphincter area. At more posterior sites including the vagina, the elastic fibers tilted more inferosuperiorly and came to extend along the lateral vaginal wall as a fibrous skeleton. The entire extent of the PM was evident in a limited number of specimens (2/15; all 2 nulliparous), but the majority (13/15 including 5 nulliparous) carried the fibrous skeleton along the vagina with a thin and interrupted anteromedial part alongside the urethra. The compressor urethrae and urethrovaginal sphincter were embedded in the PM. These muscle fibers attached to and interdigitated with the composite elastic fibers of the PM. The female cavernous nerve passed between the levator ani and rhabdosphincter, appeared in the superficial side of the PM, and reached the cavernous tissues.

Interpretation of results

We hypothesized that these striated muscles are likely to modulate the tension of elastic fibers such as smooth muscle functions on elastic laminae of the arterial wall. A group of intrapelvic nerves descended along the arcus tendineus fasciae pelvis, passed through a smooth muscle-rich tissue mass between the levator ani and rhabdosphincter, and reached the cavernous tissues. Because the nerves took an intrapelvic course, we considered them to be the female cavernous nerve, corresponding to the neurovascular bundle in males. The periurethral tissue associated with the nerve seems to be the area usually affected by the use of cotton with forceps in tension-free vaginal tape techniques. We have tried to revise the standard diagram of perineal anatomy [3] in order to show the actual topographical anatomy of the PM and other female perineal structures (Figure).

Concluding message

The compressor and urethrovaginal sphincter are likely to modulate tension of the elastic fibers. The peri-urethral tissue along the course of the cavernous nerve seems to be the area usually treated by cotton with forceps in tension-free vaginal tape techniques.

References

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2. J Urol (2004) 172; 191-195.
3. Gray's Anatomy; Churchill Livingstone, 2005 (1199-1204)

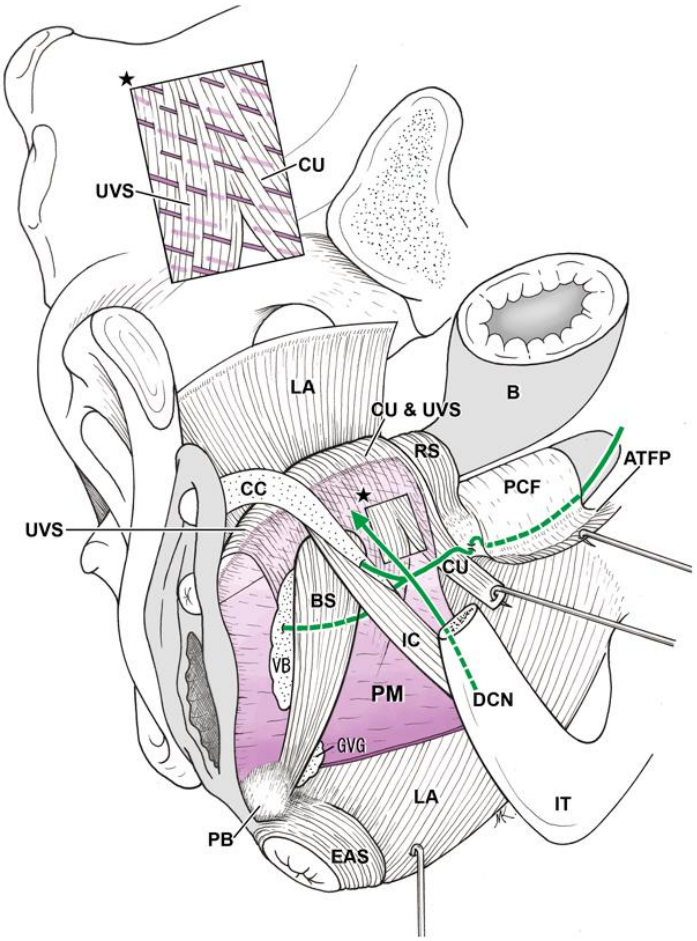

Figure. Schematic diagram of the female perineal structures including the putative cavernous nerve.

Viewed from the left side of the perineum after removal of parts of the bony pelvis.The perineal membrane (PM), colored violet, is located in the medial or vaginal side of the ischiocavernosus (IC), bulbospongiosus (BS), crus clitoridis (CC), vestibular bulb (VB) and greater vestibular gland (GVG). The compressor urethrae (CU) and urethrovaginal sphincter (UVS) are located inferiorly and superficially relative to the rhabdosphincter (RS). The putative female cavernous nerve (green line) is covered by the pubocervical fascia (PCF) and runs inferiorly along the arcus tendineus fasciae pelvis (ATFP). The nerve exhibits a tortuous course in the smooth muscle-rich tissue between the levator ani (LA) and RS before running inferiorly along the superficial side of the PM. The dorsalis clitoridis nerve (arrow with DCN) exits to the superficial or inferior aspect of the PM and crosses the lateral side of the cavernous nerve course. B, bladder; EAS, external anal sphincter; IT, ischial tuberosity; PB, perineal body.

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Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**