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RESPONSE PROPERTIES OF URETHRAL DISTENTION-EVOKED UNIFIBRE AFFERENT POTENTIALS IN THE LUT

Hypothesis / aims of study

During normal storage and micturition, bladder and urethra, work as one functional unit. It has been reported that afferent input from the urethra can modulate bladder function. Nevertheless, little is known about the functional properties of urethral afferents. Such knowledge will allow greater insight into the role of urethral afferents in LUT function. In the present study, we investigated the effect of urethral distention on single-fiber afferent activities of the lower urinary tract in the female rat.

Study design, materials and methods

Female Sprague-Dawley rats weighting 200-250g were anesthetized with urethane (1,5g/kg intraperitoneally). Single-fiber afferent activities were recorded from the left L6 dorsal root and classified by conduction velocity. The response of pelvic and pudendal units on urethral distention (60 sec) was measured. Two different distention diameters were performed in the proximal and distal urethra (Figure 1).

Results

93 pelvic and 72 pudendal units were isolated in 15 rats. Twenty (8 pelvic and 12 pudendal) units were responsive to urethral distention. Three patterns of response could be distinguished: fast adapting, and two groups of slow adapting afferents (Table 1). The largest grade of distention resulted in the biggest response in both nerves. Five pelvic and 3 pudendal units responded exclusively to proximal distention, 2 pelvic and 5 pudendal units to distal distention and 1 pelvic and 4 pudendal units to both. The responses were reproducible. No association was found between the type of nerve and the location of response to distention.

Interpretation of results

In the present study, distention-responsive afferent units could be found in the pelvic and the pudendal nerve. Pelvic afferents responsive to urethral distention exhibited a fast adapting pattern and a slow adapting pattern (group1), whereas all pudendal afferents exhibited a slow adapting pattern (group 1 and 2). One can hypothesize that the fast adapting units might signal the beginning of transurethral flow whereas the slow adapting units give information about the duration of the flow.
Respectively two pelvic and 3 pudendal units responded to urethral distention at the distal and proximal urethra. This result suggests no clear distinction of pelvic and pudendal urethral innervation and the possibility of innervation overlap.

Concluding message

This electrophysiological study demonstrates the presence of urethral distention-evoked afferents in the pelvic and pudendal nerve and describes their response to distention. Differences in sensory signaling both in type and in location were demonstrated. The current technique can be used for further investigation of urethral afferents.

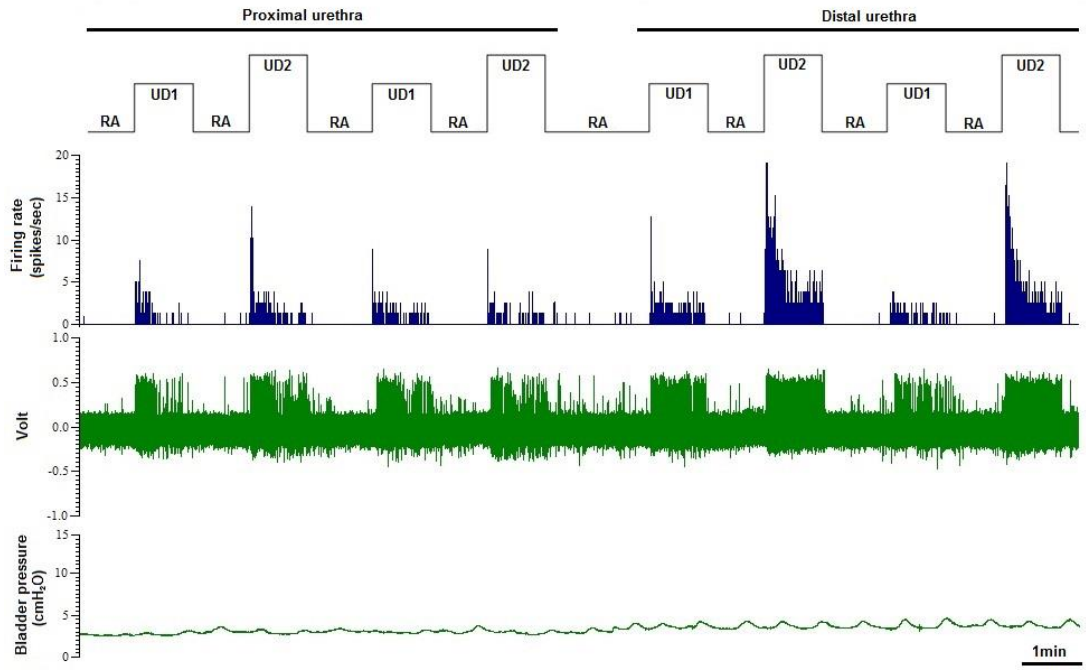

Figure 1: Schematic overview protocol. The protocol was carried out in an empty bladder and bladder pressure was recorded during the length of the protocol. Two locations in the urethra were investigated, i.e. the proximal urethra and the distal urethra. Two grades of urethral distention were analyzed at each location and repeated twice to evaluate reproducibility. RA= Resting Activity. UD1= First grade of urethral distention. Balloon diameter and length being 4,5mm and 4,5 mm. UD2= Second grade of urethral distention. Balloon diameter and length being 6mm and 6mm.

FA afferents (2/20)(10%)	Pelvic nerve	Pudendal nerve
Number (N)	2	NA
C fibers (mean CV, m/s)	1 (0,70)	NA
Aδ fibers (mean CV, m/s)	1 (2,66)	NA
SA1 afferents (10/20)(50%)		
Number (N)	5	5
C fibers (mean CV, m/s)	5 (0,89 ± 0,17)	5 (1,04 ± 0,32)
Aδ fibers (mean CV, m/s)	NA	NA
SA 2 afferents (7/20)(35%)		
Number (N)	NA	7
C fibers (mean CV, m/s)	NA	5 (0,81 ± 0,14)
Aδ fibers (mean CV, m/s)	NA	1 (4,37)
Aα/β-fibers (mean CV, m/s)	NA	1 (27,83)

Table 1: Summary of the characteristics of the three different response patterns of the single-fiber afferents identified by pelvic and pudendal nerve electrical stimulation and responsive to urethral distention. Note that one pelvic Aδ–fiber (1/20 afferents) is not included in this table because it could not be subdivided in one of the three groups. Values in conduction velocity (CV) and resting activity (RA) are means ± SE. NA= not applicable.

Disclosures
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