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Editorial Comment on: Characteristics of Spontaneous Activity in the Bladder Trigone

Christian Gratzke, Michael Seitz
Department of Urology, Ludwig-Maximilians-University, Munich, Germany
Christian.Gratzke@med.uni-muenchen.de

The normal bladder functions—storage and elimination of urine—are based on a coordinated interplay of reciprocal contraction and relaxation of the bladder and the outflow region. This interaction is regulated by neural circuits in the brain and spinal cord that coordinate the activity of the detrusor and that of the smooth and striated muscles of the outflow region [1]. While NO/cGMP-mediated relaxation of the trigone contributes to the inititation of the micturition cycle [2], the present study by Roosen et al [3] analyzes the role of the bladder trigone during bladder filling. The authors identify trigonal myocytes that show spontaneous activity in the form of [Ca2+]i as a consequence of transmembrane Ca2+ influx through L-type Ca2+ channels.

Interestingly, the cellular origin of spontaneous activity in the trigone differs from other cells in the lower urinary tract such as detrusor myocytes and interstitial cells (ICs). Recent research has focused on the role of ICs in the bladder function [4]. A network of these cells with similar characteristics as the interstitial cells of Cajal that are involved in regulation of gastrointestinal motility is located beneath the urothelium in the human bladder and in the muscular wall of the detrusor. This network has been suggested to be involved in integrating signals from the urothelium, sensory nerves, and bladder wall.

ICs have also been located in the urethra and are known to exhibit spontaneous firing activity. The close structural relation between ICs, smooth muscle, and nerves forms a basis for the involvement of these cells in the regulation of urethral tone and the continence mechanism. Recently, TRPA1-immunoreactivity was detected in interstitial cells that were evenly distributed in the muscular wall and specifically located on the boundaries of human urethral smooth muscle cell bundles [5].

Together with the finding that extensive gap junction coupling contributes to spontaneous contraction of the trigone, the study by Roosen et al provides valuable information on the physiological function of trigone myocytes. Future studies are needed to evaluate further the mechanisms leading to relaxation of the trigone in particular and the importance of interstitial cells in the regulation of bladder function in general.

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Editorial Comment on: Characteristics of Spontaneous Activity in the Bladder Trigone

Petter Hedlund
Department of Clinical Pharmacology, Lund University, Linköping University, Sweden
petter.hedlund@med.lu.se

Isolated preparations from the detrusor from various species, including humans, exhibit spontaneous contractile activity [1]. Similarly, autonomous nonmicturition contractions (NMCs) are observed under experimental conditions in isolated, whole rodent bladders and can also be recognized during cystometry in normal animals [2]. The underlying mechanisms of the spontaneous activity in vitro or in vivo are not established, and it is not known what the phenomena represent for bladder function. It is proposed that spontaneous activity may be of importance for functions such as sensory functions and pressure regulatory functions of the micturition reflex and that activity in the urothelium, nerves, interstitial cells, and smooth muscle are involved [1,2]. A role for detrusor overactivity (DO) may also be considered because increased spontaneous activity in vitro and in vivo of the bladder is reported in lower urinary tract (LUT) dysfunction [1].

Gap junctions (connexins) allow the spread of spontaneous-action potentials of bladder tissue from rodents and humans by coupling of cells [1]. In the present study, Roosen et al described a higher expression of connexin 43 in trigonal preparations than in the detrusor and also showed that trigonal spontaneous activity could be modified by blockade of gap junctions [3]. These results corroborate the findings that trigonal tissue exhibited a higher incidence of spontaneous activity than preparations from the dome. Roosen et al also show other similarities and differences in the cellular mechanism of trigonal activity compared to previous findings in detrusor myocytes and LUT interstitial cells [1,3]. Taking these findings together, the study supports a specialized function for the trigonal area during storage of urine. Of further interest are the findings that calcium channels and gap junctions are involved in trigonal spontaneous activity, since altered activities in these cellular signaling mechanims have been described for bladders from patients with DO [4,5].

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