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Pelvic Nerve and Sacral Root Activity during Bladder Distensions and Contractions

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Purpose: Electrodes implanted on suitable lower urinary tract (LUT) nerves might be used to record neural activity and provide sensory information from the bladder receptors as well as information about the activation of the detrusor and sphincter muscles. They can also be used for electrical nerve stimulation and blocking of the neural traffic. All these options of neural control could allow restoration of the normal LUT function in neuropathic patients.

Methods: Cuff electrodes were used to measure activity from different sacral roots and pelvic nerve in pigs and cats during bladder fillings/emptyings, rapid injections of fluid into the bladder and quasi-periodic reflex bladder contractions. Bladder and rectal pressures were monitored continuously.

Results: We observed slow neural activity increases during bladder filling, and sudden phasic increases during fast bladder injections, which were both mainly due to increased firing of bladder wall receptors. Withdrawal of fluid caused a decrease in recorded activity. Before and during the onset of reflex bladder contractions there was an increase in the nerve activity presumably caused by the activation of efferent parasympathetic fibers innervating the detrusor, but also by the increased activity in bladder afferents during increased bladder pressure. Decrease in the activity responsible for bladder contractions was followed by bladder relaxation.

Conclusions: Efferent and afferent information from the LUT is present in the sacral roots and pelvic nerve and can be extracted from the cuff electrode recordings from these nerves. Applications of recording include detection of the onset and duration of bladder contractions and determination of the bladder volume.