

Evaluation of an ultra-thin optical fibre pressure transducer for urethral pressure recording in female rats

Urethral pressure recording is a valuable tool for obtaining information of the mechanisms in female rat micturition. By using a model in which pressure is measured in the bladder and distal part of the urethra, information is provided about the role of the urethral sphincter in opening and closing the urethral lumen, specially in relation to stress urinary incontinence. For urethral pressure recording, the Samba 200 system (Samba Sensors AB, Västra Frölunda, Sweden), specially designed for life science research, was tested.

Methods

The micturition reflex was induced in 10 adult anesthetized (chloral hydrate and urethane) female SD rats by filling the bladder with saline. Bladder pressure (BP) (Grass Instruments) and urinary flow rate (UFR) (Transonic), measured around the distal urethra, were simultaneously recorded with urethral pressure (UP). The optic fiber pressure transducer (sensor tip OD 0.42 mm, fiber OD 0.25 mm) was inserted transurethrally with help of an applicator (PE tubing), and further connected to a Samba 200 control unit.

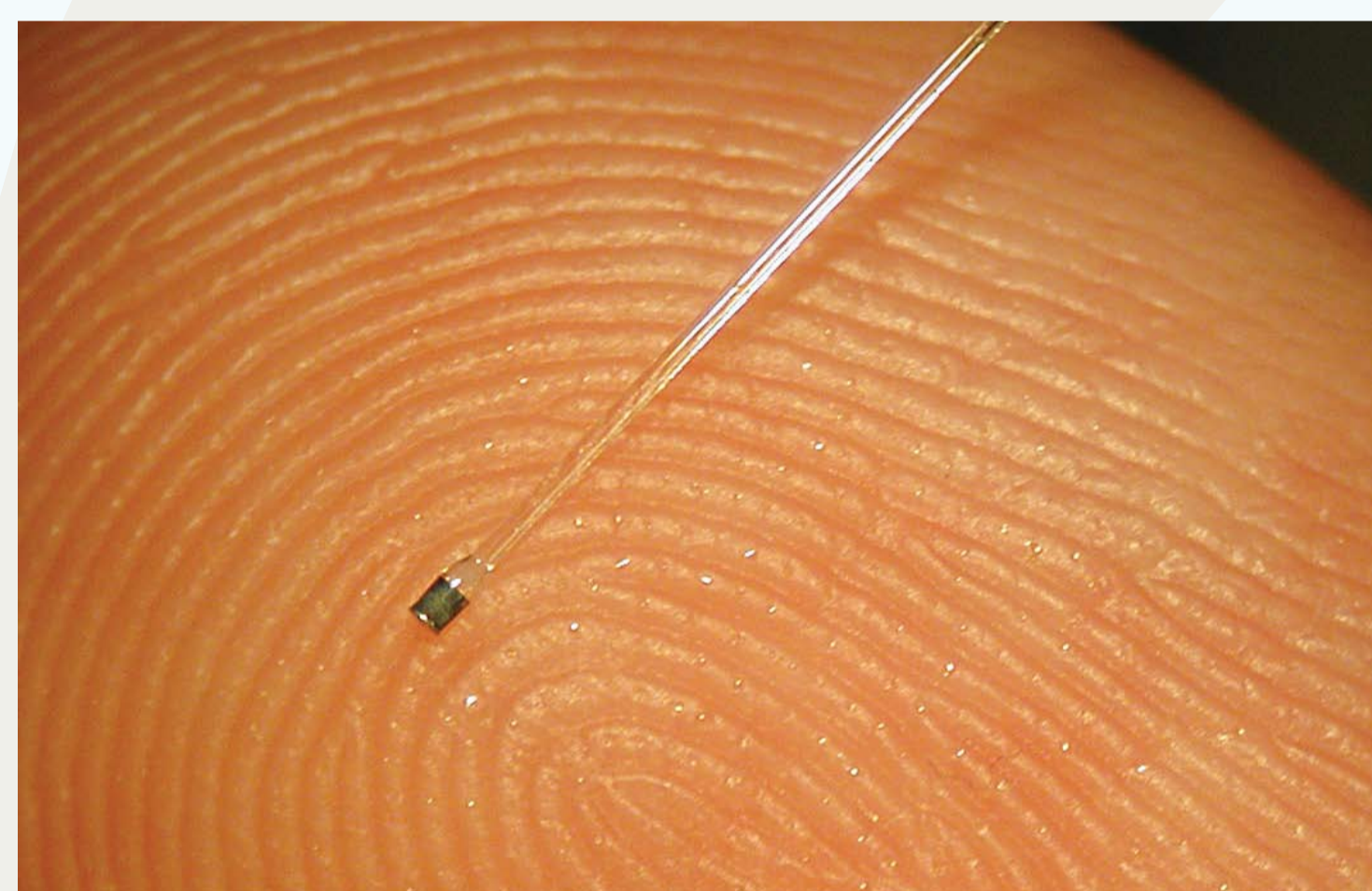


Figure 1. showing the size of the optic fiber pressure transducer.



Figure 2. The Samba control unit.

The signals were transferred to an MP100 (Biopac Systems Inc, USA) and computer. The UP results were compared to another UP recording method (Streng et al., BJU Int. 2004, 94 (1):138-42).

Conclusions

The optic fiber pressure transducer evaluated is a suitable tool for recording accurate urethral pressure changes. It is an excellent tool for measuring urethral pressure simultaneously with urinary flow rate and bladder pressure recordings in laboratory rodents.

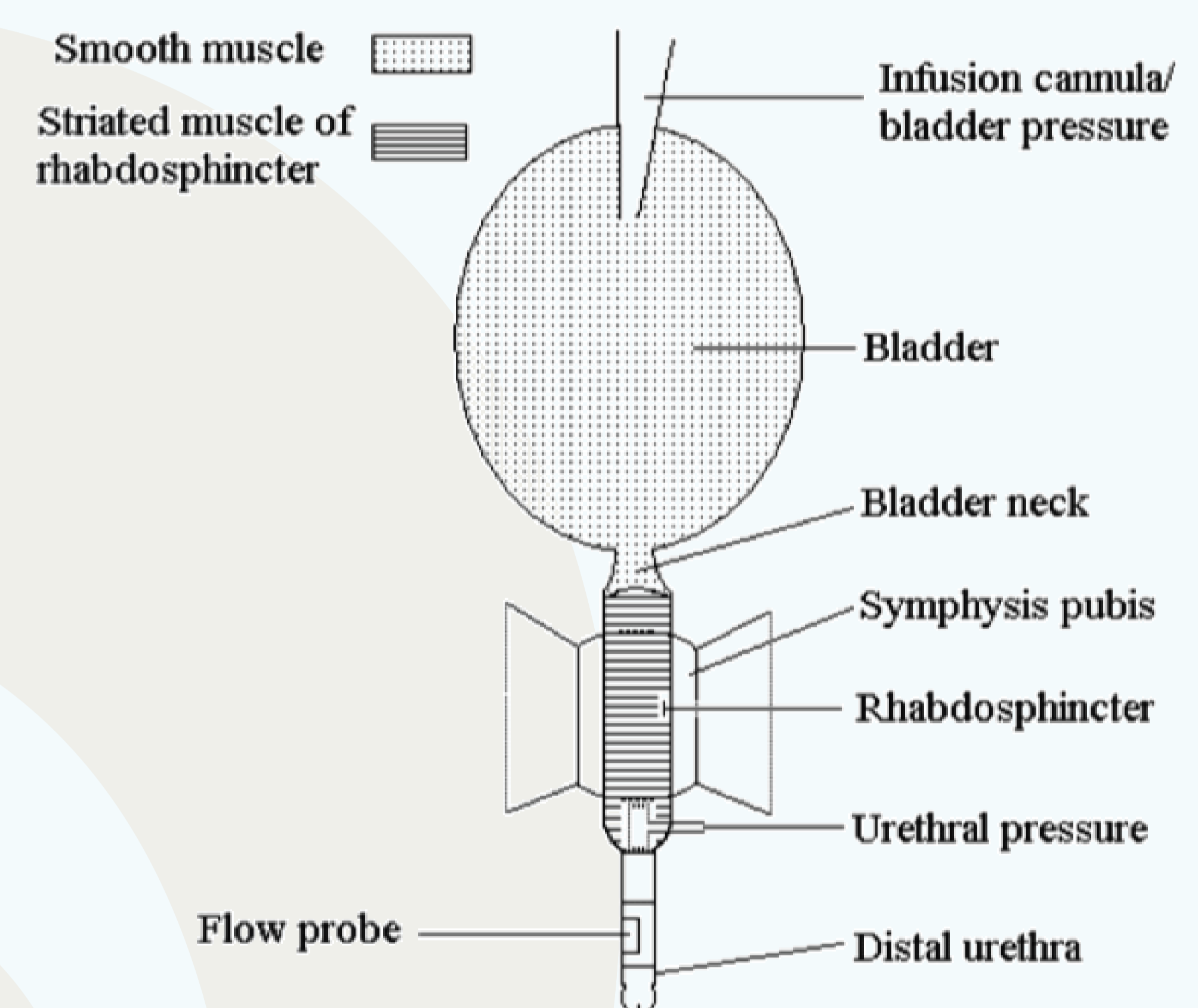


Figure 3. Schematic diagram of the structure of the lower urinary tract in rat.

Results

In the current study, pressures from the bladder and urethra (see Figure 3 above) were compared. Between micturitions, UP remained higher than BP. The oscillations seen during micturition followed the same pattern as the BP and urinary flow peaks; see Figure 4 (box). The UP values recorded during micturitions correlated with BP values (Pearson's $R=0.650$, $P < 0.001$). The optic fiber did not have an effect on urinary flow rates. No differences were seen in UP wave between the methods compared.

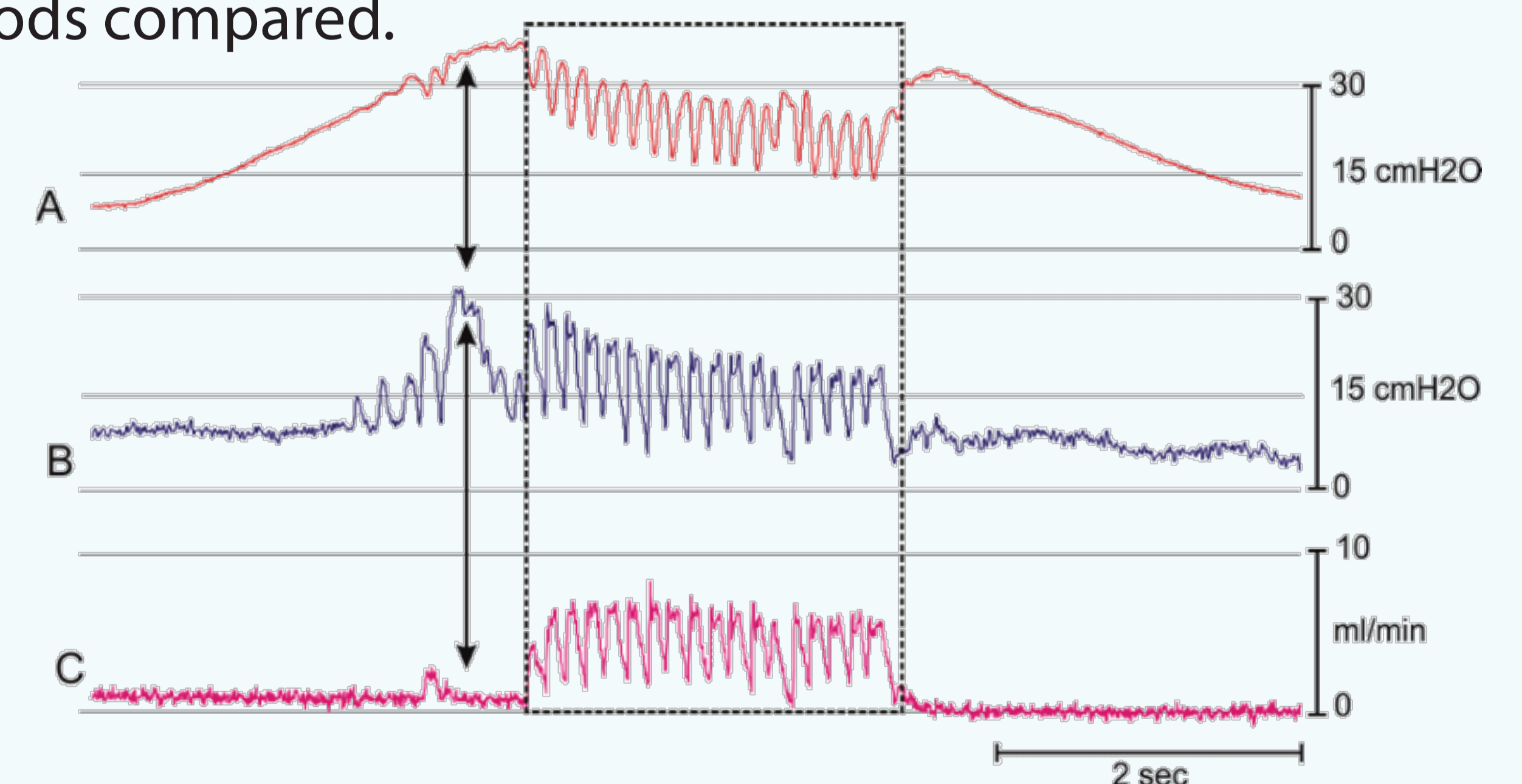


Figure 4. A) BP, B) UP, and C) UFR during one micturition cycle. Urethra contracted during interruption of voiding seen as increase of UP (arrows). UP remained at lower level during voiding (box).