

ELECTRICAL EVOKED POTENTIALS FOLLOWING LOWER URINARY TRACT STIMULATIONS

Hypothesis / aims of study

Somatosensory evoked potentials (SEPs) following electrical stimulation of the human lower urinary tract (LUT) may serve as an objective assessment of afferent LUT function. The aim of the present study was to investigate the feasibility and reliability of LUT SEPs, and to indicate the involved nerve fibres within the human LUT conduction velocities.

Study design, materials and methods

A group of healthy female subjects was recruited. Electrical stimulation was applied with a special transurethral catheter (8 Ch) to the distal and proximal urethra, trigone and bladder dome. Measurements were performed three times in each individual with an interval of 4 weeks. The impulses were applied at 0.5 Hz and at 3 Hz. SEPs were recorded at Cz referenced to Fz according to the international 10/20 EEG electrode montage. EEG raw data were filtered at 50 Hz (notch) and using a bandpass filter from 0.5 - 70 Hz. Latencies and amplitudes of the SEPs were determined and reliability was analysed with intraclass correlation coefficient (ICC).

Results

Ten healthy female volunteers (mean heights of 168 ±6 cm and mean age of 23 ±3.6 years) were included. Only following 0.5 Hz stimulations, two positive (P1 and P2) and one negative peak (N1) could be detected (table 1) while 3 Hz stimulations revealed no reliable responses.

Table 1: Mean values and standard deviation of the P1, N1, and P2 latencies and P1N1 and N1P2 amplitudes after 0.5 Hz electrical stimulation in 10 healthy female subjects measured three times. ICC = intraclass correlation coefficient.

	P1 latency [ms]	N1 latency [ms]	P1N1 amplitude [microV]	P2 latency [ms]	N1P2 amplitude [microV]
distal urethra	72.3 ±20.4	132.5 ±33.6	2.3 ±1.8	265.4 ±58	5.0 ±2.9
ICC	0.31	0.81	0.25	0.73	0.55
proximal urethra	70.3 ±23.4	133.1 ±32.1	2.8 ±1.7	240.6 ±50.1	5.6 ±3.1
ICC	0.03	0.90	0.55	0.13	0.19
trigone	69.0 ±31.7	141.9 ±51.5	2.7 ±2.2	273.0 ±79.3	4.8 ±3.2
ICC	0.14	0.83	0.37	0.37	0.37
bladder dome	71.3 ±24.8	128.8 ±23.8	3.9 ±3.5	232.9 ±39.6	6.2 ±4.7
ICC	0.26	0.88	0.27	0.23	0.55

For the 3 Hz stimulation, no reliable latencies could be determined.

Interpretation of results

SEPs applying 0.5 Hz stimulations can be reliably recorded from the human LUT from all locations (distal and proximal urethra, trigone and bladder dome) with high reliability (retest intervals of 4 weeks). The latencies observed with 0.5 Hz stimulation are in agreement with the assumption that the SEPs are conducted by A-delta fibers, which corresponds to recent animal studies, indicating A-delta fibers as the fiber type mainly involved in transmitting bladder afferent signals. In addition, the lack of reliable responses applying 3 Hz stimulations is in accordance to morphological animal studies that show no reasonable sensory innervations of the LUT by A-beta fibers.

Concluding message

Cortical SEPs following 0.5 Hz stimulation of the LUT can reliably be obtained in humans and seem mainly dependent on A-delta fibres. The application of objective SEP response complimentary to sensory testing may allow for improving the sensory assessment of LUT function and their impact on bladder dysfunction.

Disclosures

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