

NEUROPHYSIOLOGIC STUDIES OF THE SACRAL REFLEX IN WOMEN

Hypothesis / aims of study

Although clinical testing of the sacral reflex is useful in men, it is much less robust and reliable in women. In contrast, neurophysiologic measurements of the sacral reflex might be helpful also in women. In addition to latency of the shortest reproducible response, on electrical stimulation some other potentially useful parameters (i.e., sensory threshold, sacral reflex threshold, and stimulation strength to obtain the shortest latency of the reflex) could also be measured (1). Unfortunately, not only clinical assessment, but also neurophysiological measurement of the sacral reflex produces in women less satisfactory recordings than in men.

The aim of the present study was to (A) test different technical setups for stimulation and recording of the sacral reflex in women, (B) assess ability to measure the sensory threshold, the sacral reflex threshold, and the stimulation strength that produces the shortest latency in sacral reflex testing, and (C) provide reference data for these parameters.

Study design, materials and methods

All women in years 2003-2005 consecutively referred to the uro-neurophysiologic testing were considered for inclusion. Those with a history suggestive of possible focal sacral neuropathy, peripheral neuropathy or extrapyramidal disorders, with abnormalities on clinical neurologic examination, and with abnormal quantitative electromyography (EMG) of the external anal sphincter (EAS) muscle were excluded.

Neurophysiologic measurements of the sacral reflex were performed using a standard EMG system with recommended settings (filters, 10 Hz – 10 kHz). Single and double 0.1 (exceptionally 0.2 ms) long rectangular electrical pulses at frequency 1 Hz were applied to the dorsal clitoral nerves using a hand-held bipolar stimulating electrode, or custom made clip electrodes. On double pulse electrical stimulation inter-stimulus interval was always 3 ms (1). Cathode of the stimulating electrode was in contact with clitoris, and anode was 2 cm away on the labia majora. Responses were recorded by a standard concentric EMG needle electrode inserted consecutively into the left and right bulbocavernosus and the EAS muscles.

The latency of the responses, minimum stimulus intensity perceived by subjects (i.e. sensory thresholds), the minimum intensity that elicited the reproducible sacral reflex (i.e., reflex threshold), and stimulus intensity to elicit the maximal sacral reflex (i.e., stimulation strength) were recorded using single and double electrical stimulation, and detection from the left and right bulbocavernosus muscles (1).

In statistical analyses parametric methods with optimal mathematical transformations were used. The lower and upper normative (cut-off) limits were calculated as the mean \pm 2 SD's.

Results

After exclusion of subjects with possible neurologic lesion 31 women, aged 28 to 79 years (median, 53 years), with double incontinence in 9, urinary incontinence in 6, fecal incontinence in 6, sacral pain in 3, "sacral dysfunction" in 3, disturbed emptying of the bladder in 2, and constipation in 2, were studied. No significant difference in recordings obtained by bipolar, and clip stimulation electrodes were found. Turning bipolar and changing position of clip electrodes efficiently reduced the stimulus artifact. Recordings from the bulbocavernosus muscles were found to produce better traces, and were therefore systematically applied in this study. No response could be detected in 3 women unilaterally on single and in 1 on double electrical stimulation. Table 1 shows sacral reflex parameters.

Interpretation of results

The findings of the present study are in accordance with previous sacral reflex studies in women that demonstrated remarkable differences in reflex latencies between asymptomatic subjects and patients with presumably "non-neurogenic" sacral dysfunctions. Observed differences can not be explained by differences in the technical set-ups, or peripheral conduction. Similar sacral reflex prolongations in women with genital prolapse on pudendal nerve and clitoral stimulation (2), as well as normal perineal sensation, low sensory thresholds, and very strong electrical stimulation in this study (Table 1) speak against insufficient sensory input to the spinal cord as a measure for these observations.

Much more likely, observed latency differences are produced by delays in the central reflex conduction within the conus medullaris due to reduced excitation level of the spinal neurons in symptomatic women. This can be measured by the reflex threshold (as in this study) or by counting continuously firing low threshold sphincter muscle motor units during relaxation (performed in previous study (3)). Reflex thresholds found in women in this study were much higher than in men recruited by identical criteria (1). Furthermore, in patients with idiopathic fecal incontinence (mostly women) severely reduced number of continuously firing low threshold sphincter muscle motor units was demonstrated during relaxation (3). These findings also support hypothesis that critical factor in sacral reflex conduction in women with "non-neurogenic" sacral symptoms is excitation level of the spinal neurons.

Table 1. Results of clitorio-cavernosus reflex measurements in 31 women.

Parameter	Number (L / R)	Absolute values	
		Mean \pm SD	U limits*
Single electrical stimulation			
Reflex latency (ms)	29 / 27	41.24 \pm 9.62	60.6
Sensory threshold (mA)	22 / 25	6.48 \pm 2.42	13.3
Reflex threshold (mA)	20 / 22	27.43 \pm 14.93	77.7
Stimulation strength (mA)	25 / 27	73.78 \pm 49.54	240

Double electrical stimulation			
Reflex latency (ms)	23 / 25	38.23 ± 5.18	49.1
Sensory threshold (mA)	19 / 21	5.60 ± 1.91	10.7
Reflex threshold (mA)	20 / 21	16.59 ± 8.55	38.3
Stimulation strength (mA)	21 / 24	35.96 ± 15.29	83.5

Data in the first column are shown separately for the left / right side; U –upper; * - results obtained after optimal mathematical transformations aimed to reduce data skewness.

Concluding message

Comparison of sacral reflex studies performed in women with “non-neurogenic” sacral dysfunction and asymptomatic controls suggests association between reduced excitability of the spinal neurons, and “non-neurogenic” sacral dysfunction.

References

1. Neurourol Urodyn 2007; in press.
2. Zentralbl Gynakol 1994; 116(10):560-565.
3. Neurourol Urodyn 2002; 21(6):540-545.

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HUMAN SUBJECTS: This study was approved by the The National Ethics Committee of Slovenia and followed the Declaration of Helsinki Informed consent was obtained from the patients.