213

Podnar S[1]
1. University Medical Centre, Inst of Clinical Neurophysiology

THE PENILO-CAVERNOSUS REFLEX: COMPARISON OF DIFFERENT STIMULATION TECHNIQUES

Hypothesis / aims of study

In the evaluation of patients with suspected sacral peripheral nervous system lesions, apart from concentric needle electromyography (EMG), neurophysiological measurement of the sacral reflexes has been suggested (1). The aim of the present study was to compare the sensitivity of neurophysiological measurements of the penilo-cavernosus reflex elicited by single and double electrical, and mechanical stimulation. In addition, the sensitivity of combinations of different stimulation techniques was assessed. Study was performed in a group of patients with well-defined chronic cauda equina or conus medullaris lesions.

Study design, materials and methods

A group of men with clinical, electrodiagnostic, and neuro-imaging findings supportive of cauda equina or conus medullaris lesions was studied. A commercially available EMG system with recommended settings (filters, 10 Hz – 10 kHz) (1) was used. Single and double 0.1-0.5 ms long rectangular electrical pulses were applied at a frequency of 1 Hz to the dorsal penile nerves using a hand-held bipolar stimulating electrode. On double pulse electrical stimulation the inter-stimulus interval was always 3 ms, and the amplitude of the second pulse was always identical to the first. Mechanical stimulation was applied by an electromechanical hammer that switched on the time base of the EMG system. All responses were recorded by a standard concentric EMG needle electrode inserted consecutively into the left and right bulbocavernosus muscles (2). The minimal reproducible latencies of responses were compared to my previously published reference limits; 39.4, 36.0 and 35.5 ms on single electrical, double electrical and mechanical stimulation, respectively (3). Only patients with measurements performed by all three stimulation techniques, on both sides were included in statistical analyses. For each stimulation technique the sensitivity (%) of the penilo-cavernosus reflex testing was calculated separately for the left and right sides (2). In addition, the increase in sensitivity after testing perianal sensation, quantitative electromyography of the external anal sphincter (EAS) muscles, after reflex study using other two stimulation techniques, and the sensitivity using all three stimulation techniques on the same side in each individual patient were calculated.

Results

A group of 53 men, aged 17 to 82 years (median, 43 years) was included. Table 1 shows sensitivities of the electrophysiological measurement of the penilo-cavernosus reflex. The combined use of all three stimulation modalities increased the sensitivity to 82%.

Table 1. Sensitivity of neurophysiologic measurements of the penilo-cavernosus reflex separately on left and right side using different stimulation techniques.

Initial test	Sensitivity			Additional reflex studies		
				Single electrical	Double electrical	Mechanical
Perianal sensation		80%	N=24	+11%	+14%	+8%
Quantitative EAS EMG		65%	N=35	+22%	+22%	+24%
	∅	↑ LT	Total			
Single electrical	48.1%	22.1%	70.2%	N=31	+8%	+10%
Double electrical	40.4%	32.7%	73.1%	+5%	N=28	+7%
Mechanical	38.5%	34.6%	73.1%	+7%	+7%	N=28

The last 3 columns show the increase in sensitivity on performing additional reflex studies after the initial test. N – number of sides (out of 104) with normal initial study.

Interpretation of results

The present study demonstrated the similar sensitivities of neurophysiological studies of the penilo-cavernosus reflex using three different stimulation techniques (70-73%). Non-elicitable reflex responses constituted a larger proportion of abnormal findings using single electrical stimulation than using double electrical and mechanical stimulation (Table 1). In contrast, prolonged latencies of responses were more common using double electrical and mechanical stimulation. All these differences are consistent with more efficient conduction within the central part of the sacral reflex arc on double electrical and mechanical stimulation. Furthermore, all stimulation modalities also produced similar increases in sensitivity when added to initial clinical or neurophysiologic tests.

It remains open as to which stimulation modality is the most appropriate for use in daily clinical practice. I am of the opinion that double electrical stimulation offers some advantage because of the higher efficiency in eliciting responses (proving continuity of the reflex arc), and the opportunity to measure sensory and reflex thresholds (3). Single electrical stimulation is hindered by the lower frequency of elicitable responses, and mechanical stimulation by the inability to measure sensory and reflex thresholds. The sensory threshold is useful for testing the whole sensory pathway, and the reflex threshold for evaluating the excitation level of the spinal neurons constituting the central part of the sacral reflex arc (3). Unfortunately these two parameters were not measured in patients included in the present study. My previous study in control men also demonstrated much lower stimulation strength (and particularly stimulation strength/sensory threshold ratio) needed to obtain a minimal latency reflex response using double electrical compared to single electrical stimulation. This means that double electrical stimulation sufficient to elicit the minimal latency response is probably less painful than single electrical stimulation. Mechanical stimulation also has a favorable patient tolerance profile.

The present study also demonstrated that applying several stimulation techniques in the same individual does not significantly increase the sensitivity (from 70-73% to 82%). Applying several stimulation modalities is also expected to have a negative impact on the specificity of the test.

Concluding message

Although the final decision on the utility of different stimulation modalities for elicitation of the penilo-cavernous reflex will have to wait for specificity studies, based on currently available data double electrical stimulation seems the most useful.

References

1. Incontinence. Plymouth (UK); Health Publication Ltd, 2005 (675-706).
2. Neurourol Urodyn 2000; 19(5): 565-576.
3. Neurourol Urodyn 2007; in press.

FUNDING: The study was supported by the Republic of Slovenia Research Agency, Grant No. J3 7899.
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.