

A NEW METHOD TO ASSES THE PENILO-/CLITORO-ANAL REFLEX

Hypothesis / aims of study

The penilo-anal reflex (PAR) in males and clitorio-anal reflex (CAR) in females are reflex contractions of the striated anal sphincter in response to stimulation the dorsal genital nerve. The simplest method to test the reflex comprises a brisk squeeze of the glans and palpation of the anal sphincter to check for the response. However, this only provides information on the presence of the reflex. Other methods also provide the latency of the reflex. The stimulus in these methods is electrical, mechanical or magnetic while the response is examined by electromyography (EMG). Most investigators use intramuscular EMG electrodes. However, anal sphincter EMG is invasive and can be painful. In addition, determining the onset of the EMG is often difficult due to technical issues like a large stimulation artefact overlapping with the response or a low signal-to-noise-ratio of the EMG recording. In this study we investigated whether measuring anal pressure responses to genital nerve stimulation is an alternative to EMG in assessing PAR and CAR.

Study design, materials and methods

Two healthy male volunteers gave consent for the study. Two surface electrodes (Pals, 2.5 cm diameter, Axelgaard, Denmark) were placed on the dorsal side of the penis. The electrodes were connected to a current regulated stimulator (DS5, Digitimer, UK). A catheter fitted with a microtransducer (CTR-1A, Gaeltech, UK) was placed in the anal canal with the transducer at 2 cm the anal verge. The pressure signal was amplified (2300x) and low-pass filtered at 100 Hz using a custom made amplifier/filter. The output was sampled at 10 KHz and recorded at a laptop computer using a DAQ card (USB-6009, National Instruments, USA) and custom made Labview software (National Instruments, USA). The stimulation burst was sampled (10 KHz) and recorded simultaneously with the pressure signal.

The stimulus pattern consisted of a burst of 5 identical square pulses. The pulse interval and inter-pulse interval were 0.4 ms and 4 ms, respectively. In each subject the stimulus amplitude was slowly increased to determine both the sensory threshold and maximum amplitude the subject could tolerate. Next, responses were obtained by varying the stimulation amplitude in the interval between sensory threshold and maximum tolerable amplitude. Five responses were obtained at each stimulation amplitude, with 5 s separation between the stimulus bursts.

The recorded data was analysed off-line using Matlab. Latency was defined as the time between the beginning of the first stimulation pulse and the beginning of the pressure response. The onset of the pressure response was determined automatically using a windowed and weighted slope sum function (SSF) and a decision rule [1]. The SSF enhances the upslope of the pressure response and suppresses the remainder of the pressure signal. To maximize the SSF, the window was chosen approximately equal to the typical duration of the upslope of the pressure response. The onset of pressure response was determined by processing the SSF signal. The onset of each SSF pulse was established by using a threshold. The threshold was set at 0.02 cmH₂O above the maximum SSF value in the 50 ms time interval around the onset of the first stimulation pulse. Calculated results for the 5 responses were averaged.

Results

Stimulation evoked anal pressure increases were obtained in both subjects. The sensation threshold was 2.8 mA for subject 1 and 3.4 mA for subject 2. The threshold for reflex response was 4.9 and 6.0 mA, respectively. The peak anal pressure increased with increasing stimulus amplitude to a maximum of 57.2 and 121.1 cmH₂O for subject 1 and 2, respectively. An example of 5 responses evoked at 15 mA is shown in Fig.1

The latency decreased with increasing stimulation amplitude but already at 2-3 mA above reflex threshold the latency reaches a minimum which remains nearly unchanged with further increasing the stimulus amplitude. Minimum latency was 52.3 ms in subject 1 and 36.9 ms in subject 2.

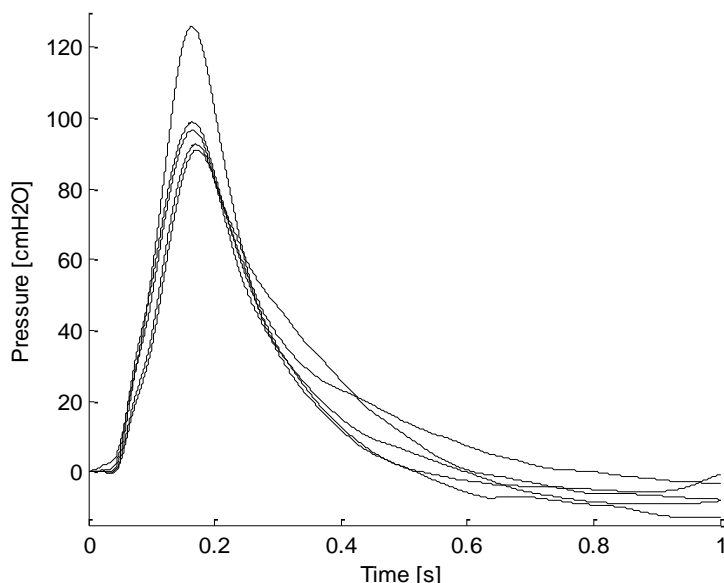


Figure 1: 5 reflex pressure responses evoked at 15 mA in subject 2. Stimulation started at $t=0$. Baseline pressure is set to zero.

Interpretation of results

PAR latencies in healthy males have been reported in the range between 24.0 and 46.8 ms. However, in those studies EMG was used to determine reflex onset. The difference between the EMG onset and the pressure increase onset is known as the electromechanical delay (EMD). The EMD of the anal sphincter during reflex activation is not known. However, the EMD of the anal sphincter in contractions evoked by transcranial magnetic stimulation of the motor cortex has been reported in the range of 13.4 to 31.9 ms.

The latencies of our study are similar to the ones reported with EMG when considering the EMD.

Concluding message

Anal pressure measurement is an attractive alternative to EMG in assessing PAR and CAR. The method is non-invasive, pain free and solves the potential problems with stimulus artifacts, low signal-to noise-ratios and cross-talk from other, nearby muscles. In addition, no special skills are needed to place pressure transducer catheter.

To compare PAR and CAR latencies, based on anal pressure, with latencies based on EMG, data on the EMD of the anal sphincter during reflex contraction should be obtained in a future study.

References

1. Zong et al, Computers in Cardiology, vol. 30, pp. 259-262, 2003

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| <i>Specify source of funding or grant</i> | The study was supported by a grant from the Danish Advanced Technology Foundation |
| <i>Is this a clinical trial?</i> | No |
| <i>What were the subjects in the study?</i> | HUMAN |
| <i>Was this study approved by an ethics committee?</i> | Yes |
| <i>Specify Name of Ethics Committee</i> | The 'videnskabsetiske' committee of region North-Jutland |
| <i>Was the Declaration of Helsinki followed?</i> | Yes |
| <i>Was informed consent obtained from the patients?</i> | Yes |