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CAN H REFLEX BE A SUITABLE SURROGATE MEASURE OF BLADDER AFFERENT ACTIVITY?

Hypothesis / aims of study

Previously, inhibition of the soleus Hoffmann reflex (H Reflex) during a urodynamic bladder filling was interpreted as an action of afferent information from the bladder (C- and Aδ), thus suggesting the use of H reflex as a surrogate measure of bladder afferent nerve activity [1-2]. However, further attention should be made in order to fully understand the mechanism of this inhibition. The aim of this study is to investigate whether H reflex changes arise only from bladder afferent nerve activity, as suggested previously, or whether they are also dependent on an increase of abdominal pressure and/or pelvic floor muscle contraction.

Study design, materials and methods

Healthy volunteers consented to one study session during which H reflex measurements were performed. The participant's soleus H reflex was monitored through the session and the participants were asked to perform the following exercises hereafter referred to as test conditions, acting as sources of changes in intra-abdominal pressure or pelvic floor muscle contraction.

- Isolated Pelvic Floor Muscle contraction (IPFM) – the participants were instructed to contract pelvic floor muscles, as described in an advisory leaflet [3]. It was emphasised to the participants that they should try to avoid contractions of abdominal and buttocks muscles.
- Maximal Pelvic Floor Muscle contraction (MPFM) – the same instructions as for the IPFM were provided. However this time the participants were asked to produce maximal contraction and were allowed to contract buttocks and/or abdominal muscles.
- Light cough (LC) – this was described as a gentle, light cough.
- Deep cough (DC) – this was described as the strongest maximal cough that the participant is able to produce.
- Valsalva Manoeuvre (VAL) – the participant was asked to pinch their nose and perform a maximal attempt to forcibly exhale against the closed nose and mouth.

A pair of stimulation electrodes were placed behind the knee at the popliteal fossa. The recording electrodes were placed on the soleus (calf muscle). Constant current stimulation pulses of one millisecond and intensity generating an M wave of around 1 mV and a clearly recognisable H reflex wave were delivered every ten seconds during the whole session. To achieve this optimal level of stimulation intensity, the stimulation electrode might have been slightly repositioned. The M wave was kept constant.

The participants were instructed about each of the test conditions and asked to empty their bladder before the electrodes were placed on the skin. The participant sat on a comfortable, adjustable chair with their knee flexed 30 degrees from full extension, and the ankle kept approximately at a right angle to the lower leg, rested against a foot support.

Each of the test conditions were performed five times, in a randomized order. Five consecutive data measurements prior to each of the test conditions were used to calculate baseline values of H reflex. The participants were warned what the next required test condition would be in advance. Five seconds before the measurement was taken, the investigator counted down the time to ensure synchronisation between the test condition and the measurement.
Each means of test condition H reflex value was compared to the baseline using Wilcoxon tests.

Results

A total of 13 participants (5 men and 8 women), mean age of 33.6 ± 11.9 (mean ± SD) were recruited. The mean H reflex amplitude across the participants decreased during the maximum pelvic floor muscle contraction and the deep cough test conditions (Table 1). *It has been noted that, in some participants, H reflex magnitude slightly increased (2/13) rather than decreased (8/13), and in some participants did not change significantly (3/13) during the test conditions. There were also some inconsistencies in each individual participant e.g. not all of the test conditions showed the same phenomenon of decreased or increased H reflex magnitude.*

Table 1 Mean H reflex amplitude in the baseline and during each of the test conditions

	H reflex amplitude pk-pk [mV]				
	IPFM	**MPFM**	**LC**	**DC**	**VAL**
Baseline					
Mean (SD)	6.2 (3.3)	6.0 (3.1)	6.1 (3.2)	6.3 (3.2)	6.2 (3.2)
Test condition					
Mean (SD)	6.2 (2.9)	4.2 (2.6)	5.1 (2.9)	4.0 (3.0)	6.5 (3.2)
Change					
Mean (SD)	-0.008 (1.4)	-1.8 (2.7)	-1.0 (1.7)	-2.3 (2.7)	0.3 (1.3)
CI 95%	-0.8 to 0.8	-3.4 to -0.2	-2.1 to 0.02	-4.0 to -0.6	-0.5 to 1.2
P value	P > 0.999	P = 0.0479	P = 0.0681	P = 0.0034	P = 0.273

Interpretation of results

Previously reported studies of H reflex changes during bladder filling have suggested a linkage between bladder afferent nerve activity and H reflex magnitude [1-2]. This study has shown that the H reflex magnitude is significantly decreased during maximum pelvic floor muscle contractions and during a deep cough. These conditions cause a significant increase in intra-abdominal pressure and/or pelvic floor muscle contraction, which are also presented during the bladder filling. Therefore, this leads to a conclusion that H reflex inhibition might not be entirely related to the increase in bladder afferent nerve activity.

Despite the best effort to explain each exercise to the participants, the inconsistency in the individual participants might also be linked to the inability of the participants to perform the tests consistently.

Concluding message

Factors such as an increase in the intra-abdominal pressure and pelvic floor muscle contractions also presented during a bladder filling should be considered before any further assumptions of connectivity between bladder afferent nerve activity and H reflex inhibition are deployed.

References

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