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INHERENT PHYSIOLOGIC MECHANISM CAUSING NEGATIVE DETRUSOR PRESSURE DURING COUGH PROVOCATION IN URODYNAMIC STUDY OBSERVED BY SIMULTANEOUS DUAL CHANNELS OF EMG

Hypothesis / aims of study

It is known that the detrusor pressure (Pdet) cannot be negative during urodynamic study theoretically.1 However, we can observe the negative Pdet during cough provocation commonly in real urodynamic study, which is regarded as the artefacts such as poor pressure transmission or rectal contraction.

The aim of this study is to observe the time differences of simultaneous changes in pressure- and electromyography (EMG)- curves during cough provocations in urodynamic study with two channels of surface EMG, in view of interaction between the muscle groups of perineal (infravesical: EMG1) and abdomen (supravesical; EMG2).

Study design, materials and methods

We recruited 22 (16 Male, 6 Female) patients, who had been referred for urodynamic study according to ICS guidelines to clarify urodynamic cause of lower urinary tract symptoms.

For urodynamic investigation, a 7 F catheter was inserted transurethrally into the bladder and a 10 F catheter was placed in the rectum. Usual EMG surface electrode was placed on the perineal area. One extra EMG channel was added to our urodynamic machine to check the bioelectric activity of rectus muscles, which was located in the supravesical position. Before starting the procedure, the transmission of channels was checked whether to be delayed.

The provocations were repeated in each patient 3 times during the same urodynamic session.

After finishing the procedure, we measured the time from some arbitrarily determined point (3 or 4 second before provocation) to starting or peak points of events through each channels during provocations after setting the time scale to 0.2 sec/cm (Fig. 2). The statistical analysis was performed using paired Student t-test to compare the time value from each channel (Sigmastat for Windows Version 3.11; $p<0.05$). To identify the starting time difference between rectus muscle and perineal muscle contraction, we subtracted the two values (EMG2-s minus EMG1-s). To identify the starting time difference between intravesical and intraabdominal pressure spikes, we subtracted the two values (Pves-s minus Pabd-s).

 # Abbreviation: 1-perineal, 2-rectus, s-starting time, p-peak time

Results

6 patients were excluded due to the incompleteness of EMG data. Thus we investigated total 48 cough provocations in 16 patients. There was no difference between EMG1 and Pabd1, EMG2 and Pves2. There was a difference between EMG1-s and EMG2-s, EMG1-p and EMG2-p, Pabd1-p and Pves2-p, except Pabd1-s and Pves2-s (Table1).

Table 1. Comparison and statistical significance of the time difference between the events from each channel.

	Value	EMG1-s	EMG1-p	**EMG2-s**	EMG2-p	Pabd1-s	Pabd1-p	**Pves2-s**	Pves2-p
EMG1-s	3.43±0.04		<0.001	0.033	<0.001	0.863	<0.001	0.88	<0.001
EMG1-p	3.92±0.08			<0.001	0.002	<0.001	<0.001	<0.001	<0.001
EMG2-s	3.52±0.06				<0.001	0.16	<0.001	0.111	<0.001
EMG2-p	4.00±0.08					<0.001	<0.001	<0.001	<0.001
Pabd1-s	3.51±0.07						<0.001	0.571	<0.001
Pabd1-p	4.12±0.08							<0.001	0.002
Pves2-s	3.52±0.07								<0.001
Pves2-p	4.14±0.08								

There showed three types of values of EMG1-s minus EMG2-s showed (negative -24; zero-14, positive-10), and the values of Pves2-s minus Pabd1-s (negative -20; zero-12, positive-16) (Fig. 1). This means that 70 % (34/48) among total cough provocations showed the time dismatch between rectus and perineal muscle contraction during cough provocation. In detrusor pressure, 42 % (20/48) showed the real negative pressure due to the ahead contraction of perineal muscle during cough provocation.

This dismatch happened in 12 patients and showed within-person variability.

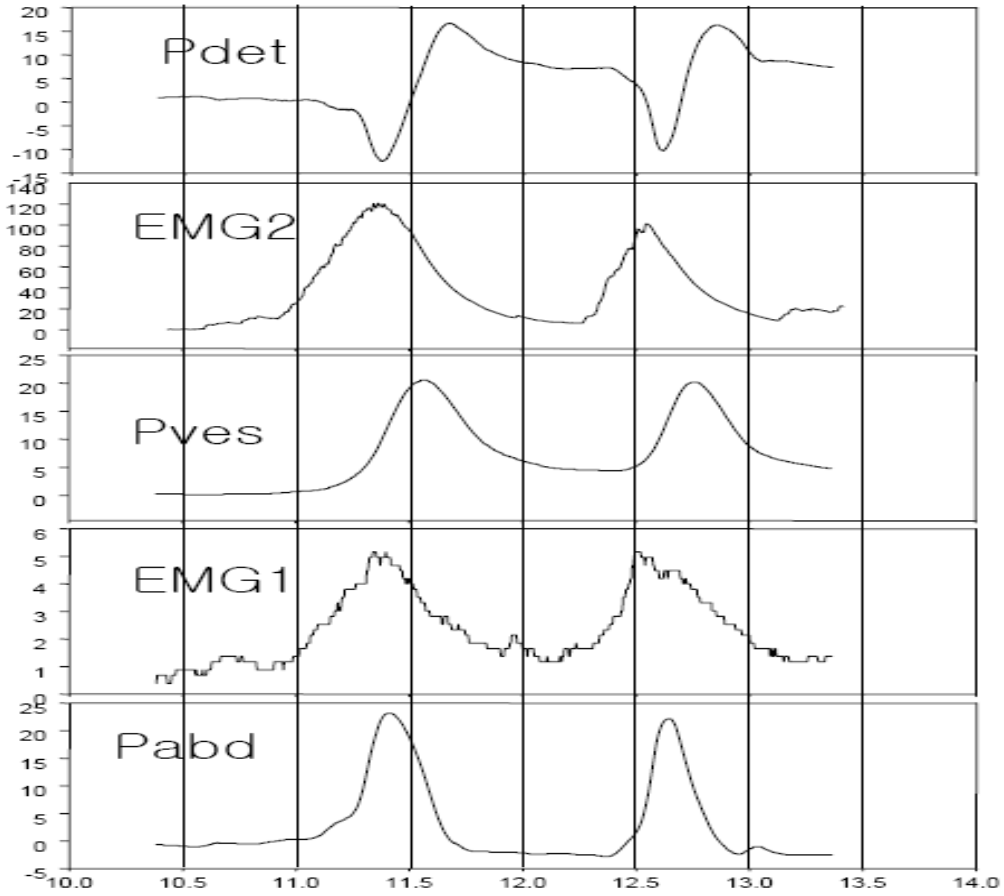

Fig.1. The representative Cystogram with dual channels of EMG. This shows that the negative pressure during cough provocation is caused by the ahead contraction of sphincter followed by the rectus muscle.

Interpretation of results

Patients showed three different types of mechanisms during cough provocation, ahead contraction of rectus muscle followed by that of perineal muscle, ahead contraction of perineal muscle followed by that of rectus muscle, and simultaneous contraction of those two muscles, which is associated with inter and intra-person variability.

Concluding message

This dismatched contraction between rectus and perineal muscles, especially an ahead contraction of perineal muscles could cause the negative detrusor pressure during cough provocation of urodynamic study. Thus, our study suggest that this negative pressure during urodynamic study is inherent physiologic reaction, not an artefact.

References

1. Neurourol Urodyn 2002, 21:261-274

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Is this a clinical trial?	**Yes**
Is this study registered in a public clinical trials registry?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**Inha University Hospital Ethic Committee, Registration Number 2009-377**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**No**