

PERINEAL SURFACE ELECTROMYOGRAPHY TO MEASURE URETHRAL AND PELVIC FLOOR ACTIVITY DOES NOT TYPICALLY DEMONSTRATE EXPECTED RELAXATION DURING NORMAL VOIDING

Hypothesis / aims of study

Normal stress incontinent female subjects without neurological disorders and/or urinary retention should demonstrate relaxation of the pelvic floor and urethra during voiding. If the surface perineal electromyography (EMG) accurately and reliably measures pelvic floor and urethral activity, then subjects with a continuous flow, and who do not strain, should demonstrate EMG activity that is absent or less than the activity measured during filling or just prior to voiding. The aim of this study was to determine if quantitative EMG measures acquired from surface perineal electrode during voiding were less than filling and prevoid baseline measures.

Study design, materials and methods

This study is a tertiary analysis of data from a large multicenter stress incontinence surgical trial of 655 women who underwent preoperative filling cystometry and pressure-flow studies using a standardized protocol and similar digital capturing urodynamic equipment. Perineal surface electrodes were placed bilaterally on the perineum at the time of rectal catheter insertion prior to filling cystometry to assess for urethral sphincter relaxation. Patients moved from the standing to the sitting position between filling cystometry and pressure-flow studies. Quantitative EMG values were captured electronically at the discrete moment of each standard annotated time-point during fill and flow. We considered flow to be interrupted if more than 10% of the volume was voided after flow decreased to zero at any point during void. We defined straining as abdominal pressure during voiding more than 10cm H₂O greater than abdominal pressure at PFS baseline.[1]

Postoperative voiding dysfunction was defined by the need for surgical revision to facilitate bladder emptying or the use of any type of catheter after the 6 week postoperative visit.[2] Fisher's exact tests were used to compare the EMG patterns in the subjects with postoperative voiding dysfunction to the subjects without postoperative voiding dysfunction. Fill and flow parameters were not normally distributed, so median (25th percentile, 75th percentile) are presented.

Results

Based on the criteria for validity and plausibility previously published,[3] including signal legibility, protocol adherence and assessment of pressure measurements, 386 of the 655 preoperative UDS signals were deemed valid. 372 were available for this review (14 were unavailable, incomplete, or not performed on our standardized digital equipment). 259 subjects had annotations and digitally captured quantifiable EMG activity for all 8 major annotated events during fill and flow (Table 1).

141 subjects had annotations and digitally captured quantifiable EMG activity for 6 comprehensive pressure-flow annotations, which also included PFS baseline and post-void cough annotations. To assess whether the change in position from standing to sitting could have introduced artifact that produced the increase in EMG amplitudes during pressure-flow studies compared to filling cystometry, we performed a subsequent analysis of EMG signal amplitude in these 141 subjects who had all 6 comprehensive pressure-flow annotations (Table 2).

154 subjects had EMG measures at fill (MCC) and flow (Qmax) and did not have interruption or straining during flow. 10 of these subjects met the definition of postoperative voiding dysfunction. There was no significant difference in the rate of EMG activity being higher at Qmax than MCC in the groups with and without voiding dysfunction ($p = 0.32$).

Table 1 demonstrates the median (25th percentile, 75th percentile) in microvolts of EMG signal amplitude for subjects that had all 8 parameters measured.

	Fill				Flow			
	CMG Baseline	First Desire	Strong Desire	MCC	Pre-void cough	Uroflow Start	Qmax	Uroflow Stop
All subjects (n = 259)	57 (0,166)	86 (21,192)	74 (13,225)	87 (15,257)	500 (155,1376)	263 (62,1151)	265 (41,934)	211 (56,892)

Non-interrupted, non-straining flow (n = 128)	68 (0,171)	100 (26,209)	108 (16,242)	108 (24,301)	722 (206,1388)	344 (78,1315)	306 (48,1152)	218 (71,874)
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Table 2 demonstrates the median (25th percentile, 75th percentile) in microvolts of EMG signal amplitude for subjects that had all 6 PFS parameters measured.

	Pre-void cough	PFS baseline	Uroflow Start	Qmax	Uroflow Stop	Post-void cough
All subjects (n=141)	637 (136,1388)	80 (14,303)	358 (62,1348)	308 (61,1192)	252 (63,884)	975 (317,1393)
Non-interrupted, non-straining flow (N=70)	960 (199,1393)	85 (32,316)	427 (63,1388)	311 (42,1279)	248 (63,910)	1159 (344,1392)

Interpretation of results

In neurologically normal women with stress-predominant urinary incontinence undergoing preoperative urodynamic testing, EMG activity measured by perineal surface electrodes is typically higher during the flow study than during the filling study. This result cannot be explained by position changes between fill and flow because PFS baseline measures of EMG activity (which is measured after the position change) remained low. Increased EMG activity during flow compared to fill does not predict postoperative voiding dysfunction. We suspect that surface perineal electrodes are actually recording activity from larger muscles or other artifacts and are not accurately recording pelvic floor or urethral muscle activity which should be relaxed during the flow study.

We did not standardize the surface EMG patches to any specific company or specify the exact placement of the EMG patches, but we do not think this non-standardization limits our results or conclusions because each patient serves as their own control for comparative values obtained during the fill and flow.

Concluding message

EMG activity measured by surface perineal patches does not measure the expected pelvic floor and urethral sphincter relaxation during voiding. Our data question the value of this measuring instrument and technique in this group of stress incontinent patients at low risk of voiding dysfunction.

References

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Is this a clinical trial?

Yes

Is this study registered in a public clinical trials registry?

Yes

Specify Name of Public Registry, Registration Number

ClinicalTrials.gov number NCT00064662

Is this a Randomised Controlled Trial (RCT)?

Yes

What were the subjects in the study?

HUMAN

Was this study approved by an ethics committee?

Yes

Specify Name of Ethics Committee

All study procedures were approved by the institutional review board of each participating clinical center and the Biostatistical Coordinating Center

Was the Declaration of Helsinki followed?

Yes

Was informed consent obtained from the patients?

Yes