246

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NORMATIVE DATA FOR INTERFERENCE PATTERN ANALYSIS OF THE EXTERNAL ANAL SPHINCTER

Hypothesis / aims of study

Quantitative electromyography (QEMG) can detect neurophysiologic changes consistent with nerve injury. Because the pelvic muscles contract tonically, they are unlike other skeletal muscles and techniques for obtaining and analyzing data differ. One of the QEMG techniques, Interference Pattern analysis, is very promising due to its potential ease of use and lack of operator-induced bias.

Using the Interference Pattern analysis algorithm, we can assess the severity of denervation and reinnervation as well as estimate the sizes of the motor units contributing to moderate and maximum forces of muscle contraction. Among other findings, following nerve injury and repair, fewer, but larger motor units will be noted during EMG. This leads to fewer turns of the electromyographic signal, with overall larger amplitude during each turn.

Nerve injury can be seen after routine childbirth. Previous investigators have reported on nulliparous as well as parous women to serve as comparative controls.[1-3] In order to more accurately assess the acute neurophysiologic effects of childbirth on the anal sphincter, we wanted to establish normative data for quantitative Interference Pattern analysis in a group of healthy nulliparous women.

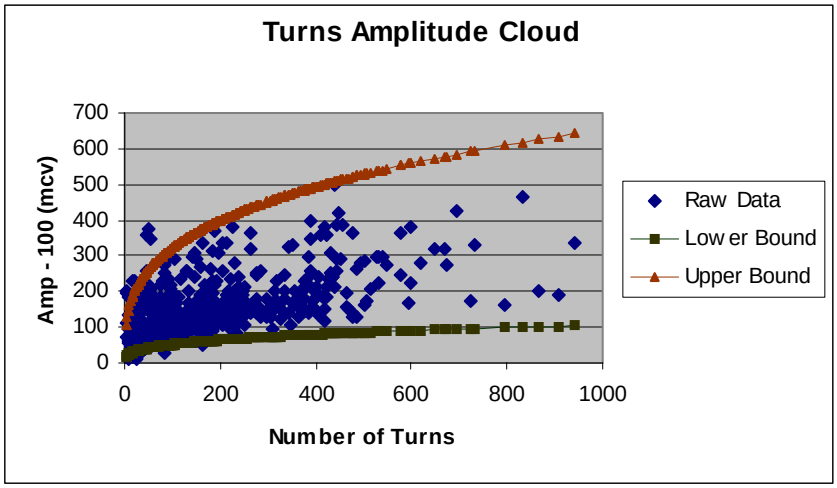
Study design, materials and methods

On 28 nulliparous women, we performed quantitative concentric needle EMG using a Medtronic Keypoint EMG machine equipped with Interference Pattern analysis software. Filters were set at 5 Hz and 10 kHz. In a manner similar to previously published reports, we used a 37 mm concentric needle to sample 5 discrete sites from the right side and then the left side of the external anal sphincter from each subject. Subjects were asked to incrementally increase voluntary contraction to maximum. At each sampling site, a 500 ms epoch was analyzed for the following EMG parameters: number of turns/second; amplitude/turn; percent activity; envelope; number of short segments. Those rare data points that were recorded as a value of “zero” (i.e. an epoch of little or no crisp EMG activity) were discarded. For pooled data, means and standard deviations were calculated. In order to create “clouds” of data to be used for future individual subject comparisons, the data were first log transformed. Linear regression lines (with 95% confidence intervals) were calculated from the log transformed variables “turns/second” and “amplitude/turn”. These confidence intervals were then transformed back into the original parameters to yield scatter plots with confidence curves.

Results

The mean age was 27 (SD = 7.6) years, the mean body mass index was 24.5 (SD = 7.0) and 96% were Caucasian. None of the women had pelvic floor disorders. The quantitative interference pattern parameters are shown in the table.

IP Parameter	Mean (SD)
Turns (N/s)	203 (174)
Amplitude (mcv/turn)	266 (87)
Activity (%)	8.3 (9.4)
NSS (N)	111 (123)
Envelope (mcv)	606 (451)



This scatter plot of 490 data points represents the "cloud" turns versus amplitude (less 100 mcv). The 2 bounding curves represent the 95% confidence interval calculated from the log-transformed data and linear regression.

Interpretation of results

The IP parameters reported here are similar to one previous study[3] that separately reported them for nulliparous controls, and quite different from a second.[1] Both amplitude and turns increase as the force of contraction increases as more (and larger) motor units are recruited (Henneman principle). This technique does not measure nor require a standardized force of muscular contraction. Therefore, the extent to which the muscles were contracted in each of the studies could explain the observed differences of the parameter values.

"Clouds analysis" can be used irrespective of the force of muscle contraction. Using the same method to generate shape of the IP "cloud", we find that our cloud has different regression parameters than one of the previous reports,[3] and a slightly different shape than the other.[2]

Concluding message

Understanding how pelvic nerve injury contributes to pelvic floor disorders, and how childbirth may cause these injuries is vitally important. Investigation of nerve injury is limited by variations in normative data from international programs studying pelvic floor electrophysiology. Standardization of techniques is necessary to ensure reproducibility of results and advance the scientific inquiry of pelvic floor nerve injury.

References

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