

CHANGES OF EXTERNAL ANAL SPHINCTER INNERVATION PATTERN AFTER EPISIOTOMY EVALUATED WITH MULTICHANNEL EMG. (RESULTS OF THE MULTICENTER STUDY TASI-2)

Hypothesis / aims of study

Several studies confirmed that there is a significant correlation between anal sphincter damage during vaginal birth and subsequent development of anal incontinence in women. It is possible that also the damage of the nerves innervating anal sphincter can cause anal incontinence. Mediolateral episiotomy is usually performed on the right side for convenience in cutting and suturing by right handed operators. Knowledge of the location of the innervation zones (IZs) could allow choosing the side for performing episiotomy. Avoiding the incision in innervation regions during episiotomy would presumably reduce the incidence of anal incontinence. The aim of the TASI-2 project (Technologies for Anal Sphincter analysis and Incontinence) was to evaluate the effect of delivery related trauma on the external anal sphincter (EAS) muscle with surface electromyography (EMG).

Study design, materials and methods

Five hundred eleven women participated to the study. Nine clinical partners from five European Countries (Germany, Italy, Latvia, Slovenia, Ukraine) were involved in this multicenter study coordinated by the Laboratory for Engineering of the Neuromuscular System (LISiN). EMG measurements were performed with a cylindrical disposable rectal probe including 16 silver electrodes equally spaced along the circumference. The measurements were performed at the 28th - 34th gestational week and 6 - 8 weeks after delivery. 318 women returned to the hospital to conclude the experimental protocol.

The subjects were asked to perform three maximal voluntary contractions (MVC) of the EAS for 10s and the signals were acquired both during rest and during MVC. The IZs of single motor units were identified by means of a recently developed surface EMG decomposition algorithm.

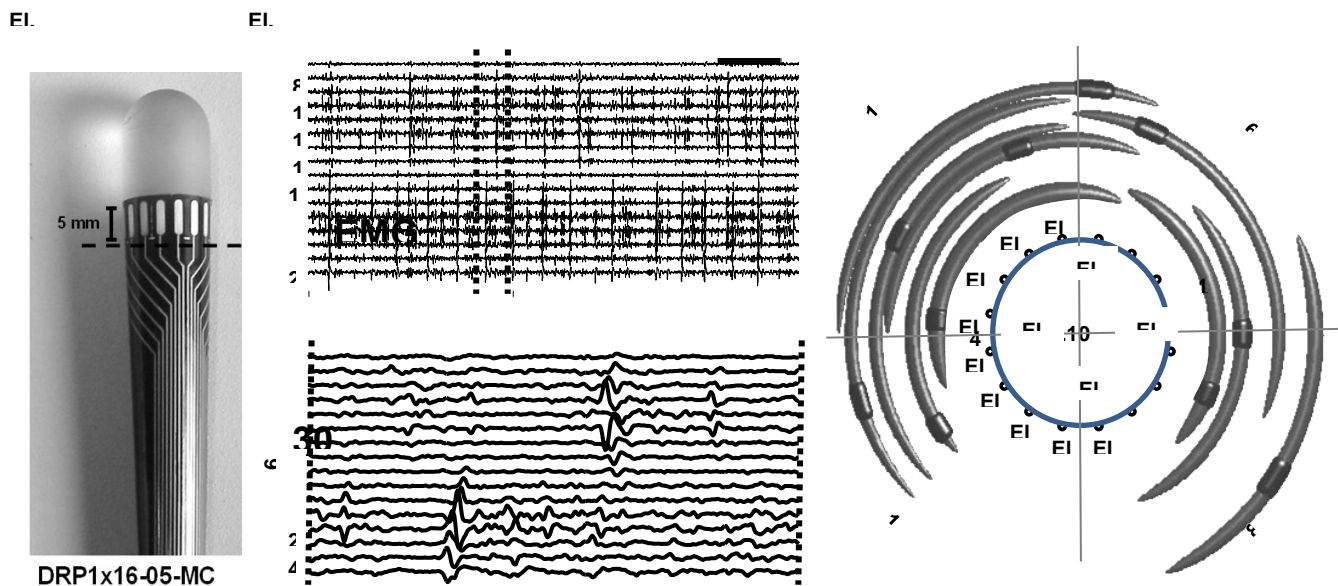


Figure 1. a) picture of the disposable rectal probe DRP1x16-10-MC probe shown in Figure 1a. The probe is a plastic support of 14 mm diameter holding an electric circuit printed on a thin plastic film with 16 electrodes equally spaced electrodes. b) example of sEMG signals detected from the external anal sphincter of a subject during rest. It is possible to observe action potentials of motor unit with different innervation zones. c) representation of the distribution of motor units (curved cylinders) and innervation zones (dark spots) in the external anal sphincter and identified by the decomposition algorithm. The distance of the motor units represented from the surface of the probe is different for each motor unit for graphical reasons.

The gynaecologists involved in the study were asked to draw a picture of the episiotomy in a standard form.

Results

All episiotomies were performed on right side, except three on the left and three in the midline. In the 82 women who underwent mediolateral right episiotomy, a statistically significant reduction of the number of IZs was observed, after delivery, in the right

ventral quadrant, corresponding to the side of episiotomy, while women who had Caesarean section did not present any significant change in the innervation pattern.

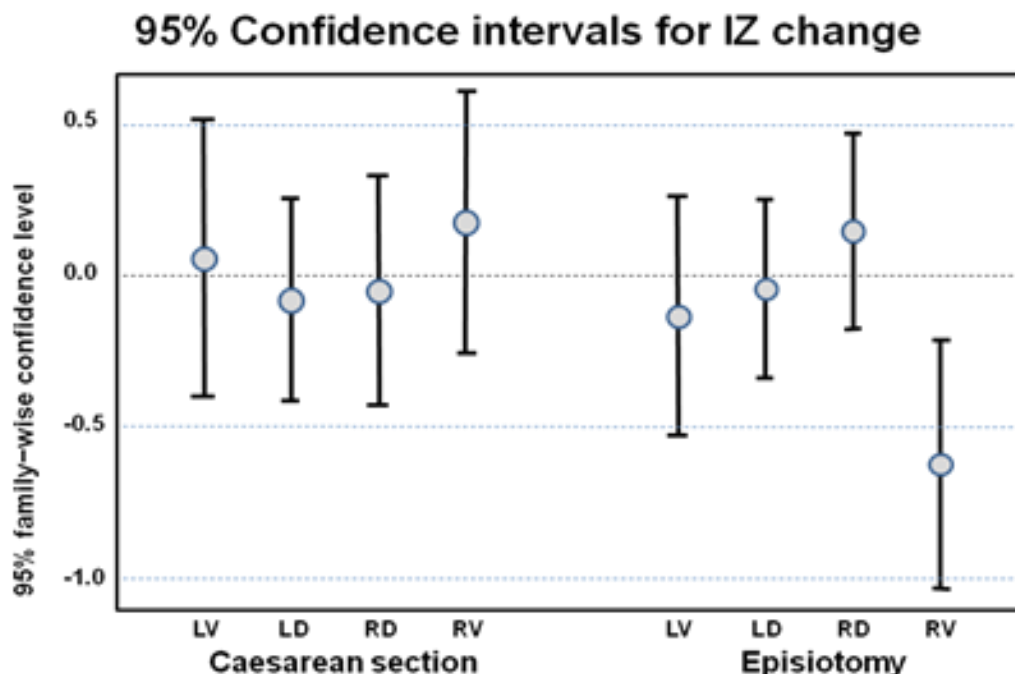


Figure 2. 95% confidence intervals of the change of innervation zones of the patients grouped according to the factors: type of delivery (Caesarean section, Episiotomy) and quadrant (LV, LD, RD, RV). The only confidence interval which does not include the zero is the right ventral quadrant of women which had episiotomy.

Interpretation of results

The results of the present study showed that the episiotomy reduces the number of IZs in correspondence to the side where is performed, thus with the proposed technique the clinicians could have a fast and reliable test which would provide indications about sphincter innervation pattern of the women before the day of delivery. Knowing the innervation zone pattern could help the obstetricians to choose which side would be preferable for performing episiotomy if this intervention will be deemed necessary at the time of delivery.

Concluding message

The superficial anal EMG is shown to be a good diagnostic tool to identify IZ. Together with clinical recognizing of the anal sphincter damage at the time of delivery, it could lower the incidence of anal sphincter damage at the time of delivery and subsequent anal incontinence in women.

References

1. Wheeler TL, Richter HE. Delivery method, anal sphincter tears and fecal incontinence: new information on a persistent problem. *Curr Opin Obstet Gynecol.* 2007 Oct;19(5):474-9.
2. Enck P, Franz H, Davico E, Mastrangelo F, Mesin L, Merletti R. "Repeatability of innervation zone identification in the external anal sphincter muscle". *Neurourol Urodyn.* 2010 Mar;29(3):449-57.
3. Merletti R, Bottin A, Cescon C, Farina D, Mesin L, Gazzoni M, Martina S, Pozzo M, Rainoldi A, and Enck P, "Multichannel surface emg for the non-invasive assessment of the anal sphincter muscle," *Digestion*, 2004, 69:112-122,

Disclosures

Funding: This work was sponsored by Projects TASI (Else Kroner-Fresenius-Stiftung, Compagnia di San Paolo), and TIFNI (Regione Piemonte, Italy). **Clinical Trial:** Yes **Public Registry:** No **RCT:** No **Subjects:** HUMAN **Ethics Committee:** Ethical Committees of: Riga Stradins University, Ljubljana University Hospital, University of Cagliari, Hospital of Como-Cantù, Charité Hospital Berlin. **Helsinki:** Yes **Informed Consent:** Yes