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THE COMPOUND MUSCLE ACTION POTENTIAL OF THE EXTERNAL ANAL SPHINCTER.

Hypothesis / aims of study

Pudendal nerve terminal motor latency (PNTML) is currently used to assess the distal innervation of the external anal sphincter in the investigation of faecal incontinence. A prolonged latency signifies pudendal nerve damage (1); however PNTML is insensitive to the progressive denervation of the external anal sphincter. The compound muscle action potential (CMAP) is a measure of the muscle response to pudendal nerve stimulation. CMAP represents the total number of muscle fibres supplied by the nerve and may be a more sensitive measurement of the denervation of the external anal sphincter. In this study we aim to correlate CMAP with age, parity, anorectal manometry, Vaizey score, and the Manchester Health Questionnaire (MHQ). We compare women with faecal incontinence against women with normal bowel control. It is hypothesised that the CMAP of the external anal sphincter will be reduced in women with reduced anal sphincter function.

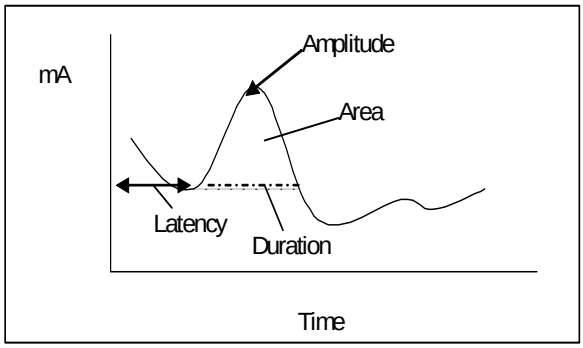
Study design, materials and methods

We prospectively studied women attending for investigations for faecal incontinence and women attending the hospital with normal bowel control. The severity of the faecal incontinence was assessed using the Vaizey score and the MHQ.

Anorectal manometry was performed using a 6mm water-filled microballoon. Endoanal ultrasound scan was performed and the structure of the anal sphincters was assessed.

CMAP was performed using a Medtronic Keypoint 2 Electromyography machine. A finger-like device was inserted intra-rectally and manipulated externally. The electrode at the tip of the device delivered a supramaximal 0.1ms rectangular pulse at a rate of one per second to the pudendal nerve. A pair of electrodes on the shaft of the device detected the response of the external anal sphincter. This was performed on the left and the right side. The muscle response was analysed for latency, amplitude, area and duration (Figure 1).

Figure 1. Response of the external anal sphincter to pudendal nerve stimulation.



Results

79 women with faecal incontinence (mean age 52 years) and 35 women with normal bowel control (mean age 48 years) were studied.

In the faecal incontinent group CMAP was measurable in 63 out of 79 women on the left side and 74 out of 79 women on the right side. The median number of vaginal deliveries was 2 and the median Vaizey Score was 14.5.

There was no significant correlation between CMAP and MSP. However, Amplitude ($p<0.05$) and Area ($p<0.01$) on the left side negatively correlated with the Vaizey Score. Area ($p<0.05$)

on the left negatively correlated with Age. Duration ($p<0.05$) on the left was reduced in women with increased number of vaginal deliveries. The nulliparous women (n=11) were compared to women who have had vaginal deliveries (n=76). The Mann-Whitney U test showed that there was a significant difference in Duration ($p<0.05$) on the left and right side.
In the women with normal bowel control CMAP was measurable in 34 out of 35 women on the left side and 33 out of 35 women on the right side. The median number of vaginal deliveries was 2 and the median Vaizey Score was 0. There was a positive correlation between Area ($p<0.05$) on the left side and MSP. Area ($p<0.05$) on the left was reduced in women with an increased number of vaginal deliveries. The nulliparous women (n=6) were compared to women who have had vaginal deliveries (n=28). The Mann-Whitney U test showed that there was a significant difference in Amplitude ($p<0.01$) and Area ($p<0.01$) on the left side.
There was no significant difference in CMAP between women with faecal incontinence and women with normal bowel control.

Interpretation of results

The results show that CMAP cannot distinguish between women with faecal incontinence and women with normal bowel control. However, women with severe incontinence have been shown to have a reduced CMAP on the left, measured by Amplitude and Area.
In women with normal bowel control there is a significant positive correlation between maximum squeeze pressure and Area on the left. Thus, with better muscle function, measured by a greater maximum squeeze pressure, the area under the curve of the CMAP is increased.
Vaginal delivery can cause compression or stretching of the pudendal nerve, this can lead to delayed conduction of the nerve and denervation of the external anal sphincter in postnatal women (2). This study has found a significant difference in CMAP between nulliparous women and women who have had vaginal deliveries. In nulliparous women with normal bowel control the Area and Amplitude on the left side is significantly greater than those women who have undergone vaginal delivery.
The CMAP measurements on the right side do not show any significant correlations, this may reflect the difficulties in performing PNTML and the reliability of the test.

Concluding message

The correlation between muscle function and CMAP in women with normal bowel control and the relationship of CMAP with number of vaginal deliveries is encouraging. There is a possibility that CMAP will improve our understanding of denervation of the external anal sphincter, however further work is needed in order to refine the test.

References

1. Slowed conduction in the pudendal nerves in idiopathic (neurogenic) faecal incontinence. Dis Colon Rectum 1989; 71:614-616.
2. Injury to innervation of the pelvic floor sphincter musculature in childbirth. Lancet 1984; Sept: 546-550.