Original article

Neurophysiological modification of pelvic floor parameters during sacral nerve neuromodulation

ELENA ANDRETTA [(1)] - EDOARDO OSTARDO [(2)] - CRISTINA ZULIANI [(3)]
LAURA DE BIAGGI [(4)] - TIZIANA DE SANTO [(4)]

(1) Department of Urology - General Hospital Dolo (Venice)
(2) Department of Urology - City Hospital S.ta Maria degli Angeli Pordenone
(3) Department of Neurology - General Hospital Mirano (Venice)
(4) Medtronic Italia

Abstract: Significant changes in function of perineal innervation have been observed in 27 patients treated with sacral nerve neuromodulation. Using electrodiagnostic techniques, performed with an Interstim implantable pulse generator switched on and off, we observed that sacral nerve neuromodulation increases the amplitude of voluntary contraction of the urethral sphincter, decreases the duration of motor unit potentials at rest in both sphincters and reduces latencies of pudendal nerve terminal motor bilaterally. These results suggest a greater recruitment of pelvic muscular fibers and a better synchronization of the fibers firing. Sacral nerve neuromodulation probably increases the motor conduction velocity of pudendal nerves and so suppresses integration between peripheral innervation and spinal cord.

Key words: Sacral nerve stimulation; Pelvic floor; IPG; Perineal innervation.

INTRODUCTION

Sacral neuromodulation (SNM) works on the neural reflexes that influence the bladder, rectum and pelvic floor. Since the initial experience of the nineteen eighties SNM has been widely used to treat both bladder and rectal dysfunction but the exact mechanism of action is still unknown. The aim of this study was to investigate the functional modifications of peripheral perineal innervation using SNM.

MATERIALS AND METHODS

The study involved 27 patients (3 males, 24 females) affected by urinary incontinence (44%), urinary retention (30%), obstructed defecation (18%), fecal incontinence (4%), and chronic pelvic pain (4%). The average treatment time – using Interstim implantable pulse generator (IPG) – was 56 months (range 19-88) and all patients experienced full remission of symptoms with the electrical parameters individually programmed. The following tests were performed: 1) Electromyography (EMG) of the external anal sphincter (EAS); 2) EMG of the urethral sphincter (US) at rest, in voluntary contraction and in reflex contraction; 3) Somatosensory evoked potentials (SEPs); 4) Pudendal nerve terminal motor latency (PNTML). The tests were performed with IPG on and off and data were statistically analyzed using the Student's t-test.

RESULTS

We observed the following significant changes: *EMG* 1) A rise in amplitude of motor unit potentials (MUPs) during maximal contraction in the US with IPG on - average 31.5 ± 24.4 uV compared to IPG off average 25.5 ± 25.8 uV - ($p = 0.058$). 2) Duration of MUPs at resting was decreased with IGP switched on and this decrease was greater for US - average 4.2 ± 0.9 msec compared to IPG off average 4.6 ± 1.1 msec ($p = 0.010$) - as well as for EAS - average 3.4. ± 0.9 ms compared to IPG off average 4.2 ± 1.2 ms ($p = 0.049$). (Figs. 1, 2, 3) *PNTML*. After the IPG was turned on, examination of PNTML revealed a decrease in latencies on both sides. The data collected were: average 1.8 ± 0.36 msec compared to IPG off average 1.9 ± 0.37 msec ($p = 0.036$) on stimulated side and average 1.85 ± 0.6 msec compared to IPG off average 2.1 ± 0.9 msec ($p = 0.024$) on the unstimulated side (Fig. 4).

The remaining examinations and parameters were unchanged.

DISCUSSION

Some Authors [1, 2, 3] suggested the use of electrodiagnostic techniques in order to better or to reprogram SNM but nobody has reported improve studies about the effects of SNM on perineal responses.

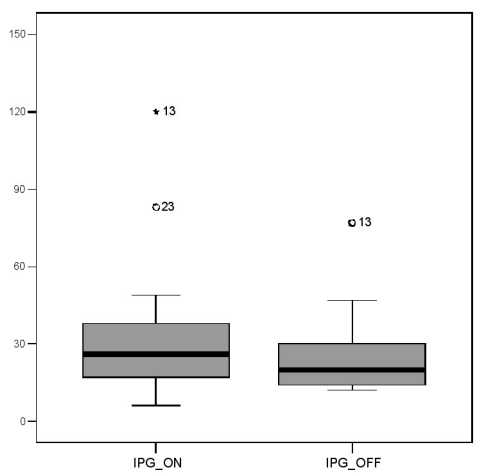

Fig. 1. – Amplitude in vulontary contraction in the US.

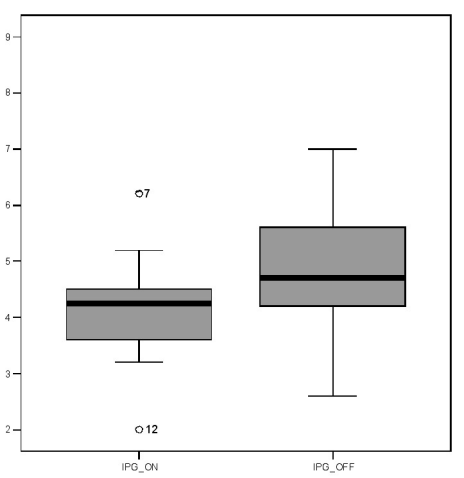

Fig. 2. – Duration of MUP at resting in the US.

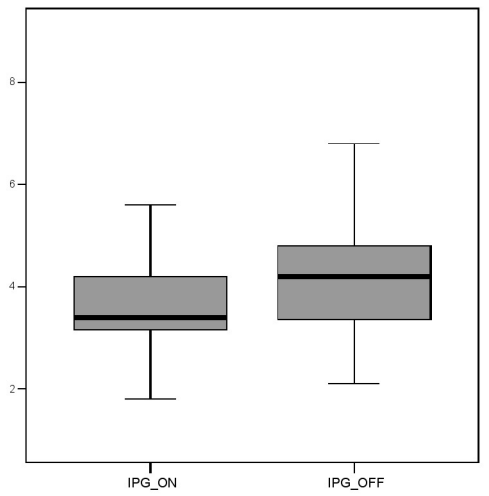

Fig. 3. – Duration of MUP at resting in the EAS.

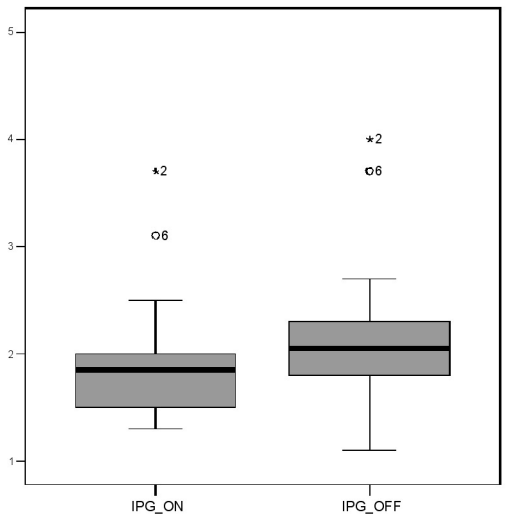

Fig. 4. – PNTML latencies unstimulated side.

We have observed that SNM produces significant changes in EMG and in PNTML. With regard to EMG, SNM has increased the amplitude of activation pattern in US and has decreased the MUPs duration at rest in both sphincters. These results suggest a greater recruitment of pelvic muscular fibers and a better synchronization of fibers firing, moreover lasting in time. The decrease of latencies in PNTML, observed on both sides, probably means that SNM stimulates motor conduction velocity of pudendal nerves and suppresses integration between peripheral innervation and spinal cord.

CONCLUSIONS

SNM produces significant modifications in function of peripheral perineal innervation. We observed an increase of amplitude of voluntary contraction in SU-EMG, a decrease of duration of MUP at rest in sphincters and a decrease of latencies of PNTML on both sides.

REFERENCES

1) Benson JT. Sacral nerve stimulation results may be improved by electrodiagnostic techniques. Int Urogynecol J 2000; 11: 352-7.
2) McLennan MT. The role of electrodiagnostic techniques in the reprogramming of patients with a delayed suboptimal response to sacral nerve stimulation. Int Urogynecol J 2003; 14: 98-103.
3) Malaguti S, Spinelli M, Giardiello G, Lazzeri M, Van Den HomberghU. Neurophysiological evidence may predict the outcome of sacral neuromodulation. J Urol 2003; 170: 2323-2326.

Correspondence to:
Dr. ELENA ANDRETTA
E-mail: elenaandretta@libero.it