

The value of electromyogram to predict the success of revision in malfunctioning sacral neuromodulation, a retrospective single centre pilot study.



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Introduction

Sacral neuromodulation (SNM) is a minimally invasive technique to treat intractable urinary and bowel disorders.

Loss of effect of SNM without technical defect can occur in around 10% of implanted devices (1).

When loss of effect of SNM appears, without technical defect (such as lead migration proven by X-ray of the sacral spine and/or fault impedance measurements) we perform an **electromyogram (EMG) of the pelvic floor**.

The optimal SNM response is obtained by **sensory response at the level of sacral nerve 3 (S3) and/or sacral nerve 4 (S4) without motor side effects** at these levels. In the absence of technical defect, multiple reprogramming sessions are performed. When no satisfying response is obtained, a surgical revision can be envisaged.

In current literature, there is little guidance on revision strategies. **We describe for the first time the use of electromyography (EMG) to predict the outcome of revision surgery.** We hypothesized that a surgical revision will be successful when there is no sensory response at S3 and S4 level.

Conclusion

The **absence of the desired sensory response at levels of S3 and S4** correlates with **higher success rates after surgical revision** for loss of effect in patients with SNM without a technical defect. **EMG** appears to be a **useful tool to suggest the success of revision in malfunctioning SNM**.

This study stresses the importance of making a flowchart for decision making.

Incorporating EMG in the decision tree can aid in patient counselling.

We realise the limits of this retrospective study. This study shows that it is useful to invest in a larger prospective study.

Study design

To objectify the stimulator effect on the urethral sphincter and other pelvic floor muscles, a **concentric needle EMG** was performed by the same electromyographer.

Sacral neuromodulation influences the interval variability of the single motor unit firing pattern in the stimulated pelvic floor muscles. The goal of these sensory stimuli is to disorder the discharge of these malfunctioning motor units so that the patient regains control over his miction. Each motor unit starts by firing somewhat irregularly, comparable with the cardiac RR variability with a certain beat-to-beat variation. In patients with sacral neuromodulation this small but regular interval variability of single motor units become very irregular. This, of course, only takes place in those muscles that depend on the sacral level(s) that are influenced by the stimulator. This effect on interval variability can be useful to determine whether the stimulator lead is placed in the best possible location. It can help to objectify the stimulator effects in patients without clinical improvement of their voiding problems despite correct anatomical positioning of the lead.

The (desired) sensory response and (non-desired) motor response at the level of sacral nerve 3 (S3) and sacral nerve 4 (S4) were determined. When **no satisfying response** was obtained, a **surgical revision was proposed**.

Materials and methods

All EMGs performed between January 2001 and February 2018 were retrospectively analysed. We excluded EMGs when the implantation of the SNM device and follow-up didn't take place in our medical centre, when the device was powered off during EMG or when there was a technical defect. The demographics, indication of SNM, timing of first SNM, EMG results (stimulus artefact at the level of S3-4 right and left, sensory response at the level of S3 right and left and S4 right and left, motor response at the level of S3 and S4), subsequent treatment (revision, no revision or explants of SNM), success of revision, reason why there was no revision or explant and most recent final outcome of the patient were recorded.

We could divide the EMG results into 4 situations:

- Situation 1:** absence of sensory response and presence of motor response,
- Situation 2:** absence of both sensory and motor response,
- Situation 3:** presence of both sensory and motor response,
- Situation 4:** presence of sensory response and absence of motor response (=preferred situation).

We hypothesized that a surgical revision will be more successful when situation 1 or 2 is present.

By using **frequency and cross tables in Excel and SPSS** we analysed the database using the **chi square test and phi coefficient**.

Results

46 EMGs were performed followed by a revision of the SNM. The patient population consisted out of 2 men and 44 women. The initial indication of SNM was urinary retention (n=29), overactive bladder (n=19) and/or pelvic pain (n=1).

- Situation 1:** 20 SNMs were revised, 60% was successful.
- Situation 2:** 18 SNMs were revised, 61.1% was successful.
- Situation 3:** 4 SNMs were revised, 25% was successful.
- Situation 4:** 4 SNMs were revised, 25% was successful.

Our hypothesis showed a **significant correlation between the EMG result and the outcome of revision surgery for situation 1 and 2** ($p < 0.0005$, $\phi = 0.326$).