

#795 Examining the Effect of Measurements with a Three-Dimensional Sacral Bone Model on Treatment Success Before Sacral Neuromodulation Operation



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Hypothesis / aims of study

Sacral neuromodulation (SNM) therapy is a treatment used in cases of refractory overactive bladder, chronic urinary retention, interstitial cystitis, and fecal incontinence. The aim of this study is to evaluate the effect of measurements on the preoperative 3D sacral bone model on facilitating the SNM procedure and increasing its success.

Study design, materials and methods

Patients who would undergo SNM application between April 2019 and October 2023 were included in the study. The demographic characteristics and clinical diagnoses of the patients were recorded. Patients were asked to fill out a 3-day bladder diary form. SNM procedure was performed on each patient percutaneously by a single surgeon (MGÇ) under fluoroscopy guidance. The patients were divided into two groups: those with and without preoperative pelvis CT and 3D sacral bone imaging. The patients' SNM test phase procedure times, fluoroscopy times, and follow-up periods were recorded. Whether the treatment was successful or not was evaluated by using a bladder diary and symptom improvement of 50% or more was considered success. For patients who did not have 3D Pelvis CT before the procedure, standard SNM application was performed under fluoroscopy guidance. In patients in whom a 3D sacral bone model was created using 3D Pelvis CT, the distance of the S3 foramen to the spinous processes, the distance of the line passing through the S3 Foramen to the sciatic notch, and the distance of the promontorium to the S3 foramen were measured. These measurements were marked during the procedure and percutaneous access to the S3 foramen was made with the help of fluoroscopy. For imaging with 3D pelvis CT, patients underwent thin-section pelvic CT in the prone position. These images were converted to 3D images in bone model via DICOM application. A 3D bone view of the pelvis region was created, and measurements were made on this image (Figure-1A-B)



Figure 1A: 3D pelvis CT image (Anterior), 1B: 3D pelvis CT image (posterior)

Results and interpretation

A total of 85 patients were included in the study. 44 of these patients were patients with preoperative 3D Sacral CT. The average age of the patients was 44.04 ± 11.86 (12-61). 60% (51/85) of the patients were female and 40% were male. A total of 51 patients underwent SNM surgery due to chronic urinary retention (60%).

In the group where preoperative 3D sacral CT was performed, the distance of the foramen to the midline, the distance of the S3 foramen to the sciatic notch, and the distance between the promontorium and the S3 foramen show significant differences compared to standard measurements. Additionally, the procedure time and fluoroscopy time were found to be shorter in the 3D CT group (89.15 ± 19.32 vs. 41.14 ± 11.60 for procedure time; $p < 0.001$ and 266.83 ± 103.37 vs. 114.55 ± 67.30 ; $p < 0.001$ for fluoroscopy time). The rate of all patients benefiting 50% or more from the testing phase is 75.3%. The success rate in the group without 3D CT was 65.9%. The success rate in patients with 3D CT was 84.1. Statistically, in terms of success, more patients in the group with 3D CT benefited from the treatment ($p = 0.044$) (Table-1). Complications developed in a total of 17 patients, 3 of whom developed revision due to infection and 14 due to electrode and stimulator migration. In one patient, a wound occurred in the area where the stimulator was placed.

Interpretation of results

At the end of the study, measurements on the CT-assisted 3D sacrum bone model before the sacral neuromodulation test phase showed that timed lead placement took less time, the amount of radiation used decreased and the success of the procedure increased.

3D sacrum bone model is an important method that will increase the success of SNM, especially in cases where there is a sacral bone anomaly and the sacral foramen cannot be clearly identified. The extra dose received with a CT scan is equivalent to approximately 5 seconds of fluoroscopy time. For this reason, when the fluoroscopy dose taken during the procedure is calculated, the advanced stimulation phase accompanied by a 3D bone model seems safer.

Table-1: Comparison of 3D sacral CT-assisted SNM and standard SNM test phase

	Standard SNM		3D Sacral CT-assisted SNM		p
	Mean	Std. Deviation	Mean	Std. Deviation	
Age	45,13	11,94	44,1	11,58	0,734
Foramen midline distance (right)(mm)	20	0	16,55	2,26	<0,001
Foramen midline distance (left)(mm)	20	0	17,68	2,08	<0,001
S3 foramen-sciatic notch distance (mm)	0	0	5,36	3,88	<0,001
Coccyx-S3 foramen distance(mm)	90	2,739	83,9	8,715	<0,001
Operation Time (min)	87,9	19,36	41,5	13,27	<0,001
Fluoroscopy time (sec)	266,8	103,37	5	67,31	<0,001
Follow up time (day)	22,68	6,51	19,41	5,87	0,051

Conclusions

Making appropriate measurements with 3D sacral CT imaging before the SNM test phase and determining these measurements at the bedside reduces the duration of the procedure and the X-ray exposure. It will be possible to increase the success of SNM in the future with the 3D sacral bone model, which is a method that statistically increases the success of the procedure.