

ULTRASOUND TECHNIQUE FOR LOCATING SACRAL FORAMINA AND PLACING AN INTERSTIM PNE LEAD

Hypothesis / aims of study

We evaluated the use of ultrasound for locating the S3 sacral foramina and the use of ultrasound as a guide for placing an InterStim PNE needle into the foramen of cadaveric specimens. Our aim was to evaluate an ultrasound technique for locating the S3 foramen and how that technique might allow lead placement without fluoroscopy.

Study design, materials and methods

Six physicians with experience placing InterStim PNE leads were instructed in the following ultrasound procedure for placing a needle into the S3 foramen. Fresh cadavers were used for imaging and needle placement. A GE Vivid 7 ultrasound machine was used with a 7L linear probe. The probe was operated at 4-6 MHz. With the patient (cadaver) in a prone position, the S3 foramen is approached from the coccyx while moving cephalad and observing the following key anatomical features.

1. The **Coccyx** is observed with the probe oriented in the transverse plane.
2. The **Coccygeal Cornua** ("mouse ears") are coccygeal protrusions pointing posterior-laterally.
3. The **Sacral Hiatus** is readily identified by partial ultrasound penetration of the sacro-coccygeal ligament and parallel line from sacral hiatus floor. The **Sacral Cornua** ("praying nuns") are also readily visible at the level of the sacral hiatus. The cephalad border of the sacral hiatus is observed when the sacral hiatus floor signal disappears.
4. The **S4 foramen** is found laterally within the level of the sacral hiatus (Note: in some individuals it is possible to see S4 and S5). An excellent marker of the foramen is the ultrasound return signal dropping into the foramen.
5. The probe is centered on S4 and advanced cephalad. The **S3 foramen** is found when the posterior bone signal drops out – same as the S4 signal. The sacral hiatus should be out of view to ensure placement is S3 and not S4 in the patients that have a S5 foramen.

The physicians were asked to place a 20 gauge needle into the S3 foramen in the cadaver specimen using only bony landmarks and then a second time using the above ultrasound procedure. Additionally, a needle guide attached to the ultrasound probe was evaluated. The procedures were video taped and later the time was determined for each procedure.

Results

	procedure time			avg secs
	blind	with U.S.	with US guide	
Dr. 1	1:12	0:45	0:25	
Dr. 2	1:15	0:40	0:38	
Dr. 3	no data	3:13	1:20	
Dr. 4	no data	2:15	0:35	
Dr. 5	1:30	2:15	1:40	
Dr. 6	0:25	0:40	0:30	
	65.5	98	51.3	

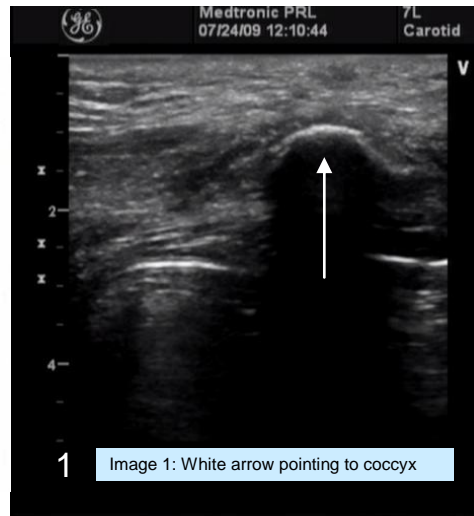
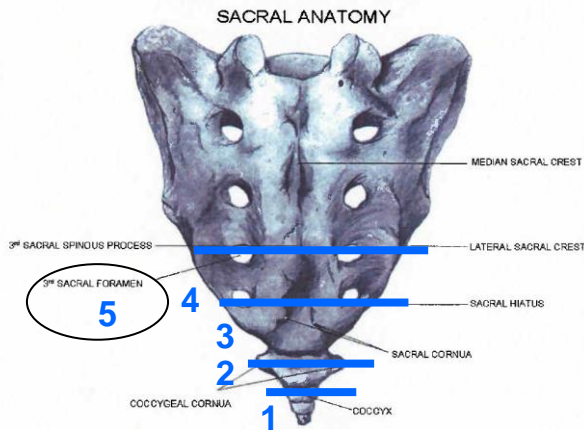


Image 1: White arrow pointing to coccyx

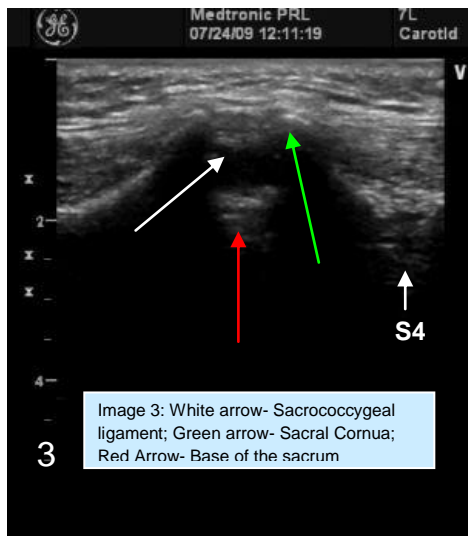


Image 3: White arrow- Sacrococcygeal ligament; Green arrow- Sacral Cornua; Red Arrow- Base of the sacrum

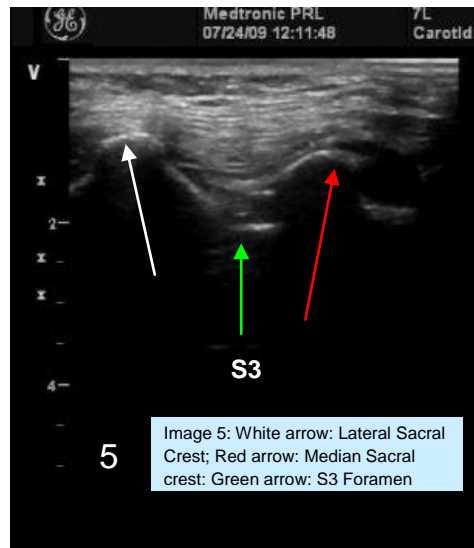


Image 5: White arrow: Lateral Sacral Crest; Red arrow: Median Sacral crest; Green arrow: S3 Foramen

Interpretation of results

The experienced clinicians were very efficient in placing a needle into the sacral foramen using a blind procedure (just over a minute). However, often a second needle will be placed cephalad or caudad and physical responses are used to confirm correct S3 placement. The learning time of the first ultrasound procedures was approximately fifty percent greater than the blind procedures, but there was assurance of being in the correct foramen. Additional attempts (learning) and the addition of a needle guide made the ultrasound procedure comparable to the blind procedure in terms of time to enter into the foramen.

Concluding message

Ultrasound imaging can be used effectively and efficiently for locating the sacral foramina. The coccygeal approach allows for a quickly learned procedure with easily recognized, step by step landmarks for reaching the S3 foramina. The needle shaft and tissue movement from the needle is observed via ultrasound and confirms correct placement within S3. Ultrasound may prove to be a valuable imaging technique in placing an InterStim PNE lead for physicians wishing to limit radiation exposure.

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Is this a clinical trial?	No
What were the subjects in the study?	NONE