

## ORIGINAL ARTICLE

ANATOMICAL STUDY OF THE SACRUM FOR  
TRANSSACRAL BLOCK OF SACRAL NERVESDS Patil<sup>1</sup>, HR Jadav<sup>2</sup>, KB Chauhan<sup>3</sup>, CR Bhatt<sup>4</sup>, R Brahmbhatt<sup>5</sup>

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## ABSTRACT

**Introduction:** For transsacral block of sacral nerves in analgesia and anesthesia of the rectal, anal or urethral region the dorsal sacral foramina are used. To find solution of this by identifying additional anatomical landmarks and measurements of dorsal sacral foramina for transsacral nerve block.

**Materials & Method:** Total 100 complete and undamaged adult, dry sacrum were measured with a vernier caliper (accurate to 0.1 mm). Dorsal sacral foramina of the sacrum were taken as points.

Calculations and analyses were expressed as mean (SD), median and range using Open Office 3.2.0 spreadsheet version for Linux (Ubuntu 10.04).

**Results:** The average distance between the two superolateral sacral crests was 60.61 (SD 6.71) mm. Distance between dorsal sacral foramina vertical right side 1<sup>st</sup> to 2<sup>nd</sup> 14.05 (SD 2.35)mm, 2<sup>nd</sup> to 3<sup>rd</sup> 12.33 (SD 1.84)mm, 3<sup>rd</sup> to 4<sup>th</sup> 11.26 (SD 2.35)mm and vertical left side 1<sup>st</sup> to 2<sup>nd</sup> 14.18 (SD 2.61)mm, 2<sup>nd</sup> to 3<sup>rd</sup> 12.18 (SD 1.95)mm, 3<sup>rd</sup> to 4<sup>th</sup> 10.78 (SD 2.42)mm. Transverse distance between dorsal sacral foramina 1<sup>st</sup> to 1<sup>st</sup> 34.72 (SD 3.97)mm, 2<sup>nd</sup> to 2<sup>nd</sup> 29.43 (SD 3.51)mm, 3<sup>rd</sup> to 3<sup>rd</sup> 25.58 (SD 3.46)mm, 4<sup>th</sup> to 4<sup>th</sup> 24.63 (SD 3.22)mm.

**Conclusion:** Measurements of dorsal sacral foramina can be used for transsacral nerve block.

**Keywords:** Sacrum; Transsacral approach; Dorsal sacral foramen; Transsacral block

## INTRODUCTION

Transsacral epidural block is used for anesthesia of the rectal, anal or urethral region and has been performed through the dorsal sacral foramina. For analgesia and anaesthesia in various clinical procedures we need Transsacral block of sacral nerves used diagnostically and therapeutically for urological problems of bladder spasm in patients with spinal cord damage.

The sacrum is a triangular bone formed by fusion of five vertebrae and forms the posterosuperior wall of the pelvic cavity, wedged between the two hip bones. Its blunted, caudal apex articulates with the coccyx and its superior, wide base with the fifth lumbar vertebra at the lumbosacral angle. It is set obliquely and curved longitudinally, its dorsal surface being convex, the pelvic concave. The dural sac and its contained subarachnoid space usually extends to the level of the S2 segment of the sacrum but the dural sac may end as high as the L5 or to S3.

In adults it is sometimes hard to determine the anatomical location of the dorsal sacral foramina. The success rate of transsacral nerve block is based on

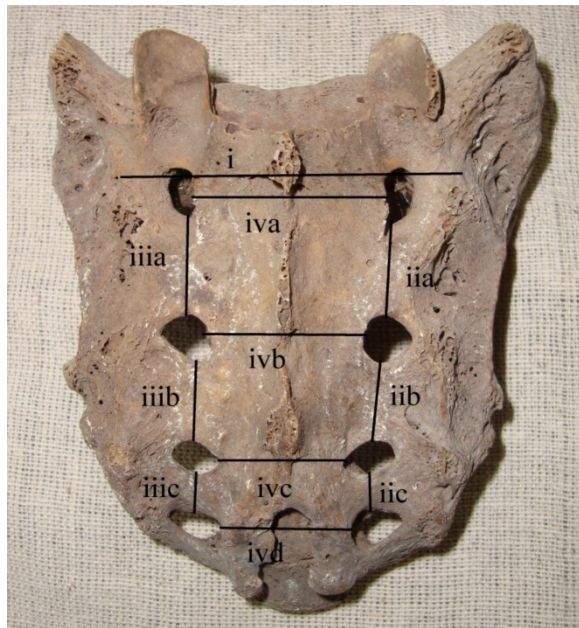
determination of the sacral landmarks. The main aim of this study was to find practical solution of this problem by identifying additional anatomical landmarks mainly of dorsal sacral foramina and measurements that may enhance the location of dorsal sacral foramina for transsacral nerve block. Measurements on dry sacral bones was determined and the anatomical landmarks that may be used during procedures.

## MATERIALS &amp; METHOD

After approval for the study from the local ethical committee for our research, total 100 complete and undamaged adult, dry sacral bones, obtained from Anatomy department, Government Medical College Surat were used in present study. The gender and age of bones were undetermined. Vernier caliper (accurate to 0.1 mm) was used for Anatomical measurements. Sacrum's with total posterior closure were excluded from the study.

As our measurements were carried out on dry sacral bones, palpable posterior superior iliac spines in living

humans were used as landmarks. Right and left superolateral sacral crests of the sacrum were taken as two points on dorsal surface of sacrum because posterior superior iliac spines impose on the superolateral sacral crests. The dural sac terminates around the level of S2. Eleven direct morphometric measurements which will help in transsacral nerve block through dorsal sacral foramen relating to the sacrum, dorsal sacral foramina were obtained (Fig. 1). With the help of data received statistical analysis done as mean (SD), median and range. For analyses OpenOffice.org spreadsheet software version 3.2 for Linux Ubuntu 10.04 were used.



**Fig.1:** Direct Morphometric Measurements

- i Distance between two superolateral sacral crest (mm)
- ii Distance between dorsal sacral foramina vertical right (mm) 1<sup>st</sup> to 2<sup>nd</sup>

- iiib Distance between dorsal sacral foramina vertical right (mm) 2<sup>nd</sup> to 3<sup>rd</sup>
- iiic Distance between dorsal sacral foramina vertical right (mm) 3<sup>rd</sup> to 4<sup>th</sup>
- iiia Distance between dorsal sacral foramina vertical left (mm) 1<sup>st</sup> to 2<sup>nd</sup>
- iiib Distance between dorsal sacral foramina vertical left (mm) 2<sup>nd</sup> to 3<sup>rd</sup>
- iiic Distance between dorsal sacral foramina vertical left (mm) 3<sup>rd</sup> to 4<sup>th</sup>
- iva Transverse Distance between dorsal sacral foramina (mm) 1<sup>st</sup> to 1<sup>st</sup>
- ivb Transverse Distance between dorsal sacral foramina (mm) 2<sup>nd</sup> to 2<sup>nd</sup>
- ivc Transverse Distance between dorsal sacral foramina (mm) 3<sup>rd</sup> to 3<sup>rd</sup>
- ivd Transverse Distance between dorsal sacral foramina (mm) 4<sup>th</sup> to 4<sup>th</sup>

**OBSERVATIONS**

The average length of the sacral hiatus was 34.13 (SD11.82) mm; 34; (range 7–76 mm). The average distance between the two superolateral sacral crests was 60.61 (SD 6.71) mm;60;(range 43–78 mm). Distance between dorsal sacral foramina vertical right 1<sup>st</sup> to 2<sup>nd</sup> 14.05(SD 2.35)mm; 14; range 9-20, 2<sup>nd</sup> to 3<sup>rd</sup> 12.33(SD 1.84)mm;12; (range 8-17), 3<sup>rd</sup> to 4<sup>th</sup> 11.26(SD2.35)mm;11;(range 0-19).Distance between dorsal sacral foramens vertical left 1<sup>st</sup> to 2<sup>nd</sup> 14.18(SD 2.61)mm;14; (range 8-20), 2<sup>nd</sup> to 3<sup>rd</sup> 12.18(SD 1.95)mm;12; (range 7-16), 3<sup>rd</sup> to 4<sup>th</sup> 10.78 (SD2.42)mm;11;(range 0-15).Distance between dorsal sacral foramens transverse 1<sup>st</sup> to 1<sup>st</sup> 34.72(SD 3.97)mm; 34;(range 25-46), 2<sup>nd</sup> to 2<sup>nd</sup> 29.43 (SD 3.51)mm; 30;(range 17-41), 3<sup>rd</sup> to 3<sup>rd</sup> 25.58(SD 3.46)mm;25; (range 16-35), 4<sup>th</sup> to 4<sup>th</sup> 24.63 (SD 3.22)mm; 24; (range 19-36),

The anatomical measurements and calculations are given in Table 1.

**Table 1: Different Parameters observed**

	Morphometric Measurements	Mean	SD	Median	Max	Min
i	Distance between two superolateral sacral crest (mm)	60.61	6.71	60	78	43
ii	Distance between dorsal sacral foramina vertical right (mm)					
iia	1 <sup>st</sup> to 2 <sup>nd</sup>	14.05	2.35	14	20	9
iib	2 <sup>nd</sup> to 3 <sup>rd</sup>	12.33	1.84	12	17	8
iic	3 <sup>rd</sup> to 4 <sup>th</sup>	11.26	2.35	11	19	0
iii	Distance between dorsal sacral foramina vertical left (mm)					
iiia	1 <sup>st</sup> to 2 <sup>nd</sup>	14.18	2.61	14	20	8
iiib	2 <sup>nd</sup> to 3 <sup>rd</sup>	12.18	1.95	12	16	7
iiic	3 <sup>rd</sup> to 4 <sup>th</sup>	10.78	2.42	11	15	0
iv	Transverse Distance between dorsal sacral foramina (mm)					
iva	1 <sup>st</sup> to 1 <sup>st</sup>	34.72	3.97	34	46	25
ivb	2 <sup>nd</sup> to 2 <sup>nd</sup>	29.43	3.51	30	41	17
ivc	3 <sup>rd</sup> to 3 <sup>rd</sup>	25.58	3.46	25	35	16
ivd	4 <sup>th</sup> to 4 <sup>th</sup>	24.63	3.22	24	36	19

## DISCUSSION

William R. Meeke<sup>1</sup> marks the second sacral foramen is 2.5 cm. inward and 1 cm. downward from posterosuperior spine after its identification. Another wheal is placed which represents the sacral notch or fifth sacral foramen. The distance between point just lateral and below the sacral cornu and 2<sup>nd</sup> sacral foramen is divided into three equal parts to get third and fourth foramina. The first is then located by a wheal placed 2.5 cm. above that which marks the second foramen, following the same straight line.

David M. Schultz<sup>2</sup> used fluoroscopy for transsacral blockade of the inferior hypogastric plexus for the diagnosis and treatment of chronic pain conditions involving the lower pelvic viscera with 73% success rate by marking an entrance point on the skin surface 1–2 cm lateral to the lateral edge of the S2 or S3 sacral foramen on the side to be blocked. Edward C. Brenner<sup>3</sup> in 3 of the 12 failures by the caudal bloc a successful anaesthesia was obtained by transsacral injection but the method for this is lacking.

Paulo Busoni<sup>4</sup> in children's aged 2 months to 13 years found sacral inter vertebral epidural block to be safe and easily performed, alternative to the more commonly used caudal approach. Also for patients in whom an epidural catheter is required for postoperative pain control and in whom caudal anatomy is distorted or caudal blockade is not desirable.

Tomoki Nishiyama et al<sup>5</sup> used transsacral epidural block simplified by using a median approach instead of a lateral approach through the foramen and conclude that the median transsacral epidural approach is technically feasible in adults and presents an alternative to caudal block.

Clark M. Johnson<sup>6</sup> performed transsacral block (328 patients) by technique of Gaston Labat with understanding of the anatomy, landmarks and a few trial injections on a cadaver depositing the solution

directly about the nerves. It is usually accompanied by a caudal block, which assures prolonged and complete anesthesia of all five sacral nerves and the coccygeal plexus. As per him combination of caudal and transsacral block gives a more extensive anesthesia, permitting perineal prostatectomy and extensive operations on the lower rectum, female perineum, vagina, and cervix.

## CONCLUSION

There is variability in the anatomical structure of the sacrum, especially the dorsal sacral foramina. However, we believe that the distances between dorsal sacral foramina vertically and transversely will be of practical benefit to the clinician in determining the location of the dorsal sacral foramina during transsacral nerve block. Further clinical trials are required to compare the existing techniques and our anatomical description to provide more data to support the results of this study.

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