

## CASE REPORT

## Spina bifida with higher position of sacral hiatus: a case report with clinical implications

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### Abstract

**Spina bifida is a developmental defect in the vertebral column, in which the laminae fail to fuse and thereby the spinal cord is relatively unprotected. We report a case of spina bifida, in a dried specimen of sacrum, characterized by a prominent S1 spine and a higher sacral hiatus. Conventional textbooks of anatomy provide less information about the clinical implications of such anomalies and research studies are the only source of information. The present study, discusses in detail, the structural and radiological aspects of spina bifida, with a higher sacral hiatus. Precise knowledge of normal and abnormal anatomy of the sacrum may be clinically important for anesthetists, neurologists, radiologists and orthopedic surgeons, in their clinical practice (Fig. 3, Ref. 16). Full Text (Free, PDF) [www.bmj.sk](http://www.bmj.sk)**  
**Key words: spina bifida, sacrum, sacral hiatus, spine, abnormalities.**

The sacrum is found to be wedged between the two innominate bones and forms the postero-superior boundary of the pelvic cavity (1). Five sacral vertebrae are fused to form the sacrum. Often, the number may vary in case of sacralization or lumbalization. The spines of the sacral vertebrae are raised and are represented as fused sacral spines (1). An arched sacral hiatus is usually observed below the fourth or the third sacral spine on the dorsal aspect of the sacrum. We report a rare position of sacral hiatus, located below the S1 spine.

The sacrum is clinically important for the caudal epidural block which is usually performed for the diagnosis and treatment of lumbar spine disorders (2). The knowledge of exact topographical anatomy of the sacrum is important for such procedures. Presence of anatomical variations, may possibly contribute to the failure rate of caudal epidural block, transpedicular and lateral mass screw placement.

The sacral bone has been considered to be an integral part of the pelvis and constitutes the undistorted part of the spinal curves (3). Abnormal bony configuration and shape may prove to be the causative agent in spondylolisthesis (3). The anatomy of the sacrum is also important for endoscopic surgeries (4).

Presence of spina bifida may increase the chances of damage to the sacral nerves and create difficulty in internal fixation of screws. Many research studies have underlined the importance of evaluation of the anterior sacral foramen and its projection on the posterior sacral surface in skiagrams (5). Hence,

skiagrams are important investigations for the diagnosis of such anatomical variations. We also obtained a skiagram of the anomalous sacrum in the presented case, keeping in view that this may help clinicians and radiologists.

The present article deals with the anatomical- radiological evaluation of spina bifida, detected in a dried bone specimen, which may be clinically important for anesthetists, neurologists, orthopedic surgeons and radiologists.

### Case report

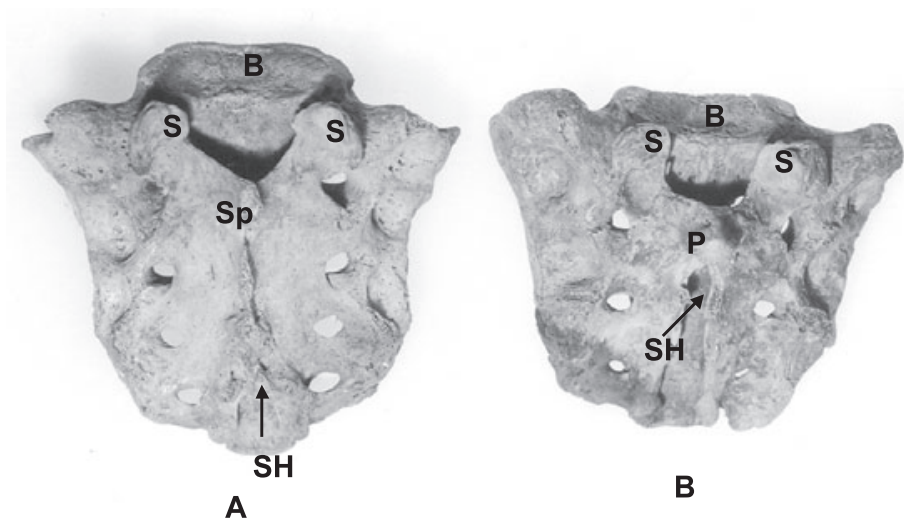
Anatomical features of the anomalous sacrum were studied in detail and appropriate measurements were recorded. The specimen was photographed (Fig. 1) and skiagram (Figs 2 and 3) was also obtained.

### Observations

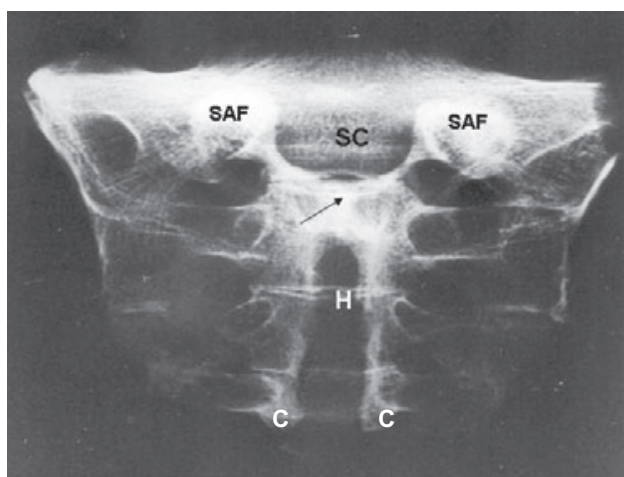
The maximum transverse width of the body and the ala of the sacrum were 4.4 cm and 3.6 cm, respectively. The auricular surface of the sacrum extended till the lower border of S2 sacral

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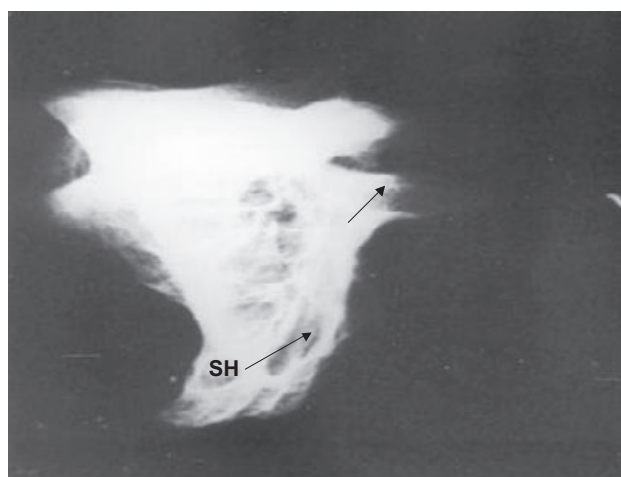
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**Fig. 1.** Photograph of dorsal surface of sacrum showing. A) Normal sacrum: B – body of S1, Sp – spine of S1, S – superior articular process of S1, SH – sacral hiatus. B) Anomalous sacrum: B – body of S1, P – projected spine of S1, S – superior articular process of S1, SH – sacral hiatus.



**Fig. 2.** Skiagram of anomalous sacrum (AP view) showing: SAF – superior articular process, SC – sacral canal, H – sacral hiatus, C – sacral cornu. Projected spine of S1 is shown with arrow.



**Fig. 3.** Skiagram of anomalous sacrum (lateral view) showing: SH – sacral hiatus. Projected S1 spine is shown with arrow.

vertebra on both sides. The sacrum exhibited three well formed sacral foramina and an ill formed S4 foramen. The S1 spine terminated as a rounded bony projection and measured 2 cm, antero-posteriorly. The sacral hiatus was situated 0.6 cm, below the S1 spine and ended a distance of 5.2 cm above the sacral cornu. The sacral hiatus had a transverse width of 0.6 cm near the apex and 1.4 cm near the sacral cornu. The sacral canal was triangular shaped. The two sacral cornua were separated by a distance of 1.4 cm. No other abnormalities were observed.

### Discussion

The sacrum consists of the five sacral vertebrae and the number may vary according to the case of socialization and lumbal-

isation (6). The incomplete fusion of the posterior elements of the fifth or sometimes the fourth sacral vertebra, results in the formation of sacral hiatus. This, 'U' shaped sacral hiatus is covered by the sacrococcygeal membrane and forms an important landmark to perform the caudal epidural block (7). In the present study, we observed a sacral hiatus which may be due to incomplete fusion of the posterior elements of the S2 vertebra. Such types of higher sacral hiatus are a rare entity.

The authors consider the spine of the sacrum, to be a well known site for internal fixation specially from the clinical point of consideration (8) The anatomy of the sacrum is essential especially for placement of screws in the pedicle (9, 10). Essentially, ilio-sacral screw fixation involves the constant fixation of the screws on the pedicle of S1 vertebra (11). The knowledge of

the sacral spine may be important for any screw fixation. In the presence of spina bifida, as seen in the present case, would the planning of screw fixation certainly pose a challenge for the orthopedic surgeons.

Even the past research workers have stated that there is paucity of literature involving sacrum especially the S1 (9, 12, 13). The spine surgeons have been using the S1 for fixation of the screws and for these procedures, understanding of anatomy of sacrum and its abnormalities is imperative. In the caudal epidural block, the drug is injected into the epidural space through the sacral hiatus, to provide the analgesia (7). The most ideal technique used by clinicians to identify the caudal epidural space is by palpating the sacral cornu first, then feeling the 'pop' on penetrating the sacrococcygeal membrane (7). It has to be considered that even while using different techniques, a high failure rate of 25 % has been observed (2, 14, 15). There are research reports of 74 % success rate without the use of fluoroscopy (16). The success rate of caudal epidural block increases to 100% by using ultrasonography guided needle placement (14). Presence of spina bifida, as seen in this case, would lead to accidental injury of neural structures which are otherwise covered by the sacral canal.

The morphological features of the sacrum in the present case, are suggestive of male sex as width of the base was more than the width of the ala. The presence of a projected S1 spine and a sacral hiatus immediately below it signifies a developmental defect. Admittedly, no clinical history of the patient was available to corroborate these findings. The absence of the spines below S1 could be clearly made out in the skiagram (Figs 2 and 3) and we as anatomists would certainly advocate the use of skiagram as an important tool for investigation prior to any operative procedure.

Apex of sacral hiatus is an important landmark for carrying out successful caudal epidural block. Thus, exact localization of the sacral hiatus would certainly help in the easy passage of needle into the sacral canal. Interestingly, it has been a documented fact that the incidence of failure of caudal epidural block in 7 % cases has been attributed to the presence of bony septum in the sacral hiatus, hiatal agenesis or complete agenesis as found in spina bifida (17).

Abnormal spina bifida may also result in the exposure of all the structures in the sacral canal. The attachment of the muscles like erector spinae and the multifidus may also be altered in case of any anomaly involving the dorsal surface of the sacrum. A comprehensive structural and radiological study as done in the present case, may be beneficial from the academic point of view and may also be helpful for clinicians and radiologists in the clinical practice.

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