

## SURGICAL MANAGEMENT OF SACRAL AND PRESACRAL TUMORS: A MULTICENTER EXPERIENCE

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### Abstract

**Background:** Sacral and Presacral tumors are rare tumors. Due to their slow growth, lack of clinical manifestations, and involvement of adjacent structures such as the iliac arteries and sacral nerves, these tumors present a significant challenge to surgeons. They often mimic other common spinal pathologies. This study aimed to determine the age of presentation, histological types, and surgical approaches used in managing these tumors, with the goal of addressing the challenges associated with their management. **Materials and Methods:** This multicenter prospective analytical study was conducted in MGM Medical college & SSH hospital Indore (M.P) and Pt JNM Medical college attached DKS hospital Raipur (C.G). Total of 30 patients admitted between September 2019 to August 2024 were included in this study. The statistical analysis was performed with SPSS version 23.0 for windows. **Result:** In our study, the mean age of presentation was 38.20 years, with a predominance of male patients (80%). Sacral tumors most commonly occurred below S3 (low levels), comprising 60% of the cases. The primary diagnostic approach involved MRI of the lumbo-sacral region, supplemented by MRI of the lower abdomen and plain CT of the lumbo-sacral region. Among the patients, 6 (20%) with low-level epidermoid tumors (below S3) underwent surgery via the anterior approach. The remaining 24 patients (80%), who had high, mid, or low-level sacral tumors, were treated using the posterior approach. Postoperatively, the most common histopathological diagnosis was dermoid/epidermoid tumors, observed in 12 patients (40%). Additionally, sphincter dysfunction was the most common postoperative complication, affecting 12 patients (40%). **Conclusion:** Sacral tumors are challenging tumors for surgeons to diagnose and to manage surgically. We conclude that sacral tumors can be better managed by the surgeons if a proper clinical and radiological diagnosis is made, the pathophysiology of these tumors is understood, and surgical techniques are better planned, as our study has shown.

## INTRODUCTION

Sacral and presacral tumors are rare tumors.<sup>[1]</sup> These tumors pose a significant challenge for surgeons due to their slow growth, subtle clinical presentation, and involvement of the sacral nerves, iliac vessels, and other surrounding structures. They often mimic other common spinal pathologies, such as lumbosacral spondylosis.<sup>[2]</sup> The combination of non-specific symptoms, inadequate diagnostic imaging, and clinical rarity frequently leads to delays in diagnosis.

The surgical treatment of these tumors is complex because of the intricate regional anatomy, requiring surgeons to navigate the dilemma between functional preservation and effective tumor management. This study aims to provide insights into the age, gender, histological types, and surgical approaches for managing these tumors to help address the challenges associated with their treatment. Sacral tumors are classified as outlined in [Table 1].

## MATERIALS AND METHODS

This multicenter prospective analytical study was conducted at MGM Medical College attached SSH Hospital in Indore (M.P.) and Pt JNM Medical college attached DKS Post Graduate Institute hospital in Raipur (C.G.), India. The study included all age group patients of sacral and presacral tumors, admitted between August 2019 and April 2024 who consented to surgery. MRI and CT scans were performed for all patients. For the analysis of tumor location and distribution, tumors were categorized based on their position: S1-S2 as high level, S2-S3 as mid-level, and S3 and below as low level. Surgical resection of these tumors was performed using either anterior or posterior approaches. Statistical analysis was conducted using SPSS version 23.0 for Windows. All patients were followed up with MRI imaging and clinical examinations every three months post-discharge. Post-operative radiotherapy was advised for malignant sacral tumors, chordoma and sacral nerve schwannoma patients in whom we did maximum total safe resection of tumor.

## RESULTS

[Figure 1] A Case of Anterior pre-sacral epidermoid tumor in 30 years old female operated by posterior approach



Figure A: Pre operative MRI images showing: A large cystic epidermoid tumor (shown by blue arrow) of size 14mm X 12.8X11.5 cm in the pelvis in presacral region, communicating with the spinal canal through the defect at S3-S4-S5 vertebrae level. Cystic lesion was compressing the urinary bladder (shown by red arrow) and rectum.



Figure B: Pre op CT pelvis: Showing agnesis of part of S2-S3-S4-S5

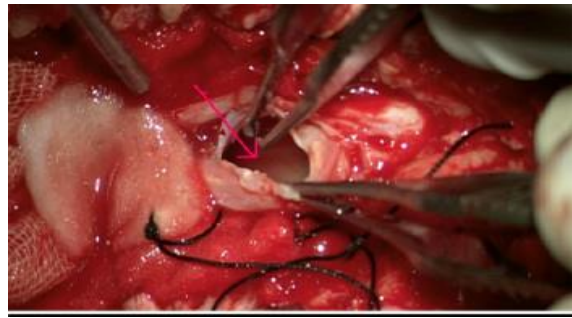


Figure C: Showing intra-operative images: A defect was present in the anterior dura of S1-S2 thecal cord communicating with capsule of presacral epidermoid tumor.



Figure D: Shows the post op CECT pelvis after decompression of anterior presacral epidermoid tumor



Figure 2: Shows that by an anterior approach it is possible to reach low sacral tumors (Below S-3)

[Figure 3] Shows preoperative and post operative MRI images of excision of low sacral epidermoid (below S3- to Coccyx) in 30 years old male by anterior approach

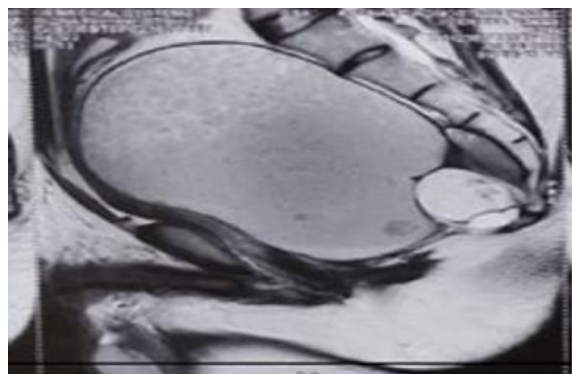


Figure A: MRI shows well defined large loculated septated cystic lesion in lower presacral region. It is seen as heterogeneous hyperintense on t2 wt image (as shown in below figure) and hypointense on t1wt image. Areas of fatty components and tiny calcifications noted within. A lesion was abutting the lower part of sacrum(s3-s5) and coccyx.

The mean age of presentation was 38.20 years as shown in [Table 2].

In, most of the patients, tumor was present below S3, 18(60%) patients followed by S1-S2, 6(20%) patients and S2-S3, 6(20%) patients. [Table 3]

By anterior approach, sacral tumor resection was done in 6 patients in whom tumor was below S-3

(Low level). Posterior approach was performed in rest 24 patients. Out of these 24 cases, 12 patients were having low level sacral lesion (below S-3), 6 patients had high-level (S1-S2) and rest 6 patients were having mid level sacral tumor as shown in [Table 4].

**Table 1: Shows classification of sacral tumors.**

Metastasis	Congenital tumors	Primary bone tumors	Primary neurogenic Tumors
Breast (adult) Prostate (adult) Lung (adult) Rhabdomyosarcoma (pediatric) Neuroblastoma (pediatric) Clear cell sarcoma (pediatric) Malignant schwannoma	Teratoma Hamartoma Dermoid cyst Tarlov cyst Meningocele	Giant cell tumor Aneurysmal bone cyst Chordoma Lymphoma Multiple myeloma Ewing's sarcoma Chondrosarcoma Osteosarcoma Chondromyxoid fibroma	Schwannoma Neurofibroma

**Table 2: Shows Age distribution**

Sr.no	Age in years	No of patients	% percentage
1.	0-20	0	0%
2.	21-40	18	60%
3.	41-60	6	20%
4	>60	6	20%

Mean Age = 38.20 years

**Table 3: Shows level of sacrum involvement**

Sr.no	Levels of sacrum	No of patients	% percentage
1	S1-S2(High-level)	6	20%
2	S2-S3(Mid-level)	6	20%
3	Below S3(Low-level)	18	60%

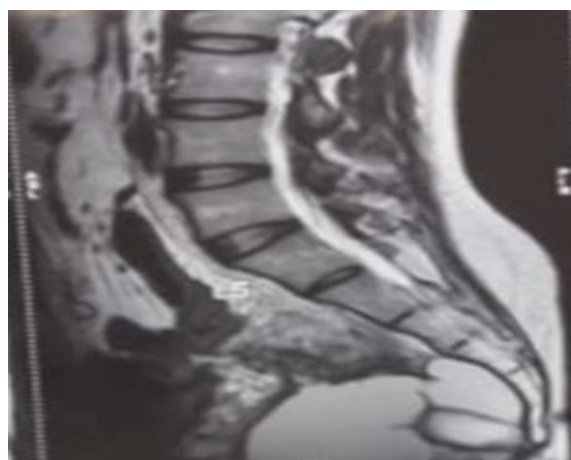
**Table 4: Shows surgical approaches with level of sacrum involvement**

Sr.no	Level of sacrum involvement	Anterior approach	Posterior approach
1	S1-S2(high level)	0	6
2	3.S2-S3 (mid-level)	0	6
3	Below S3(low level)	6	12

**Table 5: Shows histopathological diagnosis**

Sr no	Histopathology	No of patients	Percentage (%)
1	Chordoma	6	20%
2	Epidermoid	12	40%
3	Schwannoma	6	20%
4	Metastatic disease	6	20%

The most common histopathological diagnosis, post operatively was found to be Epidermoid 12(40%) patients followed by chordoma 6(20%), schwannoma 6(20%) and metastatic disease 6(20%) patients.



**Figure B: Post operative MRI image: Shows that maximum solid tumor was resected by anterior approach and only the lower cystic portion densely attached with S-5 and coccyx was left in situ**

## DISCUSSION

Sacral tumors are rare, slow-growing lesions that account for less than 7% of all spinal tumors and present significant challenges for surgical management.<sup>[2]</sup> In our study, we have reported the age and gender of patients, the level of sacral involvement, the surgical approaches used, the histological diagnoses, and the complications encountered in managing these tumors.

### 1. Age and gender distribution

The mean age of presentation in our series was 38.20 years, which is close to the mean age of 37.20 years reported by Wei Sun et al.<sup>[3]</sup> The majority of patients were male (80%), with females comprising only 20%, consistent with the findings of Wei Sun et al., who reported 54.68% males and 45.31% females.<sup>[3]</sup> In our study, the most common age group for

chordomas, epidermoid tumors, and schwannomas was 21-40 years, while secondary sacral metastases were observed predominantly in patients over 60 years of age.

## 2. Tumor location and extent

The most common tumor location of sacral tumors in our study was below S3 (low levels) in 18 cases (60%) followed by S1-S2 (high level) in 6 (20%) patients and S2- S3 (midlevel) in 6 (20%) patients. Our study was in contrast to the study by Wei Sun et al who reported maximum patients of high level 53% (S1-S2).<sup>[3]</sup>

## 3. Radiological investigations

The investigation of choice done in our study was MRI Lumbo-Sacral region with MRI lower abdomen and pelvis to know the extent of tumor location and status of surrounding pelvic organs. CT plain of Lumbo-Sacral region was done to know the involvement of sacral bones. USG KUB with pelvis was done to know the pre and post void residual urine status.

## 4. Surgical procedures

Different surgical levels were selected based on extent of tumor involvement. The extent to which the tumor protrudes pre-sacrally into the pelvic cavity is also one of the key factors that determines the surgical approaches. In 6 patients of high and mid level sacral schwannoma by posterior approach maximum gross total excision of tumor was done. In 6 patients of high level (S1-S2) epidermoid tumor maximum tumor decompression was done by posterior approach while in 6 patients of low lying (below S-3) epidermoid tumor, near total excision of tumor was done by anterior approach. In 6 chordoma patients (below S-3) extensive resection of tumor with sacrectomy (S3-S4-S5) was done and in 6 patients of high level S1 metastatic disease, S1 sacrectomy along with maximum gross total excision of tumor was done preserving more than 50% of SI joint to avoid sacro-pelvic fixation.

### A. Single posterior approach

Out of 30 patients, 24 patients were operated by posterior approach. Out of these 24 patients, 12 patients who were having low level (below S-3) sacral tumors, were operated by posterior approach. 6 patients of mid-level (S2-23) and 6 patients of high level (S1-S2) sacral tumor were operated by posterior approach. Institutions have used posterior only approach in middle, low and distal sacrectomies (4). Tumor invasion into the pre-sacral fascia, rectum and iliac vessels excludes the use of the posterior only approach.<sup>[4]</sup>

### B. Single anterior approach

Out of 30 patients, 6 (20%) patients of low level (below S3) presacral epidermoid tumor was operated by anterior approach.

Our study was in contrast to the study of Angelini and Ruggieri and Fuchs et al who reported posterior only approach for low level sacral lesions below S-3.<sup>[5]</sup>

The decision on whether to operate by an anterior approach depends on the anteroposterior diameter, stage, and characteristic of tumor.<sup>[3]</sup>

We concluded the tumors which are low lying below S3, which have well defined plane in presacral region between tumor capsule and presacral fascia with no involvement of sacral canal and with a large antero-posterior diameter (extend of protrusion into the pelvic cavity) can be easily approachable by anterior approach as shown in below [Figure 2]. There are also contraindications to the anterior approach. These include patients with histories of repeated multiple surgeries via an anterior approach or obese patients whose sacrum are located deeply in the body and whose surgical risks and difficulties are therefore high, single posterior approach is thus indicated in these patients. Tumor wound and presacral hemorrhage are often hard to control during a single anterior surgery. For, an anterior approach, we operated by vertical skin incision, which was given starting 2 cm above umbilicus till 2 cm above pubic symphysis.

### Relationship between sacral nerve preservation and nerve function<sup>[3]</sup>

- When only S-1 nerve root is preserved, anal sphincter function is lost post-operatively.
- When the S-2 nerve roots are preserved bilaterally, bladder and bowel function can be preserved in 50 % of patients.
- When the S-3 nerve roots are preserved unilaterally, most patients retain anal sphincter function.

Out of 25 patients, in 5 patients of chordoma due to extensive resection of tumors bilateral S3-S4-S5 was sacrificed and thus post operatively bladder-bowel incontinence was present in 5 patients.

In 5 patients unilateral S2-S3 was sacrificed and other side S2-S3 nerve root was preserved, So no post operatively bladder – bowel incontinence was noted, and thus we found that in some of the patients with unilateral preservation of S2-S3 nerve roots, bladder /bowel function can be preserved similar to study reported by Sun Wei et al who also concluded the same.<sup>[3]</sup>

In rest 15 patients, all the sacral nerve roots were preserved and thus they have preserved post operative bladder – bowel function.

### Reconstruction of iliolumbar stability

Iliolumbar reconstruction is required in patients with tumor involvement of more than 50% of sacroiliac joints. None of our patients had sacral tumors with more than 50% of Sacro-iliac joint involvement and thus iliolumbar fixation and reconstruction was done in none of our patients.<sup>[6,7]</sup>

### Histopathology

The most common histopathological diagnosis in our series was epidermoid tumor in 12 (40%) patients followed by schwannoma 6 (20%), secondary malignant tumor of sacrum 6 (20%) and sacral nerve schwannoma in 6 (20%) patients.

Our study, contrasted with the study of Wang et al, who reported giant cell tumor as the most common histological diagnosis in 30.6% patients followed by neurofibroma in 23.2% patients.<sup>[1]</sup>

## Complications

The most common complications in our study were sphincter dysfunction in 12(40%) patients, wound infection in 6 (20%) patients, recurrence in 6(20%) patients and post-operative cystic collection of fluid in the pelvis in 6(20%) patients.

Other complications in different studies were severe hemorrhage, damage to adjacent organs, nerve damage, intestinal adhesions, tumor recurrence and failure of posterior incision to heal.<sup>[8-10]</sup>

The mean operative time was 3 hours and the mean blood loss was around 800 ml.

## Follow-up

Follow up was done in all patients every 3 months of discharge for 1 year by clinical examination and by MRI. 6(20%) patients of chordoma had recurrence and was re-operated. None of the 24(80%) patients had recurrence.

A meta-analysis by Yu et al,<sup>[11]</sup> concluded that the surgical margin is the most decisive factor in achieving good disease control in sacral chordomas. Recurrence was lower in patients with wide surgical margins in contrast to inadequate margins.

## Post-operative rehabilitation

Sacral nerve root sacrifice is common in sacrectomy, making the restoration of neurologic function and rehabilitation critical components of successful postoperative management. This can be achieved through a multimodal approach that includes early initiation of in-bed resistance training and progressive mobilization towards sitting, standing, and ambulation as tolerated.<sup>[10]</sup>

A case study by Guo and Yadav demonstrated improved pain control and earlier mobilization with use of lumbar-sacral belt, external orthosis by decreasing lumbar- sacral load and motion during patient transfers and rehabilitation exercises.<sup>[12]</sup>

## Strength of our study

We did the multicenter study and our study is among the few reported studies from India that address the clinical presentation, planning, and management of sacral tumors.

## Limitation of our study

Our study had a limited sample size and lacked an extended follow-up period. Therefore, we believe that further research with larger sample sizes and longer follow-up is necessary to gain more comprehensive information about the characteristics and management of sacral tumors.

## CONCLUSION

Sacral tumors continue to present significant challenges for surgeons, from diagnosis till its surgical management. Key considerations include preserving sacral nerve roots during surgery to maintain postoperative bladder and bowel function,

controlling intraoperative bleeding, selecting the appropriate surgical approach (anterior or posterior), and sometimes planning for sacroiliac fixation. We conclude that with accurate clinical and radiological diagnosis, a thorough understanding of the various pathologies associated with sacral tumors, and careful planning of surgical approaches as outlined in our study, these tumors can be managed more effectively by surgeons.

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