Section: Neurosurgery

Original Research Article

OUR INSTITUTIONAL EXPERIENCES IN THE SURGICAL MANAGEMENT OF SACRAL AND PRESACRAL TUMORS': A STUDY FROM CENTRAL PART OF INDIA

Shashank Nahar[1]

[1]*Assistant Professor, Department of Neurosurgery, MGM Medical College, Indore Madhaya Pradesh, India.*

Received *: 23/04/2024*
Received in revised form *: 09/06/2024*
Accepted *: 24/06/2024*

Corresponding Author:
Dr. Shashank Nahar,
Assistant professor, Department of Neurosurgery, MGM Medical College, Indore Madhaya Pradesh, India.
Email: naharshashank@gmail.com.

DOI: 10.5530/ijmedph.2024.2.168

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (2); 871-876

ABSTRACT

Background: Sacral and presacral tumors are rare and can affect patients of all ages. These are challenging tumors for a surgeon because of their slow growth, lack of clinical presentation and involves the sacral nerves, iliac vessels, and other surrounding structures. These tumors often mimic other common spinal pathologies This study is undertaken to know about the age, gender, histological types, and surgical approaches in management of these tumors, to avoid the dilemma in management of these tumors by surgeons.

Material and Methods: This prospective analytical study was conducted in MGM Medical college & SSH hospital Indore (M.P) and DKS Post graduate institute Raipur (C.G), India. Total of 25 patients admitted between August 2019 to April 2024 were included in this study. The statistical analysis was performed with SPSS version 23.0 for windows.

Results: The mean age of presentation in our series was 41+/- 12.68 years The maximum patients were males 80%. The most common tumor location of sacral tumors in our study was below S3(low levels) in 60% cases. The investigation of choice in our study was MRI Lumbo-Sacral region with MRI lower abdomen and CT plain of Lumbo-Sacral region was done. 5(20%) patients of low level epidermoid (below S-3) was operated by anterior approach while rest of the 20(80%) patients of high, mid, and low-level sacral tumors were operated by posterior approach. The most common histopathological diagnosis post operatively was found to be Epidermoid in 10 (40%) patients. The most common complications in our study were sphincter dysfunctions in 10(40%) patients.

Conclusion: Sacral tumors are still the challenging tumors for the surgeon from its diagnosis till the surgical management. We conclude that, with proper diagnosis clinically and radiologically, understanding the various pathology of sacral tumors and with better planning of surgical approaches as mentioned in our study, these tumors can be better managed by surgeons.

Keywords: Sacrum, sacral tumor, Sacrectomy, bone metastasis, sacral chordoma.

INTRODUCTION

Sacral and presacral tumors are rare and can affect patients of all ages.[1] These are challenging tumors for a surgeon because of their slow growth, lack of clinical presentation and involves the sacral nerves, iliac vessels, and other surrounding structures. These tumors often mimic other common spinal pathologies such as lumbosacral spondylosis.[2] The combination of non-specific symptoms, inadequate diagnostic imaging and clinical rarity contributes to frequent delay in diagnosis of these tumors. The surgical treatment of these tumors is often difficult because of the complex regional anatomy and operating surgeons has to face dilemma between functional preservation and management of these tumors. This

study is undertaken to know about the age, gender, histological types, and surgical approaches in management of these tumors, to avoid the dilemma in management of these tumors. Sacral tumors are classified as mentioned in table no.[2]

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 cystTarlov cyst Meningocele	Giant cell tumor Aneurysmal bone cystChordoma Lymphoma Multiple myelomaEwing's sarcoma Chondrosarcoma Osteosarcoma Chondromyxoid fibroma	Schwannoma Neurofibroma

MATERIAL AND METHODS

This prospective analytical study was conducted in MGM Medical college and SSH hospital Indore (M.P) & DKS Post graduate institute, Raipur (C.G) India. Total of 25 patients admitted between August 2019 to April 2024 were included in this study. We included the patients of all ages who gave the consent for surgery and all types of sacral and presacral tumors who reported to us. MRI and CT scan was done for all patients. For, the analysis of tumor location and distribution, S1-S2 was described as high level, S2-S3 as mid-level and S3 below as a low level. We went by anterior and posterior surgical approaches for resection of these tumors. The statistical analysis was performed with SPSS version 23.0 for windows. Numeric variables were reported as the mean +/- standard deviation. We did the follow up of all patients based on MRI imaging and clinical examination every 3 months of 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

The mean age of presentation was 41+/- 12.68 years as shown in Table no – 2. [Table 2]

In, most of the patients, tumor was present below S3, 15(60%) patients followed by 5(20%) patients and S2-S3, 5(20%) patients. [Table 3]

By anterior approach, sacral tumor resection was done in 5 patients in whom tumor was below S-3 (Low level).

Posterior approach was performed in rest 20 patients. Out of these 20 cases, 10 patients were having low level sacral lesion (below S-3), 5 patients had mid sacral tumor (S2- 3) and 5 patients had high-level (S1-S2) sacral tumor as shown in Table-4. [Table 4]

Figure 1: 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.

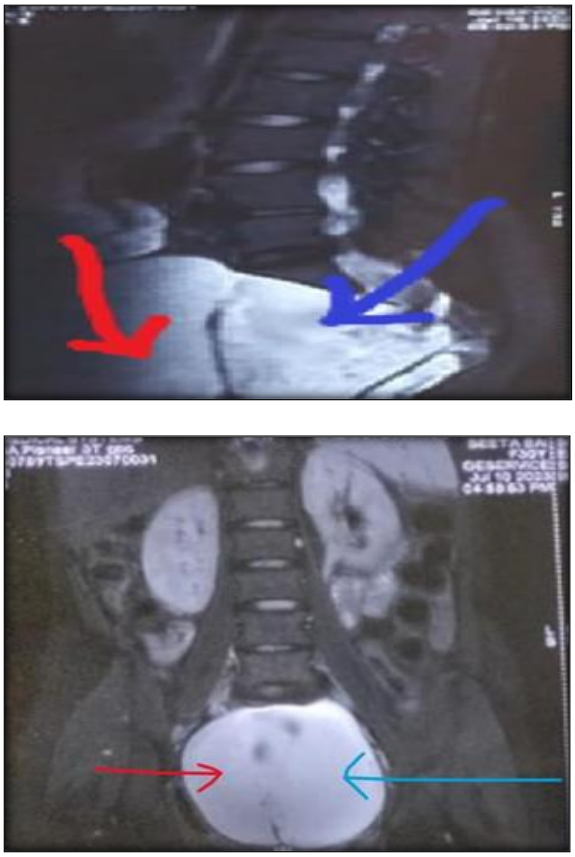

Figure 1: MRI shows a Case of Anterior pre-sacral epidermoid tumor in 30 years old female operated by posterior approach (Red arrow shows bladder and blue arrow shows tumor)

Figure 2: Showing intra-operative images: A defect was present in the anterior dura of S1-S2 thecal cord communicating with capsule of presacral epidermoid tumor

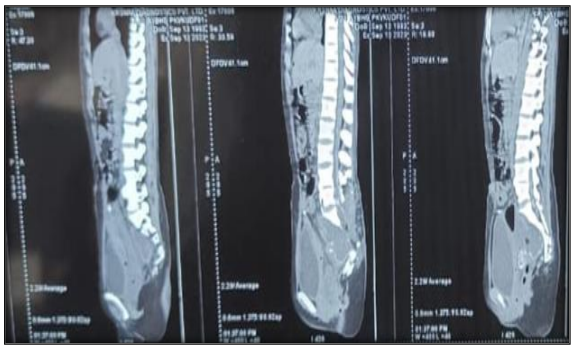

Figure 3: Shows the post op CECT pelvis after decompression of anterior presacral epidermoid tumor

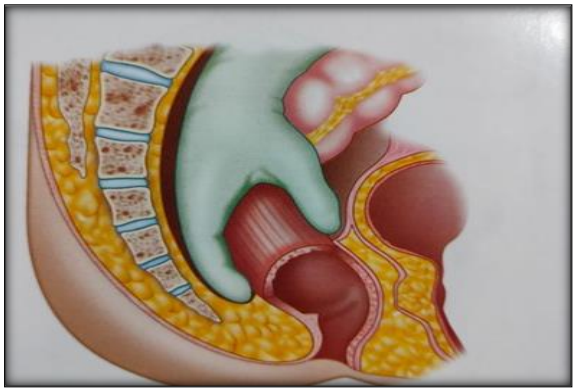

Figure 4: Shows that by an anterior approach it is possible to reach low sacral tumors (Below S-3)

Figure 5: Shows preoperative (Fig A) and post-operative MRI (Fig B) images of excision of low sacral epidermoid (below S3- to Coccyx) in 30 years old male by anterior approach

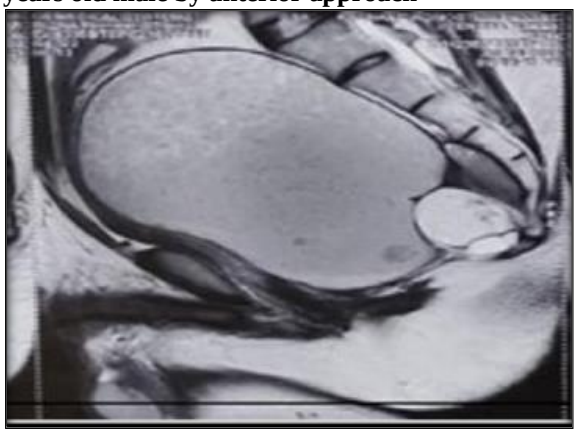

Figure A: MRI SHOWS WELL DEFINED LARGE LOCULATED SEPTATED CYSTIC LESION IN LOWER PRESACRAL REGION. IT IS SEEN AS HETEROGENOUS HYPERINTENSE ON T2 WT IMAGE (AS SHOWN IN BELOW FIGURE) AND HYPOINTENSE ON T1WT IMAGE. AREAS OF FATTY COMPONENTS AND TINY CALCIFIACTIONS NOTED WITHIN. A LESION WAS ABUTTING THE LOWER PART OF SACRUM(S3-S5) AND COCCYX.

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

Table 2: Shows Age distribution

Sr.no	Age in years	No of patients	% percentage
1.	0-20	**0**	**0%**
2.	21-40	**15**	**60%**
3.	41-60	**5**	**20%**
4	>60	**5**	**20%**
Mean age = 41 +/- 12.68 years			

Table 3: Shows level of sacrum involvement

Sr.no	Levels of sacrum	No of patients	% percentage
1	S1-S2(High-level)	5	20%
2	S2-S3(Mid-level)	5	20%
3	Below S3(Low-level)	15	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	5
2	3.S2-S3 (mid-level)	0	5
3	Below S3(low level)	5	10

Table 5: Shows histopathological diagnosis

Sr no	Histopathology	No of patients	Percentage (%)
1	Chordoma	5	20%
2	Epidermoid	10	40%
3	Schwannoma	5	20%
4	Metastatic disease	5	20%

DISCUSSION

Sacral tumors are rare slow growing lesions, accounting for less than 7% of all spinal tumors and are one of the most challenging tumors to manage by surgeons.[2] In our study, we have reported the age and gender presentation, level of sacral involvement, surgical approaches, histological diagnosis, and complications in managing the sacral tumors.

Age and gender distribution

The mean age of presentation in our series was 41+/-12.68 years which was closed to mean age of 43.1 +/- 17 years reported by Wang et al.[1] The maximum patients were males 80% and only 20% patients were females, similar to the study by Sun Wei et al who also reported maximum males 54.68% followed by females 45.31%.[3] Most common age group reported for chordoma, epidermoid tumor and schwannoma in our series were 21-40 years while the secondary metastasis of sacrum was noted in more than 60 years of age group.

Tumor location and extent

The most common tumor location of sacral tumors in our study was below S3(low levels) in 15 cases (60%) followed by S1-S2 (high level) in 5(20%) patients and S2- S3(midlevel) in 5(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).[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.

Surgical procedures

Different surgical levels were selected based on extent of tumor involvement. The extend to which the tumor protrudes pre-sacrally into the pelvic cavity is also one of the key factor that determines the surgical approaches. In, 5 patients of high and mid-level sacral schwannoma by posterior approach maximum gross total excision of tumor was done. In 5 patients of high level(S1-S2) epidermoid tumor maximum tumor decompression was done by posterior approach while in 5 patients of low lying(below S-3) epidermoid tumor, near total excision of tumor was done by anterior approach, in 5 chordoma patients (below S-3) extensive resection of tumor with sacrectomy (S3-S4-S5) was done and in 5 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 25 patients, 20 patients were operated by posterior approach. Out of these 20 patients, 10 patients who were having low level (below S-3) sacral tumors, were operated by posterior approach. 5 patients of mid-level (S2-23) and 5 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.[4]

B. Single anterior approach

Out of 25 patients, 5(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.[5]

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

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 staring 2 cm above umbilicus till 2 cm above pubic symphysis.

Relationship between sacral nerve preservation and nerve function.[3]

- 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.[3]

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.[6,7]

Histopathology

The most common histopathological diagnosis in our series was epidermoid tumor in 10 (40%) patients followed by schwannoma 5 (20%), secondary malignant tumor of sacrum 5(20%) and sacral nerve schwannoma in 5(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.[1]

Complications

The most common complications in our study were sphincter dysfunction in 10(40%) patients, wound infection in 5 (20%) patients, recurrence in 5(20%) patients and post-operative cystic collection of fluid in pelvis in 5(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.[8,9,10]

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. 5(20%) patients of chordoma had recurrence and was re- operated. None of the 20(80%) patients had recurrence.

A meta- analysis by Yu et al,[11] 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

As sacral nerve root sacrifice is common in sacrectomy, restoration of neurologic function and rehabilitation is a critical component of successful post-operative management. This can be achieved through a multimodal approach which include early initiation of in-bed resistance training and progressive mobilization towards sitting, standing and ambulation as tolerated.[10]

A case study by Guo and Yadhav 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.[12]

Limitation of our study

Our study had limited sample size and lacked a longer follow-up. So, we believe that studies with larger sample sizes and longer follow-up period is necessary to get more information regarding the characteristics and management of the sacral tumors

CONCLUSION

Sacral tumors are still the challenging tumors for the surgeon from its diagnosis till the surgical management. Preserving the sacral nerve roots intra-operatively for preservation of post-operative bladder-bowel function, controlling the intra-operative bleed, planning for surgical approaches (anterior or posterior) and sometimes planning for sacroiliac fixation are key considerations while dealing with these tumors.

We conclude that, with proper diagnosis clinically and radiologically, understanding the various pathology of sacral tumors and with better planning of surgical approaches as mentioned in our study, these tumors can be better managed by surgeons.

Funding: None

Conflict of interest: None declared

REFERENCES

1. Wang et al. Epidemiological characteristics of 1385 primary sacral tumors in one institution in China. World journal of surgical oncology.2020;18:297.
2. Fiani B et al. Clinical manifestations, classification, and surgical management of sacral tumors and the need for personalized approach to sacrectomy. Surgical Neurology. Surgical Neurology International.2021;12(209).
3. Wei Sun et al. Surgical Treatment of Sacral Neurogenic Tumor: A 10-year Experience with 64 Cases. Orthopaedic Surgery 2016; 8:162–170.
4. Clarke MJ, Dasenbrock H, Bydon A, Sciubba DM, McGirt MJ, Hsieh PC, et al. Posterior-only approach for en bloc sacrectomy: Clinical outcomes in 36 consecutive patients. Neurosurgery 2012; 71:357-64; discussion 364.
5. Angelini A, Ruggieri P. A new surgical technique (modified Osaka technique) of sacral resection by posterior-only

approach: Description and preliminary results. Spine (Phila Pa 1976) 2013;38: E185-92.
6. Peh WC, Koh WL, Kwek JW, Htoo MM, Tan PH. Imaging of painful solitary lesions of the sacrum. Australias Radiology. 2007; 51:507-15.
7. Puffer RC, Gates MJ, Copeland W 3rd, Krauss WE, Fogelson J. Tarlov cyst causing sacral insufficiency fracture. Oper Neurosurg (Hagerstown) 2017;13: E4-7.
8. Hugate RR, Dickey ID, Phimolsarnti R, Yaszemski MJ, Sim FH. Mechanical effects of partial sacrectomy: When is reconstruction necessary? Clin Orthop Relat Res 2006; 450:82-8.
9. Kemp WL, Burns DK, Brown TG. Pathology of the Bones and Joints. Pathology: The Big Picture. Ch. 19. New York: The McGraw-Hill Companies; 2008.
10. Kiatisevi P, Piyaskulkaew C, Kunakornsawat S, Sukunthanak B. What are the functional outcomes after total sacrectomy without spinopelvic reconstruction? Clin Orthop Relat Res 2017; 475:643-55.
11. Yu X, Kou C, Bai W, et al. Comparison of wide margin and inadequate margin for recurrence in sacral chordoma: a meta-analysis. Spine (Phila Pa 1976) 2020; 45:814-9.
12. Guo Y, Yadav R. Improving function after total sacrectomy by using a lumbar-sacral corset. Am J Phys Med Rehabil 2002; 81:72-6.