



## Original Article

# Marginal Resection of Sacral Chordoma through Posterior Approach: Study of 18 Cases

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### Abstract

The study was carried out to report the results of marginal resection in sacral chordoma using a posterior midline approach. The study was carried out between July 2008 to June 2016, there were 21 patients who underwent the operation. Fourteen patients were male and seven were female and age ranging from 28 and 76 years. All most of the patients presented with pain, sacral mass and neurological deficit. Total sacrectomy and bone reconstruction were carried out in 11 patients. Subtotal sacrectomy was carried out in the remaining ten patients. Patients were followed up for at least seven years. Recovery after the operation was good. Duration of operation ranged between three to six hours. Three to five units blood was transfused in all patients after operation. Bowel and bladder dysfunction were almost all patients. After surgery following local complications including infection and wound disruption occurs in three patients and seroma occurs in two patients. Three patients (14%) had tumor recurrence and one patient expired three years after operation. 18 patients were still tumor-free at long term (seven years) follow-up. Marginal resection of sacral chordoma through posterior approach can be a management plan for sacral chordoma with acceptable results.

**Key words:** Seroma, chordoma, sacrectomy.

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### Introduction

Chordoma is a malignant bone tumor, which rarely found in sacrum. Patients who have the tumor always have a delayed diagnosis. Bone extensively destroyed by the tumor. Surrounding soft tissue invasion is usually found. Marginal resection is still the treatment of choice in chordoma of the sacrum even though most of the patients might have significant complications. Disability of the patients and Neurological complications are the most common complications. The level of tumor involvement affects the severity and extent of

neurological deficit. Both anterior and posterior approaches are used by surgeon. In the posterior approach allows better exploration and protection to neural elements.

On the other hand, anterior approach, visceral organs can be protected and dissected out from the tumours directly. In addition, the posterior approach needed bone reconstruction in total sacrectomy. However, the combined approach is extensive soft tissue damage with a prolonged operative time and prolonged recovery time of the patient. The posterior approach better used on its

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own has been reported. But this posterior technique was not a commonly used operation as great vessels and visceral organs in the pelvis. There have a higher chance of injury during osteotomy. The aim of this study was to present our experience in management of chordoma sacrum by performing a margin resection with a posterior approach only.

### Materials and Methods

Between July 2008 to June 2016, 21 patients who had chordoma of the sacrum were treated at spine unit, Department of Orthopaedic Surgery, BSMMU & other private hospital in Dhaka city. A prospective interventional study with selective inclusion criteria was carried on. All the patients were followed up for seven years after operation and evaluate accordingly.

### Study procedure:

Twenty patients presented with pain and a mass at their sacrum. One patient presented with a sacral mass without pain or neurological deficit. Twelve patients who had pain and a sacral mass also had neurological deficit and neuropathic pain has eight patients. All patients underwent physical examination and investigation including plain radiograph, MRI and bone scan. Open biopsy was carried out via a posterior longitudinal approach when all investigation completed. All biopsies showed typical chordoma with moderate to well differentiated tumours. To locate the extent of the tumor MRI was used. Pre-operative management was carried out as for a major orthopaedic surgical procedure.

### Operative technique:

In the all patient intra-operative bleeding was minimize by hypotensive general anesthesia. After general anesthesia, the patient was positioned in prone position. The skin was prepared and draped from mid back to buttock and posterior thighs. A longitudinal incision was given over the tumor mass extending from three vertebral levels above the lesion to down up to the coccyx. The tumor mass was dissected with biopsy scar. Dissection through fascia and muscles was performed down to the bones with the help of electro-cautery. Two to three cm of gluteal muscles were preserved to provide an adequate tumour-free margin around

the tumor. Dissection was done to identify the spinous processes and lamina of L3 to L5. Both posterior inferior iliac spines and posterior superior iliac spines were identified and dissection was performed to expose the posterior part of both iliac crests, both iliac wings and ala of the sacrum. Dissection was also done through the anterior aspect of the posterior iliac crests. Dissection was then carried out along the posterior part of both iliac wings to expose both sciatic notches. The superior gluteal vessels must be identified and protected in the sciatic notch. Blunt dissection under the rim of sciatic notch was done and a certain number of rolled radio-opaque gauze swabs were packed under the iliac wing and ala of sacrum. Gauze packs help to push the visceral organs and great vessels away from iliac wings, ala of sacrum and the bodies of lower lumbar vertebra and sacrum. During the osteotomy procedure, vital organs should be protected. Then laminectomy was performed. All nerve roots were identified and dissected the tumor mass. We tried to preserve nerve roots as much as possible.

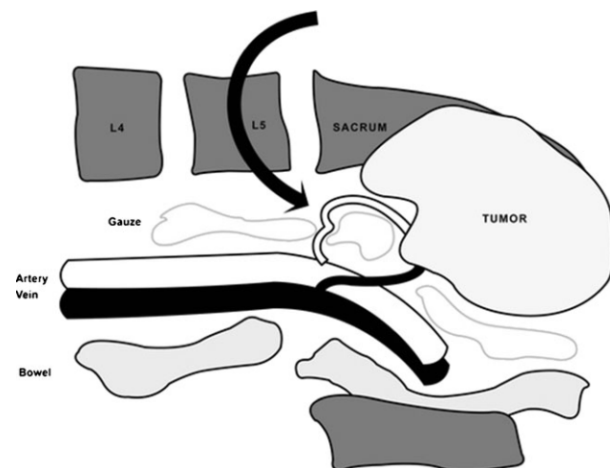


Figure1. Per-operative diagrammatic picture

Dissection was carried out along the anterior aspect of the posterior iliac crests. A number of rolled gauzes were used to pack under the iliac crests and anterior to the body of lower lumbar vertebra and sacrum in order to push viscera and great vessels away from the bones.

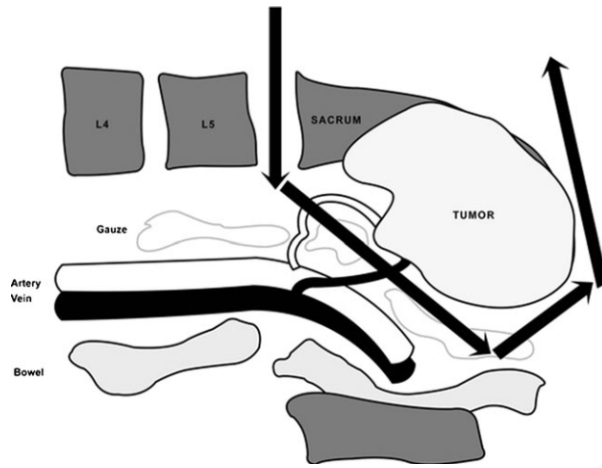


Figure 2. Per-operative diagrammatic picture

An osteotome mass have to be cut and gauze packing could protect the visceral and great vessels. Then, an image intensifier as well as the relationship of bone lesion in the MRI and intra operative findings was used to carefully re-evaluate the margin of resection. 2–3 cm away from the tumor margins, small Steinmann pins were superficially fixed on the iliac wing and the lower lumbar spines. These were used to fix the line of the osteotomy so that a tumour-free margin is ensured. The normal vertebral body or the disc above the tumor was cut with an osteotome in the postero-anterior direction. It was applied to cut the both the posterior iliac crests. Then, a bone hook was placed at the upper surface of the cut vertebra above the lesion and the hook was pulled up to rotate the sacrum and the tumor mass posteriorly. The pre-vertebral space could be explored with this technique. All feeding vessels as well as the sacral nerves were dissected out from the tumor. The L5 nerve roots which usually pass closely anterior to the ala of sacrum were identified and protected. By this L5 nerve identification of the sacral plexus was done.<sup>6</sup> All the gluteal muscles above the sacral plexus were cut by using electrocautery. Exploration of sacral plexus was done on both sides. The sacrospinous and sacrotuberous ligaments on both sides were identified and cut. The mobilization of the cut sacrum with the tumor was easily done to facilitate blunt and sharp dissection between the tumor mass

and the visceral organs. All bleeding points were secured after removal of the sacrum and the tumor.

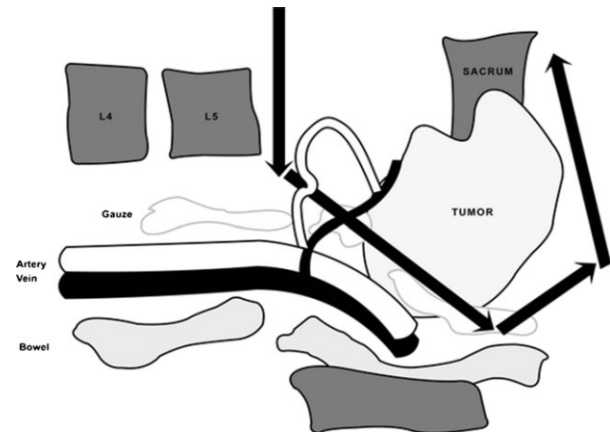


Figure 3: Per-operative diagrammatic picture

After cutting the body of the upper most vertebra and the iliac wings, the sacrum with the tumor could be rotated backward by the use of a bone hook. The tumor mass was examined for the free margin and all findings were noted. To minimize blood loss from the raw surface of the cut bones, bone wax was used also. The Urogenital diaphragm reconstruction was done with Dacron mash. Composite auto-allogenic bone graft and pedicular screw and plate or pedicular screw and rod system were used for stabilization between the ilium and spine for the patient who underwent total sacral resection. For the patient with partial sacrectomy, all still had enough stability of the axial skeleton so that instrumentation was not needed to apply. Repairing of the skin and the rest of the soft tissue were done. Bulky pressure dressing was applied to close the dead space and to minimize blood loss. On the third day post-operative day, the surgical wound was examined and pressure dressing was re-applied. Wound complications were identified if there were any. Re-evaluation of neurological signs was done. To determine the osteotomy site, plain radiograph was taken post-operatively.

#### Follow-up:

Stitches removal was done at the end of the second week after the operation. Histopathological examination of the tumor mass was studied to identify the tumor margin. At the ventral aspect of

the tumor, the criteria of tumor free margin were marginal. Radiotherapy at the average dose of 3,500–4,500 Gy was administered to minimize local tumor recurrence in the patients who did not have tumor free margin as has been mentioned. At every post-operative follow up, physical examination including neurological examination of the lower limbs and perianal area, per rectal examination and plain radiograph of chest, sacrum and lower lumbar spine were carried. During the first two years post operatively, the patient was followed-up every three months. Then, follow up was done at every six months interval between the third and fifth years after the operation. After that, the patient was followed-up yearly. MRI of the lumbar spine and sacrum was carried half yearly during the first two years and then yearly for the later follow-up.

### Results:

Partial sacrectomy was done in all patients. Sacrectomy up to S3 was done in 16 patients & up to S2 level in 5 patients. The average operative time ranged between three to five hours. Average intra-operative blood loss was around 1,200 ml. The average postoperative drain tube collection was around 475 ml. All patients needed blood transfusion from three to five units. Infection and skin necrosis was found in three patients. After debridement, local flap and hamstring muscle flap were used for soft tissue reconstruction in these patients and all healed satisfactorily. Two patients had a seroma and they were managed well by repeated aspiration and pressure dressing. Eleven

patients developed neuropathic pain post-operatively. Eight patients having pre-operative neuropathic pain had neuropathic pain after the operation. All were managed well by anti-neuropathic administration. Visual analog scales of pain severity were used to assess pain in the patients, and it was ranged between 0.5 and 3 at four months after operation. Seven patients had a definite tumor-free margin in histopathological examination. The rest (14 patients) had a marginal tumor-free margin at the ventral aspect and there was no tumor contamination. But the margins at the gluteal muscles were too close which was less than 2 cm. In these patients, radiotherapy was used. In these patients, no significant complication was found except for one who had radiation colitis. This 52-year-old male upon had sacrectomy up to S2 level. His complaints were lower abdominal pain and bleeding per rectum which responded well with symptomatic and supportive treatment. None of the patients had tumor recurrence at two year follow up. At the three-year post-operative follow-up, one female patient had local tumor recurrence. Successful re-operation was carried in this patient. At later follow-up, she was tumor free. There was no tumor recurrence or metastasis at five-year follow-up. At the seven-year follow-up, two patients were found to have recurrence at their pelvises with generalized metastasis. One patient had passed away due to generalized metastasis of the tumor, including lung and bones.

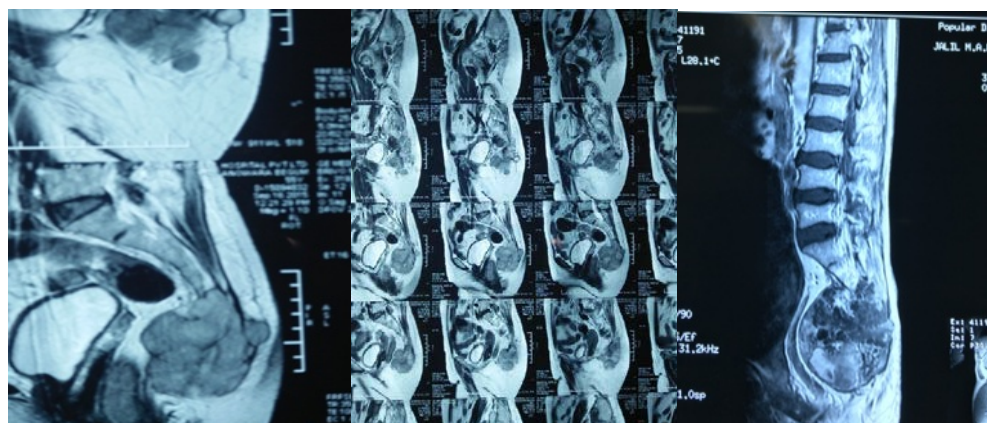


Figure 1: Pre-operative MRI



Figure 2: Intra-operative picture

### Discussion:

Marginal resection is still the best treatment in chordoma of the sacrum even though most of the patients have permanent neurological deficit after surgery. The chances of local recurrence of the sacral chordoma<sup>9</sup> will decrease after resecting the tumor as completely as possible.<sup>9</sup> Percentages of being tumor free have been reported to be about 80% at the five-year follow-up after complete resection. During the surgery the patients who have gross tumor contamination, significantly shorter tumour-free period than the ones who underwent marginal resection. In case of our patients, marginal resection was carried out to lessen recurrence rate and to reduce the tumour-free period by the posterior approach. Most authors preferred a combined anterior and posterior approach to provide a proper approach to the tumor.<sup>4,14</sup> To minimize blood loss hypotensive anesthesia was also used during the operation; however, all patients had blood loss around 1300 ml. We noticed that all patients had prolonged operative time, ranging from 2-5 hours. Wound complications and long-time bed rest were also commonly found in the patients. Where the patient who had large sacral mass that goes anteriorly and near to the pubic symphysis, great vessels and visceral organs were usually displaced upward and laterally. When the greater sciatic notch and posterior iliac crest were identified, we could introduce a large number of rolled gauzes

underneath the ala and the body of sacrum. We found that these gauzes were lies in between the visceral organs and bones. With a large number of gauzes packing under the bones, vessels and all visceral organs were pushed away from the anterior surface of sacrum and bodies of lower lumbar spines. However, the packed gauze could provide a tamponade effect to intra pelvic venous plexus which decrease less intra-operative bleeding. This procedure has been used in our patients successfully. There were no patients who had injury to their visceral organs or great vessels during bone cutting from the posterior approach. Sacral tumours in our patients were removed completely with free margin about seven patients (30%) and no patient had tumor contamination during the surgery. No great vessel or visceral organ injury in the pelvis and close to the tumor mass was observed. All patients recovered well after the operation. About 14 patients had less than 2 cm of normal sparing gluteal muscles on the postero-lateral side, even though no gross tumor contamination and a histopathologically tumour-free margin were observed. Radiotherapy was used in these 14 patients. Our findings could be compared to another report concerning adequate safe margins.<sup>11-14</sup> The tumor recurrence rate and tumour-free period of our patients were comparable to other reports. Tumor recurrence rate in our patients was 14% (3/21) at the seven-year follow-up which was also slightly less than

the previous reports, ranging between 26 and 40%.<sup>11-14</sup> The tumor free period of our patients was 86% at the seven-year follow-up which slightly better than most previous reports which ranged between 56 and 77%.<sup>1-5,11-15</sup> The lower tumor recurrent rate in our patients might be the result of both the use of radiotherapy and surgical technique. Blood transfusion needed in all patients. Average 3-5 unit of blood needed in all patient. This figure was better than previous reports that indicated blood transfusion of more than eight units was required in most of the patients.<sup>4-5</sup> Gauze packing under the bones to be cut during surgery could reduce intra-operative blood loss. Gauze packing under the bones could provide a pressure effect on intra pelvic venous plexus and result in less blood loss. Neuropathic pain after partial sacrectomy should be studied in detail because this was the burden the patient's quality of life. One required a second operation and there were five patients who had post-operative complication. The complication rate of our patients seemed to be less than the other reports.<sup>1-5, 11-15</sup> However, there were no serious complications including great vessels injuries, great vein thrombosis, pulmonary embolism or bowel and bladder injuries in our patients.

### Conclusion:

Marginal resection of chordoma of sacrum using a posterior approach body of sacrum during bone cutting was safe with better results in terms of remaining tumour-free and reduces blood loss. This procedure may be used for other common primary malignant sacral tumours.

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