Emisacrectomy, experience in 11 cases

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Abstract Emisacrectomy is a challenging surgery in the treatment of tumours that affect the sacrum. Authors report their experience in 11 cases affected by tumours of the sacrum (9 chordomas, 1 ependymoma, 1 monostotic bladder metastasis) operated on at the Orthopaedic Department of A.S.O. S. Giovanni Battista Molinette in Turin, Italy, from 1998 through 2005 discussing planning surgery, level of osteotomy, functional and oncological results and complications of the treatment at a median follow-up of 5 years (range 2–9), describing the surgical and medical teaching learned from the treatment of these patients. Despite the potential complications, emisacrectomy can be performed successfully and is an important procedure in the treatment of sacral tumours.

Keywords Emisacrectomy · Sacral tumour

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Introduction

Sacral tumours are relatively rare and experience related to resection of these tumours is, therefore, usually limited to a small number of patients. Surgical removal according to Steiner and Campanacci in radio- or chemio-resistant tumours or associated to adjuvant therapy is the treatment of choice [1, 2]. When the first sacral vertebra is not involved, total sacrectomy is not mandatory, avoiding problems related to the reconstruction of the mechanical continuity between the spine and the pelvis [3–5], but subtotal sacrectomy (emisacrectomy) remains a challenging surgery. The extensive sacral resection and the complexity of the amputation, mechanical and neurological consequences, the respect of oncological margins and possible occurrence of local and systemic complications affect the clinical results [6, 7]. The purpose of this retrospective study was to review the author's experience in emisacrectomy in sacral neoplasm over the last 10 years.

Materials and methods

Eleven patients with tumours of the sacrum were surgically treated between 1998 and 2005 at Orthopaedic Unit of S. Giovanni Battista Hospital in Turin (Italy). Six males and five females aged 61 (57–73) were followed up for a mean of 5 years [2–9]. All patients complained of back pain since 3 years in media and received long-time physical and medical therapy for a misleading diagnosis of lumbar arthrosis. The sacral mass was occasionally detected during anal exploration for constipation in seven cases, in one case because of kidney colic. All patients were studied with X-rays, CT and NRM. Angiography was performed in large tumours to visualize relationships with internal iliac,

mid-sacral and gluteal arteries and when large cavities were observed in the sacral mass.

The histopathologic diagnoses, confirmed by CT pre-op guided biopsy through a point of the estimated surgical incision, were chordoma in nine patients, ependymoma in one case, monostotic bladder metastasis in one patient.

The surgical margin was wide in all cases, planned on CT and NRM. In the first patient operated for a bulky chordoma, surgery was preceded by internal iliac vessels embolization, but a postembolization syndrome (nausea, sciatic and lumbar pain and fever for 24 h) occurred delaying surgery. In all patients, a subtotal horizontal sacrectomy was performed at S1–S2 level in seven cases and at S2–S3 in two removing tumours of larger size or previously irradiated through a combined approach (anterior–posterior), at S3–S4 in two cases for smaller tumours operated through a single posterior approach. In cases of combined approach, ventral access to the sacrum was achieved via a transabdominal route through a midline incision to provide a superior exposure of the presacral space, of the tumour vascular supply and easy dissection of visceral structures. Iliac internal arteries were isolated and prepared routinely before exposing the mass and the anterior sacral artery frequently occluded by the compression was clamped, the retrovesical reflection of the peritoneum was cut and the rectosigmoid colon mobilized. In very large presacral tumours that extended almost to the symphysis pubis, a temporary colostomy was performed, closed 2 months later if some rectal tone reappeared or left definitive when S2 roots were sacrificed. In combined approach, the posterior incision was carried out along an arcuate intertrochanteric line with the apex in L5–S1 leaving a subcutaneous strip which was reflected distally to expose the gluteal muscles until to the apex of the coccyx. A simple median longitudinal incision was performed in smallest and more distally located tumours during a single posterior approach. Tumours were always removed en bloc in all patients through the posterior approach. The empty space left by the resection was reconstructed with an accurate and progressive suture of the gluteal fascia using a posterior mash to close the retroperitoneal space only in the first case operated. Two deep and one subcutaneous drainages were left for 3 days after accurate haemostasis. Surgery mean time was 9 h (18–8) for the combined approach, blood loss was estimated on 1,500 cc in media during surgery, greater from epidural veins during the L5-sacrum laminectomy carried out to expose the dural sac, and 1,200 cc in postoperative time from drainages. All patients had subintensive therapy for 24 h.

During hospital stay, three patients treated by a combined approach showed posterior wound dehiscence in the middle part of the incision that closed spontaneously in 1 month, delaying hospital discharge. The first case operated

developed at the 3rd postoperative day the necrosis of the posterior wall of the rectum with perforation and deep infection although inspection during surgery showed a normal blood supply. Revision surgery through an anterior approach provided closure of the rectum and removal of the mash. Hospital stay was 31 days (15–51). Sparing S1 roots, all patients at discharge walked with crutches wearing a lumbosacral corset for 30 days.

Results

The median follow-up time was 5 years, ranging between 4.5 years (25° percentile) and 6 years (75° percentile). At the last control at our hospital, all patients could walk with independent ambulation using crutches in three cases (27%), referring irregular back pain with no difference irrespective of the level of osteotomy. No fracture of the remaining sacrum segments or lumbosacral instability either posterior or perineal visceral hernias was detected. Sphincter activity was normal when S3 was spared bilaterally and some residual late bladder function was present in two S2 bilateral sparing. Three cases (27%) of the nine chordomas had a local recurrence (along the osteotomy line in two, throughout gluteus muscle fibres in one case in which tumour mass with large cavities fractured during posterior removal) and required revision surgery (one time in two, three times in one patient) leaving always S1 segment intact. In one patient, a bilateral L4–S1 laminotomy for L5 root decompression because of oncoming L4–L5 lumbar stenosis was added to revision surgery during the third surgery performed 9 years later. Four patients (36%) died with median overall survival of 4 years (range 2–6), two from visceral metastasis in recurrent chordomas after 4 and 6 years, respectively, one for the evolution of the primitive tumour after 2 years and one patient affected by a chordoma from other general causes after 4 years. They were ambulant until the tumour progressed. At present, six patients (55%) are alive with no evidence of disease.

Discussion

Tumours of the sacrum are mostly benign aggressive lesions or low-grade malignancies that progress slowly expanding out of sacral cortex limits, prevalently on the anterior surface pushing against visceral, vascular and neurological structures in the pelvis. Less frequently in bulky forms, posterior growth of the tumour can change the profile of the buttocks. Early diagnosis often is difficult because symptoms of bowel, bladder and epigastric and sacral plexus compression became evident late and the patient has been treated meantime for more common

pathologies. CT and NRM that could detect the initial forms generally show tumours of large size, sacral and iliac osteolysis, spinal canal and sacral foramina invasion and relationship with surrounding structures and define the margins of resection, the level of the sacrum osteotomy and surgical approach.

Angiography is rarely indicated in tumours when diagnosis is difficult or when cavernous vascular spaces or cavities of haemorrhage and necrosis suggest a hypervascularized lesion like in large chordomas, giant cell tumours or aneurismal bone cyst where radiotherapy or embolization may precede surgery. Embolization in sacral tumours must be indicated only in selected cases to prevent blood loss, because postembolization syndrome with nausea, vomiting, low-grade fever, pain and sciatica for a ischemic neuropathy is a potential complication of any pelvic embolization such as gluteus muscular mass necrosis, that decrease the walking autonomy of the patient at discharge instead of S1 sparing, and rectal posterior wall ischaemia. It is our surgical impression that embolization worse blood loss from epidural veins during sacral laminectomy because of impaired blood flow in the pelvis.

Percutaneous needle CT guided biopsy may be diagnostic before surgery to recognize radio- and chemio-

sensible tumour to complete treatment with adjuvant therapy before or after surgery. The needle puncture should be carefully planned along the estimate surgical incision in all cases to facilitate the resection of the bioptical tract and tumour at the time of definitive therapy.

The goal of the surgical treatment is the “en bloc” sacral resection of the tumour with wide and free margins but controversies exist between the respect of oncological limits and surgical sacrifice because it may be associated with substantial functional impairment and possible numerous complications such as bowel and bladder dysfunction and gait abnormality [8] according to the surgical approach and the level of osteotomy [9]. Most of these tumours arise from the inner part of the sacrum and from the coccyx and generally are bulky at first observation. When tumour size is <5 cm or is located distally to S3, foramen neoplasm can be removed by a single posterior approach (Fig. 1) [10]. Surgery is relatively easier because sacral osteotomy is performed below the sacroiliac joint and less invaliding because S3 roots are spared. Larger tumours need a combined exposure to isolate anterior structures of the pelvis (Figs. 2, 3) but high amputation increases the morbidity and the risk of complications during or after surgery.

Fig. 1 **a** R.A., female 45 years, low back pain. Casual diagnosis of a small chordoma of the sacrum during MRI for suspected lumbar discopathy. **b** Resection by posterior approach through a S3–S4 osteotomy

Fig. 2 **a** M.V., male of 51 years, casual diagnosis of ependymoma during kidney colic. **b** Tumour invades the sacrum distally to S1. **c** Emisacrectomy S1–S2 through combined approach and colostomy with S2 spared on one side. Normal walking but definitive colostomy and incomplete bladder function

Following partial sacrectomy extensive soft tissue defects are created with a communication between the abdominal cavity and the central gluteal region. The closure of the wound could be difficult especially in large tumours leaving an empty cavity that predispose to ematomas, increasing blood loss and deep infection, making walking difficult for gluteal insufficiency in spite of S1 roots left intact and predispose to sacral hernias through the pelvic floor. Gluteus maximus or abdominal myocutaneous flaps has been proposed for definitive closure of these large defects [11, 12], posterior mesh repair also fixed to bone with anchors have been advocated to close the dead space and to fix the gluteal fascia [13–15]. In our experience, the accurate closure of the peritoneum and a progressive suture of the gluteal fascia starting from the most lateral edges of the wound with a progressive traction of the muscles towards the median line has permitted the closure of the cavity without dead spaces left and a good gluteal function during walking at discharge. The only mesh implanted in

the first case operated was removed for the oncoming of a deep infection after rectal necrosis acting as a foreign body.

Theoretically, biomechanical limitations to radical resection of the tumour exist when wide resection is necessary for complete disease control and surgical reconstruction of the mechanical stability of the pelvis ring has also been advocated for emisacrectomies [16]. Although mechanical tests on human cadaver pelvis suggest considering reconstruction, we did not observed any fracture or lumboileosacral instability after partial sacrectomy also when a subtotal S1 vertebral body was left in place because iliosacral ligaments supported well the spine. We believe that instrumentation and ileo-lumbar arthrodesis, which are difficult to achieve [17], are not mandatory, extending the surgical time and exposing to further complications.

Nerve root transections are necessary to achieve wide margins for tumour control [18, 19]. Bowel and bladder function was retained when S3–S4 osteotomy with preservation of S3 nerves bilaterally was performed but some

Fig. 3 **a** Bulky sacral chordoma invading the pelvis.
b Bowel and bladder are pushed against the pelvis.
c Emisacrectomy at S2–S3 through combined approach

mechanical difficulties were relieved in one patient for a long time after anococcygeal ligament compromising. When S2 was spared bilaterally, all patients had no bowel function but in two (18%) incomplete bladder control developed during time.

Local recurrence in the resected end of the gluteus maxims muscle has been observed in sacral chordomas despite well-planned surgical management in patients in whom pre-operative magnetic resonance imaging indicated no invasion of the tumour into surrounding soft tissues [20]. In our patients, we had three relapse on nine chordoma operated on (27%) at 5 years of follow-up (mean 3–9) observed along the osteotomy line in two and for cells dissemination through gluteus maximus muscle fibres for tumour fracture during posterior removal. The authors, therefore, recommend to perform resection in chordomas over an adequate osseous margin, including a larger osseous edge and a part of soft tissues such as fibres of gluteus maxims or piriformis muscle in larger forms because of the

infiltrating behaviour of the tumour. Leaving some muscle around the pseudocapsula also avoids an unadvertised penetration of the tumour during dissection and does not affect the ambulation. Care must be observed in manipulation during posterior enucleating of the mass especially in presence of large cavities. Strict surveillance because of frequent recurrence and late onset of metastasis for their aggressive treatment is advising.

The value of resection for locally recurrent rectal or bladder cancer remains controversial but carefully selected patients without other metastasis may benefit from resection to resolve local pain and to favour chemotherapy [21].

In conclusion, emisacrectomy is a demanding bony and neurological amputation that must consider mechanical, functional and oncological consequences. Discussion concerns to perform an intentional transgression to oncological principles for functional purpose. In our experience, the spine remained stable without need of any instrumentation to preserve or restore the ileolumbosacral junction and,

therefore, if not requested by the size and extension of the tumour, complete sacrectomy is not mandatory in these pathologies. Tumour must be resected intact “en bloc” to avoid local recurrence with osteomuscular edges wider than what could be planned on the imaging, especially in chordomas, sacrificing neurological structures required. Bilateral sparing of S3 preserves sphincter function. The empty space created by the resection can be restored in dimension and function by an accurate muscular tissues suture without the use of meshes or flaps. Pre-operative embolization is not mandatory compared to the complications of the procedure.

Considering little number of cases analysed and the different types of tumours evaluated, statistical analysis cannot be performed.

Conflict of interest statement None of the authors has any potential conflict of interest.

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