Total sacrectomy



Magnetic resonance imaging-CT fusion and 3-dimensional reconstruction techniques using an intraoperative CT scanner with image-guided navigation to aid preoperative planning and surgical resection of sacral chordomas can be used for planning en bloc surgical resections and for more precisely identifying tumor margins intraoperatively ¹⁾.

Adverse effects of sacrectomy: if S2 nerve roots are the most caudal nerve roots spared, there is \approx 50% chance of normal bladder and bowel control. If S1 or more cephalic roots are the most caudad nerve roots spared, most will have impaired bladder control and bowel problems.²⁾.

The main goal of any total sacrectomy is to completely remove aggressive tumor involving S1 and lower. Although this is a technically demanding procedure, and one that is associated with major complications, this procedure provides a disease-free survival benefit ^{3) 4) 5) 6)}.

Total sacrectomy is an accepted treatment for aggressive tumors involving the entire sacrum. Because of the instability and discontinuity between the lumbar spine and pelvis, most surgeons perform spinopelvic reconstruction to facilitate early mobilization and better ambulation ^{7) 8) 9) 10) 11) 12) ^{13) 14) 15) 16) 17)}.}

However, some surgeons prefer not to perform bony reconstructions after sacrectomy because some patients can ambulate and to avoid the risk of implant-related complications ^{18) 19) 20) 21)}.

The usual procedure for partial sacrectomies in locally advanced colorectal cancer combines a transabdominal and a posterior sacral route. The posterior approach is flawed with a high rate of complications, especially infections and wound-healing problems. Anterior-only approaches have indirectly been mentioned within long series of rectal cancer surgery.

In cases of rectal cancer involving the low sacrum, the combination of a transabdominal and a perineal route to carry out the partial sacrectomy is a feasible approach that avoids changes of surgical positioning and the morbidity related to posterior incisions. This strategy should be considered when deciding on undertaking partial sacrectomy in locally advanced rectal cancer²²⁾.

Aggressive sacral tumors often require en bloc resection and lumbopelvic reconstruction.

Instrumentation failure and pseudarthrosis remain a clinical concern to be addressed. The objective in this study was to compare the biomechanical stability of 3 distinct techniques for sacral reconstruction in vitro. METHODS In a human cadaveric model study, 8 intact human lumbopelvic specimens (L2-pelvis) were tested for flexion-extension range of motion (ROM), lateral bending, and axial rotation with a custom-designed 6-df spine simulator as well as axial compression stiffness with the MTS 858 Bionix Test System. Biomechanical testing followed this sequence: 1) intact spine; 2) sacrectomy (no testing); 3) Model 1 (L3-5 transpedicular instrumentation plus spinal rods anchored to iliac screws); 4) Model 2 (addition of transiliac rod); and 5) Model 3 (removal of transiliac rod; addition of 2 spinal rods and 2 S-2 screws). Range of motion was measured at L4-5, L5-S1/cross-link, L5-right ilium, and L5-left ilium. RESULTS Flexion-extension ROM of the intact specimen at L4-5 (6.34° ± 2.57°) was significantly greater than in Model 1 (1.54° \pm 0.94°), Model 2 (1.51° \pm 1.01°), and Model 3 $(0.72^{\circ} \pm 0.62^{\circ})$ (p < 0.001). Flexion-extension at both the L5-right ilium (2.95^{\circ} \pm 1.27^{\circ}) and the L5left ilium $(2.87^{\circ} \pm 1.40^{\circ})$ for Model 3 was significantly less than the other 3 cohorts at the same level (p = 0.005 and p = 0.012, respectively). Compared with the intact condition, all 3 reconstruction groups statistically significantly decreased lateral bending ROM at all measured points. Axial rotation ROM at L4-5 for Model 1 (2.01° \pm 1.39°), Model 2 (2.00° \pm 1.52°), and Model 3 (1.15° \pm 0.80°) was significantly lower than the intact condition $(5.02^{\circ} \pm 2.90^{\circ})$ (p < 0.001). Moreover, axial rotation for the intact condition and Model 3 at L5-right ilium (2.64° \pm 1.36° and 2.93° \pm 1.68°, respectively) and L5-left ilium (2.58° \pm 1.43° and 2.93° \pm 1.71°, respectively) was significantly lower than for Model 1 and Model 2 at L5-right ilium (5.14° \pm 2.48° and 4.95° \pm 2.45°, respectively) (p = 0.036) and L5-left ilium (5.19° \pm 2.34° and 4.99° \pm 2.31°) (p = 0.022). Last, results of the axial compression testing at all measured points were not statistically different among reconstructions. CONCLUSIONS The addition of a transverse bar in Model 2 offered no biomechanical advantage. Although the implementation of 4 iliac screws and 4 rods conferred a definitive kinematic advantage in Model 3, that model was associated with significantly restricted lumbopelvic ROM²³⁾.

Videos

Radical Sacrectomy and Reconstruction for a High-Grade Primary Sarcoma of the Sacrum

<html><iframe width="560" height="315" src="https://www.youtube.com/embed/mkvDii-5Gv4" frameborder="0" allow="accelerometer; autoplay; encrypted-media; gyroscope; picture-in-picture" allowfullscreen></iframe></html>

Operative technique

For the anterior approach, Kiatisevi et al., used a longitudinal midline incision from 5 cm above the umbilicus down to the lower abdomen. Using a transperitoneal approach, they identified both ureters and cleared them off from the tumor and ligated both internal iliac arteries and veins and the middle sacral vessels. The rectum is mobilized off the tumor if possible. Then the disc of L5–S1 (or L4–L5) was exposed and partially removed. They used the anterior approach in patients who had large tumors and in most patients we were unable to identify the lumbosacral plexus or the sacroiliac joint. However, gauze was packed anterior to the tumor, which was intended to isolate the tumor from the rectum, ureters, and vessels and to use as landmarks for posterior osteotomies. A drain was placed and the abdominal incision was closed layer by layer. Then the patient was rolled to the prone position preparing for a posterior approach.

For the posterior approach, the midline longitudinal incision was used or three-limbed incision depending on the extension of the tumor to the lateral aspect. The dissection is carried down just lateral to the sacrum to release the presacral fascia, the sacrotuberous ligaments, the sacrospinous ligaments, and the piriformis. Lower sacral nerve roots were also ligated and cut. Laminectomy was performed to identify the most caudal nerve roots to be preserved, which was already determined from the MRI. These roots were traced down to the sciatic nerves and were protected. The dural sac was ligated and divided below the preserved nerve roots. The disc of L5-S1 (or L4-L5) was identified and divided by using a sharp chisel to connect to that from the anterior approach surgery. Next, the iliac wings were exposed. The vertical osteotomies of the sacrum were performed by using multiple sharp osteotomes at appropriate areas depending on the predetermined type of sacral resection as described earlier. The sacral tumor specimen now was mobilized from its surroundings. They then were able to rotate the specimen and dissect the anterior connective tissue, vessels, and rectum off. These osteotomies should be performed before dissecting the anterior soft tissue, especially when using the posterior approach only. While dissecting the anterior soft tissue off the tumor, blunt dissection is not recommended because it can cause much bleeding from vessels torn and when the torn vessels retract anteriorly, it is very difficult to identify and control. With completion of these procedures, the specimen was completely removed. Then bony and soft tissue margins of the specimens and the patient were inspected. Any questionable tumor contamination areas were reresected ²⁴⁾.

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