Gluteus Maximus Turnover Flap for Sacral Osteomyelitis After Radiation Therapy

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abstract

Developments in radiation therapy modalities offer alternative treatments for unresectable malignant tumors in the pelvis and trunk. However, poor vascularity as a result of radiation therapy makes the treated lesion susceptible to infection, and there are no established treatments for pelvic osteomyelitis with a large dead space after radiation therapy. The authors report 2 cases of sacral osteomyelitis after radiation therapy that were treated successfully with a gluteus maximus turnover flap. To create the flap, the distal portion of the lower third of the muscle was detached from the trochanter. The distal edge of the flap was turned toward the sacral defect and sewn to the remnant of the sacrum, which filled the dead space with the muscle bulk. A 68-year-old man with a recurrent sacral chordoma was treated with carbon ion radiation therapy; however, a sacral infection developed 5 months later. Debridement and a course of antibiotics could not control the infection and did not induce sufficient formation of granulation tissue in the large and deep dead space. The turnover flap with both gluteus maximus muscles cured the deep-seated infection and closed the wound. A 58-year-old woman had sacral osteoradionecrosis with infection. A turnover flap created with the left gluteus maximus muscle controlled the infection and closed the wound after the first operation, a V-Y flap, failed. This study showed that a gluteus maximus muscle turnover flap effectively controlled infectious lesions with large and deep dead space around the sacrum. [Orthopedics. 2015; 38(7):e651-e654.]
Recent developments in radiation therapy modalities, such as intensity-modulated radiation therapy and carbon ion radiation therapy, offer alternative treatments for unresectable malignant tumors in the pelvis and trunk. The reported 5-year local control rate for sacral chordoma treated with carbon ion radiation therapy was 88%. Osteoradionecrosis is considered an important late complication after megavoltage radiation therapy, although it is rare in the pelvis. In addition, skin problems and a poor vascular supply as a result of radiation therapy make the treated lesion susceptible to infection, and the management of such lesions is difficult. Various procedures have been reported to cover sacral ulcers or fill sacral dead space without infection; however, few reports include appropriate treatment of sacral osteomyelitis with a large dead space after radiation therapy.

This report describes 2 cases of sacral osteomyelitis after radiation therapy that were treated successfully with a gluteus maximus turnover flap.

**CASE REPORTS**

**Patient 1**

A 68-year-old man with a sacral chordoma underwent wide excision. After 22 months, magnetic resonance imaging scan detected a local recurrence invading the remnant sacrum, which was treated with carbon ion radiation therapy. Five months later, infection had developed in the sacral body and the retrorectal space (Figure 1A). Debridement and a course of antibiotics, including cefazolin and sulfamethoxazole/trimethoprim, did not control the infection with *Escherichia coli* and *Streptococcus anginosus* in the deep dead space (Figure 1A). A unilateral turnover flap employing the left gluteus maximus muscle was used to supply vascularity and control the infection. The pathologic diagnosis of the specimen during surgery was necrotized tissue. Gram-positive bacteria were present in large numbers. Postoperatively, the patient received imipenem/cilastatin for 1 week and ampicillin/sulbactam for an additional 2 weeks. The turnover flap filled most of the dead space except the lesion under the flap, in which infection remained. A secondary turnover flap using the right gluteus maximus muscle was made 7 weeks after the first turnover flap. The secondary flap filled the dead space completely and controlled the infection (Figure 1C). When examined 2.5 years after the secondary turnover flap, the wound remained free of infection.

The turnover flap with gluteus maximus muscle was created as follows: After a skin incision was made from the sacrum to the greater trochanter, along with the lower end of the gluteus maximus muscle, the distal portion of the lower third of the muscle was detached from the trochanter (Figure 2A). The vascular pedicle was dissected to the origin of the inferior gluteal vessels. The distal edge of the flap was turned toward the sacral defect and sewn to the remnant of the sacrum, which filled the dead space with the muscle bulk (Figure 2B).

**Patient 2**

A 58-year-old woman had previously received radiation therapy for a pelvic tumor of unknown pathologic diagnosis. Approximately 30 years later, a sacral ulcer appeared (Figure 3A). Biopsy showed a pathologic diagnosis of osteoradionecrosis with infection and infiltration of inflammatory cells. A simple debridement procedure and administration of antibiotics, including piperacillin and cefazolin, did not resolve the inflammation, and a V-Y bilateral gluteus maximus myocutaneous advancement flap did not control the infection. Culture at the V-Y flap site showed *E coli*, *Enterococcus faecalis*, and *Morganella morganii*, although no bacteria were microscopically observed in the specimen. Approximately 4 months after the V-Y flap was made, a turnover flap with the remaining left gluteus maximus muscle was performed. *Pseudomonas aeruginosa* was detected at the surgical site, and the patient received 2 weeks of treatment with imipenem/cilastatin, 1 week of treatment with cefotaxime, and 1 week of treatment with ceftazidime postoperatively. A skin graft was performed 6 weeks after the turnover flap was made, and wound closure was achieved (Figure 3B). The wound remained closed 4 years after the turnover flap procedure.

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**Figure 1:** Preoperative T2-weighted coronal magnetic resonance imaging scan showing osteoradionecrosis and a large dead space around the sacrum (A). Gross findings of the lesion. A deep and large dead space with infection from the retrorectal area to the skin was noted (B). Postoperative T2-weighted coronal magnetic resonance imaging scan. Turnover flaps using the gluteus maximus muscle filled the dead space completely (C).
**Discussion**

The current report described 2 cases of osteomyelitis after radiation therapy. Both patients were successfully treated with a turnover flap using the gluteus maximus muscle. In both cases, the infection was not controlled by debridement alone, although the organisms responsible for the infection were not resistant to multiple drugs. There were 3 requirements for the treatment of these cases: the need to transfer tissue with abundant vascularity to the sacral dead space, the option for salvage if the grafted tissue became infected or necrotized, and the need for a simple procedure.

Debridement led to insufficient granulation tissue and infection control in these patients. One reason seemed to be poor vascularity. During debridement surgery, little bleeding from the necrotic lesions in the sacrum was observed. In patient 2, the pathologic diagnosis was osteoradionecrosis, radiation-induced ischemic necrosis of bone with soft tissue necrosis. Use of a V-Y bilateral gluteus maximus myocutaneous advancement flap did not cure osteoradionecrosis with infection in patient 2. That flap just covered the infected necrotic sacrum and did not provide adequate vascularity to the deep lesions. A gluteus maximus adipomuscular turnover flap to fill the dead space after sacral chordoma resection seemed to be an appropriate treatment method. However, fat tissue has fewer blood vessels than muscle.

Debridement around the sacral area after radiation therapy is often incomplete because of the difficulty of dissecting scar tissue from the surrounding important organs, such as the rectus and sacral nerves. As a result of incomplete debridement, infected tissue may remain in the sacral cavity. Therefore, salvage procedures must be prepared for these situations. Lin et al reported the usefulness of a free latissimus dorsi muscle flap for the treatment of osteoradionecrotic precoccygeal defects. Their report showed that wound infection occurred after the graft, although it could be cured without removal of the muscle flap. However, if the inferior gluteal artery also became infected and damaged, salvage would be difficult. If surgical sites are infected, the risk that surgically treated tissues may be vulnerable to infection should be considered during surgical planning. Furthermore, local vessels may not be suitable for anastomosis because of previous radiation therapy.

Because of the need to fill dead space with well-vascularized tissue, the possible need for salvage, and the simplicity of the procedure, a turnover flap with the gluteus maximus muscle was used in these cases. In patient 1, a unilateral turnover flap did not completely cure the infection and magnetic resonance imaging scan showed remaining dead space under the flap. However, a secondary operation with a contralateral flap that was grafted with the same method completely filled the cavity and controlled the infection. This procedure uses a simple pedicled flap, so there is no need for a 2-team approach and there is no concern about problems with a vascular anastomosis. In addition, even if the superior gluteal artery is sacrificed during tumor resection, the flap can be used with a blood supply from the inferior gluteal artery, and vice versa. Previously, Koh et al reported the same method for filling dead space after sacral chordoma resection, although their patients had no history of radiation therapy and no infection. The current study showed that a turnover flap could be used for an infected wound to suppress bacterial growth; however, of course, preoperative infection control is important for the success of the flap. In addition to this method, various procedures can be used after resection of sacral...
tumors, such as a vertical rectus abdominis myocutaneous flap and free muscle flaps.\(^9\) If necessary, these flaps can be used for salvage in the current procedure.

The authors successfully treated 2 cases of intractable osteomyelitis of the sacrum that occurred after radiation therapy with gluteus maximus muscle turnover flaps. This method is effective for controlling infectious lesions with a large and deep dead space around the sacrum.

**References**


