Total or subtotal sacrectomy is often required to treat sacral chordomas. The only effective treatment for this slow-growing malignant primary bone tumor is en-bloc surgical resection with wide margins usually combined with high-dose radiation therapy. Both anterior and posterior exposures are often required to ensure negative margins. The surgery results in massive perineal and sacral defect. The reconstruction of this cavity is challenging and there are no standard guidelines on how to select the best option. It is imperative to obliterate the dead space between the pelvis and the gluteal region to avoid secondary perineal eventration and seroma formation. Several reconstructive approaches have been described after resection, classically including the transpelvic vertical rectus abdominis musculocutaneous flap, gluteus musculocutaneous flap, and omental flap, which can be combined or not. Recipient vessels are difficult to access at the defect site, making free flap-based reconstructions challenging and, therefore, not the preferred option. Repair with well-vascularized soft tissue to promote wound healing is important due to the frequent need of adjuvant radiation. As reconstruction with local tissues is the most appropriate, we aim at describing an innovative and reproducible method to repair extensive three-dimensional sacral defects. Reduction of morbidity and complication rate of the reconstructive surgery is taken into consideration. We present a clinical case where we used acellular dermal matrix and double pedicled gracilis muscle flap combined with gluteal fasciocutaneous rotation flap.

CASE PRESENTATION

A 70-year-old man presented with locally invasive sacral chordoma. The magnetic resonance imaging revealed a 7.2 cm × 6 cm × 7.6 cm sacral tumor invading up to S2 nerve root and involving piriform muscles. Staged surgery was planned. After a laparoscopic abdominoperineal...
amputation with terminal colostomy, we performed a high sacral amputation though the level of S1-S2 disc with preservation of the S1 nerve root and the two superior thirds of the sacroiliac joints to preserve a maximum of stability. The en-bloc resection of the tumor was achieved via a posterior approach incorporating the sacro-spinalis, gluteus, and the piriform muscles. The gluteal vessels were exposed and preserved. A lumbopelvic stabilization was not necessary. Nevertheless, pelvic ring continuity was reinforced by the bi-disciplinary spinal team using bilateral sacroiliac cannulated screws.

The defect was initially covered using an ABTHERA Open Abdomen Negative Pressure Therapy dressing (Kinetic Concepts, Inc., (KCI), San Antonio, TX, USA). The final histologic result confirmed an R0 resection. We proceeded to the reconstruction with the aim of limiting the donor site morbidity in this ambulatory patient and avoiding postoperative herniation of the abdominal content, a well-known complication. We first harvested bilateral gracilis flaps in a prone position through a longitudinal incision without including a skin paddle (Fig. 1). The main neurovascular pedicle was identified and dissected to allow easy rotation without tension. The patient was turned to supine position, and the double pedicled gracilis flaps were advanced through a 4-cm-wide subcutaneous tunnel (Fig. 2).

To cover the defect between the promontory and the bladder, an acellular dermal matrix (Cellis rectopexy medynamic) was then placed using an onlay technique. The mesh was anchored to the remaining bone cranially and sutured to the bladder posteriorly (Fig. 3).

The gracilis flaps were then sutured together and secured without tension to the sacrum via their tendon to cover the mesh. Finally, the overlying soft tissue defect was reconstructed with a unilateral gluteal fasciocutaneous rotation flap partially deepithelialized to fill the dead space. Three drains were left, one intrabdominal and two subcutaneous. The donor sites were closed directly. The operative time was 8 hours. The drains were kept for approximately 3 weeks.

No surgical reconstruction-related complications were observed, with flaps and donor sites healing uneventfully.

After 3 days in the intermediate intensive care and 22 days in the plastic surgery department, the patient was transferred to the rehabilitation center. Walking was resumed after 2 weeks and sitting after 4 weeks. Satisfying outcomes both functionally and cosmetically for both patient and surgeons were observed at 9-months follow-up (Fig. 4). Notably, we observed complete recovery of preoperative ambulatory function, including walking without limitation or need for support. The patient was able to receive radiation therapy without complications.

Fig. 1. Bilateral gracilis muscle flaps harvested with the patient in a prone position through a longitudinal incision without including a skin paddle.

Fig. 2. Double pedicled gracilis muscle flaps advanced through a 4-cm-wide subcutaneous tunnel with the patient in a supine position.

Fig. 3. Acellular dermal matrix (Cellis rectopexy medynamic) anchored to the remaining sacral bone cranially and to the bladder posteriorly using an onlay technique to cover the defect between the promontory and the bladder.
DISCUSSION

The trend for reconstruction strategy and flap selection for sacral defects is mainly based on the size of the defect according to Garvey et al. For large defects, the vertical rectus abdominis musculocutaneous flap is the most used, although for patients who have undergone laparotomy and/or require ostomies, it is usually not an option. Moreover, it weakens the abdominal wall. The gluteal myocutaneous flap is also used to treat smaller defects, but as Ramirez et al described, compromise of ambulatory function is a concern with deficit noted during forceful activities. More recently, numerous articles promote muscle preservation in reconstruction whenever possible, especially postural muscles. Sparing the abdominal and gluteal muscles offers numerous other advantages; it diminishes pain, postoperative rehabilitation time, and intraoperative bleeding while meeting the imperative of reconstruction. The use of the gracilis flap for perineal reconstruction was first described in 1976. It has since proven its usefulness to obliterate pelvic defects. It provides sufficient vascularized bulk, as it can be bilateral, the pedicle is reliable, and the dissection is straightforward with minimal donor site morbidity. The perforator fasciocutaneous gluteal rotation flap is the alternative we chose for the overlying soft tissue and skin defect because of its reduced morbidity obtained by sparing the gluteus muscle, its reliable blood supply, and its satisfactory appearance. Furthermore, compared with muscle flaps, this fasciocutaneous flap does not experience long-term atrophy and provides durable cover to this pressure-bearing area.

Sacral herniation of the abdominal content is another lesser known complication after sacrectomy, that occurs after denervation atrophy of the pelvic floor muscles following sacrectomy, as they are innervated by branches of S2-S5 and increase of intra-abdominal pressure. The use of an acellular matrix to create a pelvic diaphragm has been widely reported and is recommended as an adjunct to the overlying soft tissue defect reconstruction. The matrix restores the posterior abdominal wall and reduces the intrapelvic dead space.

CONCLUSIONS

Large sacral defects can successfully be reconstructed with a double pedicled muscle gracilis flap combined with a gluteal fasciocutaneous rotation flap. The association with acellular dermal matrix is recommended to avoid abdominal cavity organ herniation. The oncological and functional results are satisfying with minimal donor site morbidity.

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