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Hemicorporectomy: back to front

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Abstract. Hemicorporectomy involves amputation of the pelvis and lower extremities by disarticulation through the lumbar spine with concomitant transection of the aorta, inferior vena cava, and spinal cord, as well as creation of conduits for diversion of the urinary and fecal streams. A review of the literature reveals that the surgical technique has been relatively unchanged since 1960. The standard anterior to posterior approach is associated with significant blood loss and morbidity, likely contributing to lengthy hospital stay. Herein, we describe our back-to-front approach to hemicorporectomy, involving early division of the vertebral structures and spinal cord, pre-empting engorgement of Batson's plexus, thus minimizing blood loss. In addition, this approach greatly improves exposure of the pelvic vessels, allowing for a technically less challenging and safer procedure.

Hemicorporectomy involves amputation of the pelvis and lower extremities by disarticulation through the lumbar spine with concomitant transection of the aorta, inferior vena cava, and spinal cord, as well as creation of conduits for diversion of the urinary and fecal streams. Originally described by Kredel[1] in 1950, the first hemicorporectomy was performed by Kennedy et al[2] in 1960, with Aust and Absolon[3] and Aust and Page[4] reporting the first long-term survival after the procedure. To date, 57 cases have been reported in the literature, although undoubtedly more have been performed.

A review of the literature reveals that the surgical technique has been relatively unchanged since 1960. Hemicorporectomy typically is performed in 2 stages. During the first stage, conduits for diversion of both the urinary and fecal streams are constructed. The second stage involves amputation of the pelvis and lower extremities by disarticulation through the lumbar spine with concomitant transection of the aorta, inferior vena cava, and spinal cord in an anterior to posterior approach. Based on our institutional experience with this approach (8 cases), blood loss ranges from 2 to 12 L, morbidity is 100%, and patients can spend up to 7 months in the hospital for recovery and rehabilitation. Disarticulation through the lumbar spine and division of the spinal cord is associated with untoward blood loss and neurogenic hypotension, which likely contributes to morbidity and length of hospital stay. After ligation of the inferior vena cava, Batson's plexus becomes engorged, leading to a more challenging dissection and marked blood loss during division of the vertebral structures and spinal cord. Having experienced this problem in prior cases, we used a back-to-front approach with early division of the vertebral structures and spinal cord, pre-empting engorgement of Batson's plexus, thus minimizing blood loss and

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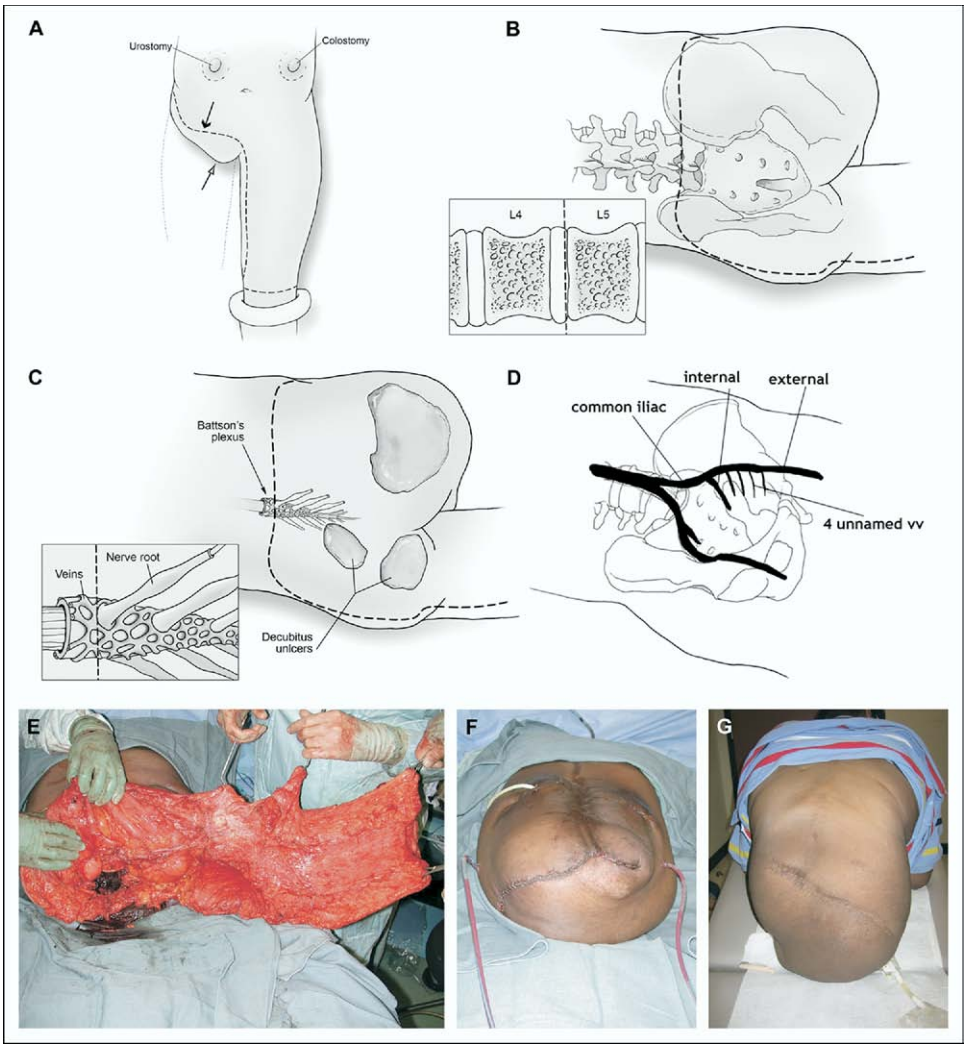

Figure 1 (A) Trunk and subtotal thigh flap incisions are denoted with a solid arrow, amputated segment is denoted by an unshaded arrow; (B) amputation through L4-5 level posteriorly; (C) Batson's plexus within the epidural fat is not engorged with blood when transected before ligation of the inferior vena cava; (D) multiple unnamed posterior tributaries of the external iliac vein; (E) left subtotal thigh fillet musculocutaneous flap is rotated to cover the lower abdominal wound; (F) subtotal thigh flap inset and closed in 4 layers; and (G) appearance of the inferior trunk at the 18-month follow-up evaluation.

neurogenic hypotension. In addition, this approach greatly improved exposure of the pelvic vessels, allowing for a technically less challenging and safer procedure. Herein, we describe our current surgical technique for hemicorporectomy.

Case report

In 2005, a 43-year-old man with T6 paraplegia presented for evaluation of nonhealing sacral decubitus ulcers and biopsy-proven chronic pelvic osteomyelitis. His osteomyelitis was recalcitrant to multiple long-term courses of antibiotic therapy. He had undergone a colostomy, an ileal conduit urostomy, and a right hemipelvectomy because of decubitus disease. Given the nature and extent of his pelvic osteomyelitis, the only remaining surgical option with the potential for cure was hemicorporectomy.

Surgical technique

The patient is prepped circumferentially from the level of the nipples to the feet and the anterior and posterior trunk incisions are marked along with the left subtotal thigh flap (Fig. 1A). The patient is positioned into a modified left lateral decubitus position. The incision for amputation is started just above the table top, to the left of the vertebral column, and carried down through the soft tissues to the thoracodorsal fascia, which is incised exposing the L4, L5, and S1 posterior elements (Fig. 1B). A posterior spinal osteotomy and bilateral facetectomy exposes Batson's plexus (Fig. 1C). As opposed to a standard approach, the vena cava is still patent so Batson's plexus is not engorged and is transected easily using bipolar electrocautery. Intradural lidocaine (1%) is administered to prevent spinal shock and the nerve roots are transected using bipolar electrocautery. The dura is closed with

6-0 Prolene (Ethicon Inc., Cincinnati, OH) and closure is confirmed by multiple Valsalva maneuvers to 40 cm H_2O. The annulus of the L4-5 disc space is incised, completing the posterior portion of the case.

The table is tilted to the right to allow dissection of a musculocutaneous flap over the ala of the ilium. At this point, rotation of the inferior half of the body to the right (right buttock rotated down towards the table top) greatly facilitates exposure of the right iliac vessels. At the level of the right common iliac artery, inflammation caused by chronic pelvic osteomyelitis is less pronounced, allowing for relatively facile division of the vessel.

Concomitant with the retroperitoneal dissection, a second team begins to prepare the subtotal thigh fillet musculocutaneous flap. We have found that disarticulation of the knee provides a handle that assists with this portion of the procedure. Dissection continues around the lateral portion of the left thigh to free the quadriceps femoris muscle. Having reached the femur laterally, dissection is carried superiorly in the plane between the vastus lateralis and biceps femoris muscles to the posterior brim of the left ala of the ilium. After freeing the lateral portion of the flap, dissection is started medially by ligating the superficial femoral artery at the adductor hiatus and continuing in a plane between the adductor Magnus and the semimembranosus muscles. The investing fascia of the superficial femoral artery pedicle serves as the deep margin of the flap. Dissection along the anterior surface of the femur is accomplished, with a few small branching vessels of the superficial femoral artery encountered and ligated.

With the subtotal thigh and anterior abdominal wall flaps raised from the right, as well as the superficial femoral artery and associated veins identified from below, proximal and distal vascular control are obtained easily to allow safe completion of the dissection and removal of the pelvis. The left common iliac artery and vein are visualized easily and dissection is continued to the bifurcation of the left iliac vessels. We have noted the presence of multiple unnamed posterior tributaries of the external iliac vein that are large and quite friable secondary to pelvic inflammation as well as venous engorgement (Fig. 1D). The benefit of addressing these vessels from the left lateral decubitus position versus the supine position cannot be overemphasized. The ability to visualize these veins from both superior and inferior perspectives owing to sequential rotation of the lower half of the body allows these venous branches to be divided close to their junction with the external iliac vein. The amount of scarring and inflammation in this area is impressive and during previous cases with the patient in the supine position, difficulty with dissection was encountered because of poor exposure causing tearing of these venous tributaries. Surprisingly, this difficulty was obviated by this change in positioning.

The left subtotal thigh fillet musculocutaneous flap is rotated to cover the lower abdominal wound (Fig. 1E). The flap is inset by securing the fascia of the flap to the fascia of the abdominal wall anteriorly and the fascia of the paraspinous muscles posteriorly (Fig. 1F). Closure is accomplished in 3 layers over closed suction drains.

Follow-up evaluation

The patient was extubated on postoperative day 1 and required only 2 days of monitoring in the intensive care unit. The total length of his hospital stay was 58 days and he was discharged on postoperative day 54 after completing extensive inpatient rehabilitation. The patient's last follow-up evaluation was at 2.3 years after surgery, at which time he had no recurrent decubitus ulcers (Fig. 1G). He leads an active social life, lives independently, and even drives a car.

Comments

A review of the literature identified 14 cases of hemicorporectomy performed for intractable pelvic osteomyelitis. Although only 2 of these 14 patients were reported as deceased at the last follow-up evaluation, hemicorporectomy was associated with significant morbidity and lengthy hospital stay. Based on our institutional experience, blood loss ranges from 2 to 12 L, and patients spend an average of 127 days in the hospital for recovery and rehabilitation. During prior hemicorporectomies performed at our institution, the standard anterior to posterior surgical technique was used. Critical appraisal of our technique led to the hypothesis that disarticulation through the lumbar spine and division of the spinal cord is associated with untoward blood loss and neurogenic hypotension. During this case, using the back-to-front approach with early division of the vertebral structures and spinal cord with Batson's plexus flaccid, decreased blood loss, and potentially limited perioperative morbidity and length of hospital stay. The estimated blood loss was only 700 mL and the patient was discharged on postoperative day 54. With hemicorporectomy being performed infrequently, there are limited opportunities to modify and improve existing techniques. We believe that the markedly improved surgical exposure, significant reduction in blood loss, and decreased length of hospital stay resulting from our modifications warrant report of our current surgical technique. We have found this surgery to be well tolerated in paraplegic patients with intractable pelvic osteomyelitis and would submit that this procedure greatly improves quality of life in carefully selected patients.

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