28

Periacetabular Resections

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OVERVIEW

The traditional treatment of periacetabular sarcomas has been a classical hemipelvectomy; that is, an amputation through the sacroiliac joint and symphysis pubis. Limb-sparing surgery, i.e. periacetabular resection and reconstruction, has been notoriously difficult. Tumors of the periacetabular area are difficult to treat and traditionally have a high complication and morbidity rate. The surgical alternatives for reconstruction of a periacetabular defect have been iliofemoral arthrodesis, ischiofemoral arthrodesis, or flail extremity. Within the past decade the development of a saddle prosthesis by Waldemar-Link (Hamburg, Germany) has made the reconstruction of periacetabular defects more satisfactory and has dramatically decreased surgical morbidity.

The surgical anatomy of the pelvis must be well understood in order to perform a periacetabular resection safely. The key to success is wide exposure both anteriorly, i.e., retroperitoneal (ilioinguinal incision) and posteriorly, a large gluteus maximus fasciocutaneous flap to expose the retrogluteal area. The retrogluteal area consists of the ilium, sciatic notch, sciatic nerve, and hip joint. This combined exposure permits safe dissection of large tumors of the acetabulum and preservation of the important neurovascular and visceral structures. Reconstruction can easily be performed through this approach.

Imaging studies are extremely important in order to determine the extent of the tumor within the periacetabular region of the pelvis. The tumor must be confined to the lower portion of the ilium and the periacetabulum but may extend into the pubic rami. Specifically, a combination Type II and III pelvic resection can be performed versus a pure Type II, periacetabular resection. CT, MRI, and bone scan is required to determine the level of iliac resection as well as the sites of the other osteotomies.

Angiography is required to determine iliac vessel displacement, especially the hypogastric (internal iliac) artery, and venography is utilized to determine the presence of intramural tumor thrombi. The hypogastric artery is usually ligated. CT scan, in conjunction with MRI, is useful to determine the extraosseous component and the extension into the pelvis as well as the retrogluteal area.

The utilitarian incision of the pelvis is used to expose the retroperitoneal area to mobilize the iliac vessels and to mobilize the tumor. The superior pubic ramus is identified anteriorly by retraction of the iliac femoral vessels. Posteriorly, the sciatic notch in the ilium is identified and an osteotomy is performed through the sciatic notch with the sciatic nerve protected. The third osteotomy is through the ischium or the posterior column, depending on the exact location of the tumor. The entire periacetabular tumor can then removed posteriorly after detaching the sacrospinous ligament

Several different methods of reconstruction have been developed over the past two decades: ischiofemoral arthrodesis, pelvic allograft, iliofemoral arthrodesis, and a flail hip; however, this chapter will emphasize the use of the saddle prosthesis. The chapter will discuss the use of the saddle prosthesis, its unique surgical and technical considerations (especially of a notchplasty) and the muscle reconstruction required in order to obtain a good functional result.

INTRODUCTION

Five percent of primary malignant bone tumors involve the pelvis. Osteosarcoma in adolescents, Ewing's sarcoma in children, and chondrosarcoma in adults are the most common primary sarcomas in this location. More commonly, though, neoplasms involving the pelvis occur as a result of metastatic spread from the breast, lung, prostate, kidney, or thyroid. Diffuse involvement of the pelvis is often seen, but bony destruction of the periacetabulum is of greatest concern as patients often present with severe pain and dysfunction that may not respond to limited weight-bearing and radiotherapy alone.

Tumors arising in the periacetabular region of the pelvis pose a difficult problem (Figure 28.1). Classically, hemipelvectomy was the primary means of surgical intervention. With the advent of aggressive chemotherapy, better imaging studies and more advanced surgical techniques, limb-sparing resections have been carried out for primary malignancies of the pelvis and metastatic lesions that have failed other forms of treatment. Periacetabular resections should accomplish the goal of achieving an adequate tumor resection with minimal morbidity followed by a reliable and functional reconstruction. Techniques of surgical reconstruction include: ischiofemoral arthrodesis, iliofemoral arthrodesis, pelvic allograft, custom prosthesis, flail extremity, and, more recently, a custom saddle prosthesis.

Given the complexity of the anatomy and the use of adjuvant therapies that require an uncomplicated and expedient postoperative recovery, osseous pelvic resections remain one of the greatest surgical challenges. This chapter will discuss the senior author's experience with saddle prostheses as a means of safe, reliable, pelvic reconstruction.

UNIQUE ANATOMIC CONSIDERATIONS

Pelvic Muscles

The pelvis is virtually covered by muscle that acts as a barrier to tumor extension into adjacent vessels and nerves. This is especially true of tumors arising in the ilium and periacetabular region.

1. *Iliacus*. This muscle provides protection from tumors extending from the inner cortex of the ilium. It often contains the tumor until it becomes very large, and usually provides an adequate margin of resection.
2. *Gluteus medius and minimus.* These muscles cover the superior and inferior aspects of the outer cortex of the ilium.
3. *Piriformis.* This muscle, which extends from the sacrum to the greater trochanter, fills the greater sciatic notch and tends to protect the sciatic nerve from tumors that extend in this area.

Neurovascular Bundle

1. *Femoral vessels and nerve*. Tumors arising from the superior pubic ramus are close to these structures (see Figure 28.1). A thick neurovascular sheath usually protects them from tumor extension. If necessary, the femoral vessels and nerve can be carefully dissected free from the sheath, leaving it with the resected specimen.
2. *Sciatic nerve*. Tumors extending from the ilium into the sciatic notch may be immediately adjacent to this nerve. Usually the nerve is not directly infiltrated and can be dissected free from the tumor pseudocapsule.

Bladder/Urethra

The bladder is separated from the anterior pubis by thick fibrous tissue that is an extension of the pecten pubis and the retropubic fat. The urethra, located just inferior to the symphysis pubis, is separated from it by the arcute ligament. The surgeon must protect these structures when dealing with tumors arising from the anterior pelvis.

Sacroiliac Joint

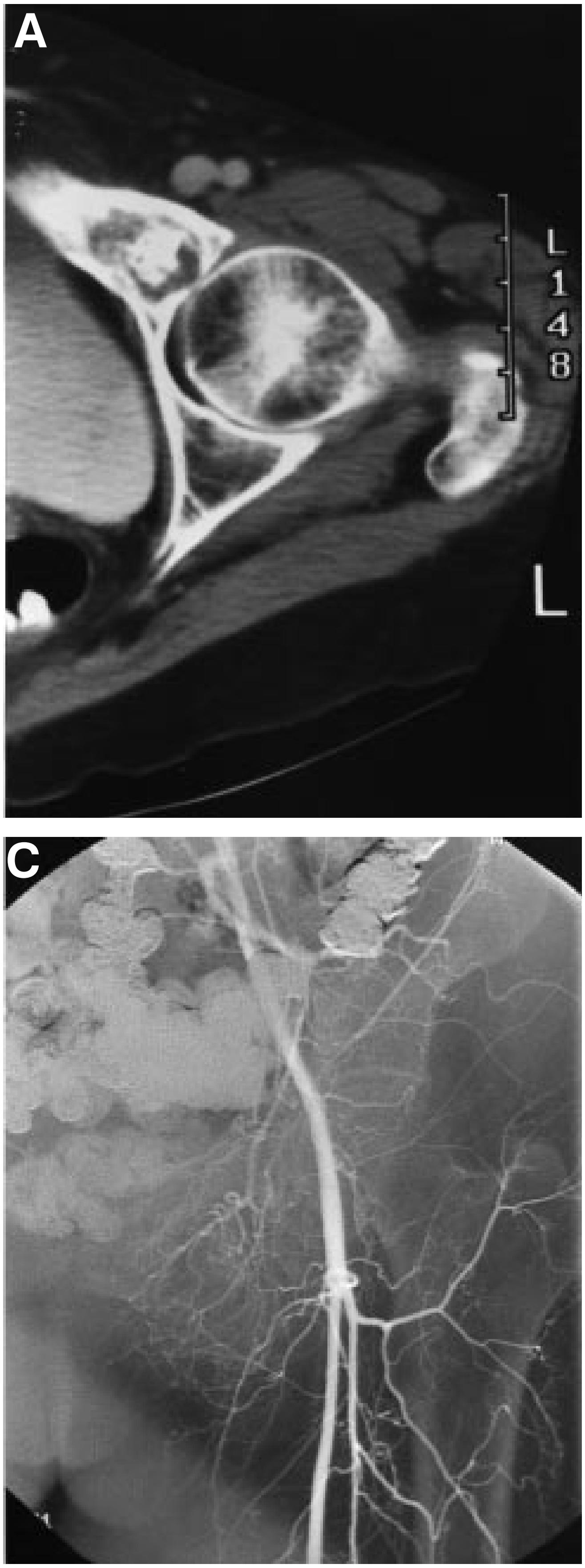
Extension of tumor across the joints of the pelvis is frequently reported. Careful preoperative and intraoperative evaluation of the sacroiliac joint is necessary (Figure 28.2). Pelvic tumor extension, in particular chondrosarcoma, can be difficult to evaluate even with modern imaging modalities.

Pelvic Veins

Tumor thrombi within the large pelvic veins has been reported for pelvic sarcomas. Meticulous preoperative evaluation with the use of MRI and venography is necessary.

IMAGING STUDIES

Appropriate imaging studies are the key to successful resection of tumors of the pelvis and acetabulum. Computerized tomography (CT), magnetic resonance imaging (MRI), angiography, and bone scintigraphy (three-phase bone scan) are the most useful preoperative studies. For tumors of the pelvis and acetabulum with a large extraosseous component, a venogram may be warranted if there is evidence of distal obstruction.



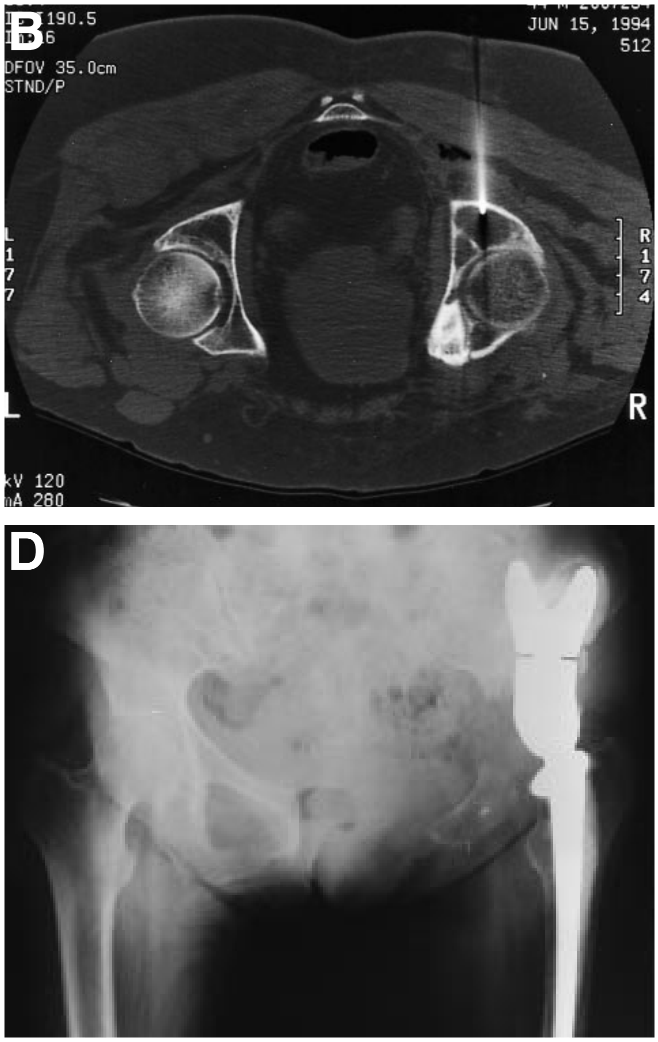


Figure 28.1 Periacetabular chondrosarcoma. There is a small, intraosseous, high-grade chondrosarcoma of the superior pubic ramus that extends along the medial wall and into the posterior acetabulum. (**A**) Initial CT scan demonstrating a small lesion of the acetabulum within the superior medial wall. (**B**) CT scan demonstrating the anterior and posterior extent of the periacetabuluar tumor. Note the biopsy is performed anteriorly away from the major vessels. Biopsies are generally not performed posteriorly in case a hemipelvectomy flap is required. (**C**) Staging angiography shows no displacement of the external iliac artery or common femoral artery. There is minimal tumor vascularity. (**D**) Postoperative radiograph (9 months) following a partial pelvic resection (Type II/III). Note the sclerosis around the saddle prosthesis, which is a common finding denoting increased heterotopic bone along the saddle. This bone provides additional stability.

The information to be obtained from each of these studies is as follows:

Radiographs

The radiographic characterization of most bone lesions on the initial plain films of the pelvis usually gives an indication of whether the tumor is a primary sarcoma, metastatic lesion, or benign process. These findings may be very subtle, however, so that one must be extremely cautious in their interpretation (e.g. chondrosarcoma of the pelvis). A patient with persistent pain in the hip or pelvic region, despite "normal" plain radiographs, should be further evaluated with additional imaging studies.

Figure 28.2 A large chondrosarcoma of the ilium involving the adjacent sacral alar. CT scans are extremely useful in determing SI joint and sacral alar involvement. If the sacrum is involved, a limb-sparing resection and even a hemipelvectomy often cannot be performed.

Bone Scan

The bone scan is used to assess the extent of tumor involvement and to evaluate for metastases. The flow phase and blood pool images are also helpful in assessing tumor vascularity. Tumor extension into the ilium and pelvic columns must be evaluated.

CT Scan

Because it shows mineralization, CT is superior to MRI for visualizing subtle cortical destruction, calcification or ossification, and fracture (Figure 28.3). This remains the study of choice by many for evaluation of the degree of cortical destruction of the pelvis, which is often critical in the periacetabular region (i.e. in evaluating the acetabular dome and columns of the pelvis). CT provides more reliable imaging for determination of the effects of induction chemotherapy and bone response. It is considered complementary to MRI in evaluating soft-tissue extent and displacement of adjacent nerves and vessels. Careful evaluation of iliac extension is required.

MRI

Magnetic resonance is the imaging method of choice for detecting tumor extension into the hip joint, sacroiliac joint, or sacrum, and extension into the superior

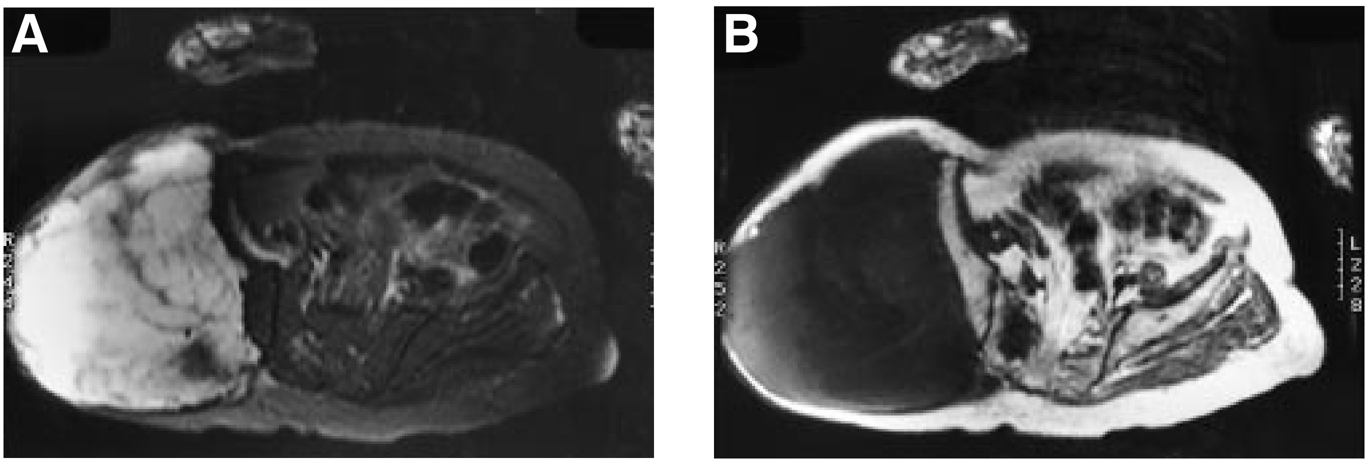


Figure 28.3 MRI scan and CT scan of an extremely large chondrosarcoma arising from the wing of the ilium and the periacetabular bone. (**A**) MRI: the high-intensity area represents gross tumor permeating through the ilium. Note that there is no intrapelvic extension. (**B**) CT scan: the large soft-tissue component is seen arising from the underlying ilium. It approaches the SI joint but a resection can be performed through the sacral alar. In general, CT scans are more helpful than MRI scans for determining bony involvement.

pubic rami and ischial region (Figure 28.3). MRI shows the fat of the marrow with superior contrast, and is therefore the best modality to demonstrate intraosseous tumor extension. This is extremely important in tumors that demonstrate subtle infiltration within the ilium, such as chondrosarcoma. MRI is superior for evaluation of soft-tissue tumor extent and for evaluating critical neurovascular structures (i.e. sacral plexus and iliac vessels) (Figure 28.4). If tumor extends to the superior pubic ramus or the ischium, then a combined Type II/III resection is required.

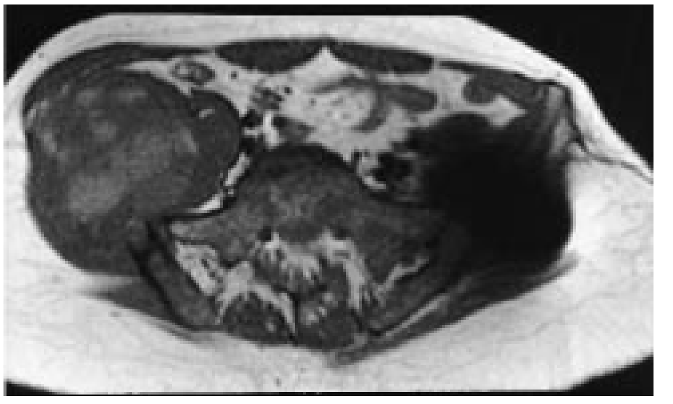


Figure 28.4 MRI scan of a high-grade sarcoma arising from the ilium, crossing the SI joint, and involving the L5 transverse process. This tumor is considered to be unresectable due to the extension along the sacrum and the lumbar spine. MRI scans are invaluable in determining extraosseous soft-tissue extension of bony tumors.

Arteriography/Venography

Although MRI and MRA (magnetic resonance arteriography) can be used to visualize the pelvic vessels, arteriography remains the most useful study for evaluating tumor vascularity and anatomy. It more accurately assesses the vascular anatomy, including anatomic variants and anomalies. Arteriography is the most reliable study to determine the response to neoadjuvant chemotherapy. The venous flow phase is useful to detect venous occlusion or tumor thrombi. If there is any suggestion of venous occlusion, a formal venogram should be performed. The femoral vessels are often displaced by large periacetabular tumors.

Biopsy

The biopsy technique and placement is of paramount importance in periacetabular tumors as the risk of peritoneal and pelvic contamination is considerable and local control is a greater challenge (Figure 28.1). A misplaced or poorly performed biopsy can lead to extensive soft-tissue contamination and render resection difficult or not feasible. A poorly performed biopsy may be the primary reason a patient has a hemipelvectomy, and it may even interfere with soft-tissue flaps necessary for wound coverage.

Most patients with periacetabular tumors are best served with a needle biopsy placed in the incision line of the planned future resection. CT guidance should be used unless there is a large extraosseous component that is easily accessible and away from critical neurovascular structures. The needle biopsy is performed anteriorly. The posterior approach should be avoided so as not to contaminate the gluteus maximus, hip joint, femoral vessels, and femoral nerve.

A patient who has a needle biopsy that does not provide a definitive diagnosis should undergo an open incisional biopsy in the operating room, with special emphasis on biopsy placement and ensuring adequate tissue for diagnosis.

INDICATIONS AND CONTRAINDICATIONS OF LIMB-SPARING SURGERY

Most primary periacetabular tumors can be resected without amputating the lower extremity. Periacetabular resection is indicated in cases in which; (1) surgical margins similar to those obtained with a hemipelvectomy can be accomplished; (2) the resection (and reconstruction) can preserve a reasonably functional limb; (3) the life expectancy and general physical status of the patient justify the procedure. Contraindications include: (1) local recurrence following a previous limb-sparing resection unless the recurrence can be widely resected or the amputation offers no oncologic benefit; (2) tumor extension posteriorly across the sacroiliac joint with involvement of the sacral nerves and nerve root foramen; (3) tumors which extensively infiltrate the soft tissues of the pelvis and extend into the thigh with or without involvement of the sciatic nerve; (4) poor overall physical status or limited life expectancy.

DESCRIPTION OF IMPLANTS

Saddle Prosthesis

The saddle prosthesis was originally designed for reconstruction in patients who sustained extensive loss of acetabular bone after failed total hip arthroplasty. Similar defects are often encountered following periacetabular tumor resection, with previously described reconstruction techniques being fraught with high local morbidity and complication rates. Since 1988 the authors have used the saddle prosthesis, with favorable results, for reconstruction of the pelvis following Type

II and Type II/III periacetabular resections for primary sarcomas and in patients with metastatic disease.

Since its initial development the prosthesis has undergone several design changes to address design-related problems. The unique and crucial surgical considerations for implanting the saddle prosthesis should be emphasized. These include: retaining at least 2 cm of remaining ilium following tumor resection, creating a notch within the remaining ilium that is within the depth of the saddle component and is located in the thickest (medial) portion of bone, retaining the iliopsoas and abductor muscles and adjusting the pelvic–femoral tension with the correct interpositional base component length (see Surgical Technique, below).

The metal saddle component rests on a polyethylene-bearing sleeve which rotates on a peg attached to the base component (Figure 28.5). The base component is available in several lengths to accommodate variable amounts of bone loss following tumor resection. The base is attached to the stem taper in place of a femoral head.

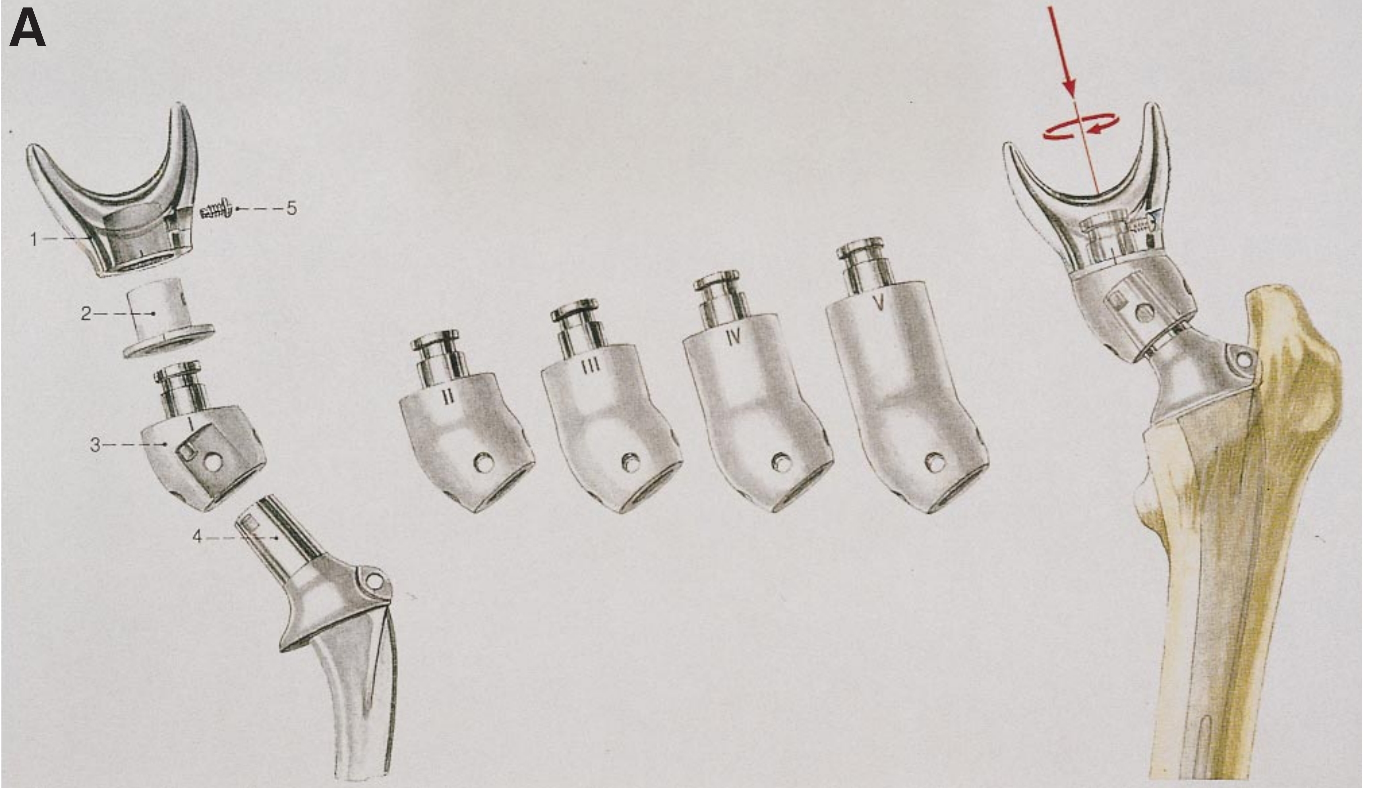
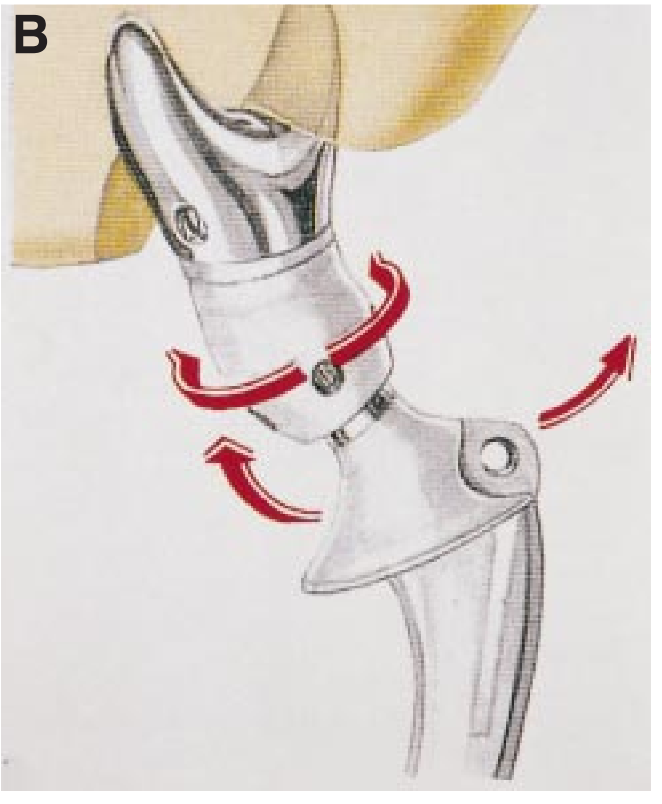


Figure 28.5 *(see also following page)* (**A**) Saddle prosthesis for periacetabular replacement and reconstruction. The saddle prosthesis (Waldemar-Link, Hamburg, Germany) was originally developed for use in total hip revision surgery. This prosthesis is now used to reconstruct the pelvis following periacetabular resections. The prosthesis consists of three components; the femoral stem, base element (body), and the saddle portion that articulates with the ilium. (**B**) Degrees of motion of saddle prosthesis. The saddle is free to rotate on the body component. The entire prosthesis can abduct, adduct, flex, and extend through the saddle and iliac "articulation". (**C**) Periacetabular resection (Type III) with the saddle prosthesis reconstruction. (**D**) Reconstruction. Photograph of the pelvic bony structure. The lines demarcating the extent of a periacetabular resection. The superacetabular osteotomy can be performed close to the acetabulum or as high as the sciatic notch (as shown). The lower the osteotomy, the more stable the prosthesis. The osteotomy along the superior pubic ramus can be made along the medial wall up to the symphysis pubis. The osteotomy of the inferior pubic ramus or pubic bone can be performed at several different levels according to the oncological needs. In general, periacetabular reconstructions are performed with a saddle prosthesis (Waldemar-Link, Hamburg, Germany). (**E**) Type II and Type III combined pelvic resection for a large, high-grade chondrosarcoma reconstructed with a saddle prosthesis. Note the typical reossification which occurs around the pericapsular structure (forms around the saddle component). This reactive bone is typically seen between 12 and 16 months. This reactive bone (arrows) increases the stability of the prosthesis. Adequate reconstruction consists of the preservation of the iliacus muscle, the abductor muscles, and the use of a notch within the ilium to create stability for the saddle.



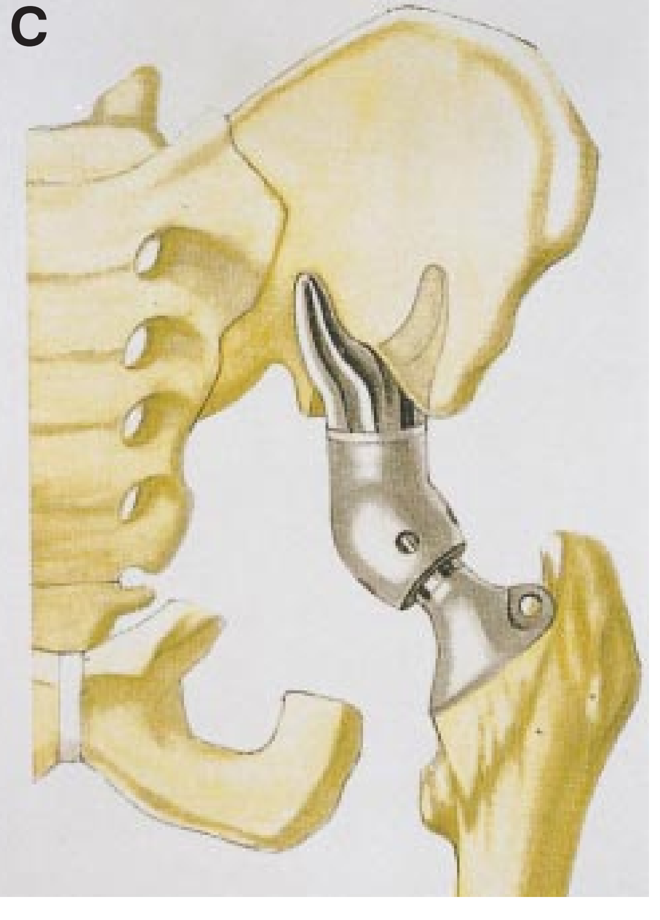


Figure 28.5 C–E

A blunt-tipped set screw engages a circumferential groove in the peg (without placing any load on the metal). The set screw prevents the saddle and base component from dislocating.

A locking pin located within the conical recess of the base engages an eccentric slot in the face of the taper. This prevents rotational instability within the conical mounting. This is necessary because axial forces (depending on the length of the base component) can occur in the saddle prosthesis, unlike an implant with a spherical femoral head.

Anatomy

The saddle component of the prosthesis articulates against a notch that the surgeon makes in the medial portion of the remaining ilium. One horn of the saddle lies within the true pelvis and is covered by the iliopsoas muscle. The other horn of the saddle is located outside the pelvis and is covered by the gluteus medius and minimus muscles.

Motion

The articulation between the saddle and iliac bone permits the leg to be turned in any direction (Figure 28.5C). Rotation is made possible within the articulation between the saddle and the base component.

SURGICAL GUIDELINES

1. The utilitarian incision is utilized to expose both the anterior (internal) and posterior (extrapelvic) aspects of the pelvis. The ilioinguinal incision is utilized to develop the retroperitoneal plane and the posterior gluteus maximus fasciocutaneous flap is utilized to develop the retrogluteal space.
2. The iliac vessels are initially mobilized and the hypogastric artery is identified and may be ligated. The sciatic and femoral nerves are identified and protected.
3. The level of osteotomy through the ilium is identified from within the pelvis as well as the superior pubic rami. Identification of the superior pubic rami requires mobilization of the external iliac and femoral vessels as they cross the ramus.
4. A large posterior myocutaneous flap is developed with the gluteus maximus muscle. The gluteal maximus muscle is detached from the iliotibial band and femur so as to be retracted posteriorly. This exposes the retrogluteal space; the ilium, sciatic notch, sciatic nerve, and hip joint.
5. The ischium is identified through the posterior incision and is osteotomized above the level of the biceps tendon insertion.
6. Complete removal of the periacetabulum requires the release of the sacrospinous ligament and some of the pelvic floor musculature.
7. Reconstruction of the periacetabular defect is performed with the saddle prosthesis (Link©, Hamburg, Germany).

Postoperative immobilization is required for 10–14 days with the lower extremity in abduction to protect the prosthesis and the abductor muscles. A hip abduction brace is utilized for 3 months. Physical therapy and rehabilitation requires 6–9 months to become fully ambulatory with a cane.

RECONSTRUCTION FOLLOWING RESECTION OF PRIMARY PERIACETABULAR TUMORS

Saddle Prosthesis Schematic of Surgical Procedures (Figures 28.6–28.8)

Notchplasty (Figure 28.6)

A notch is created in the remaining ilium using a high-speed burr. The notch should be placed in the thickest region of the remaining bone (usually medial). The notch accommodates the saddle component of the saddle prosthesis and its depth matches that of the saddle. When positioned intraoperatively the notch between the two horns of the saddle prosthesis is perpendicular to the notch created in the bone. The notch facilitates articulation between the saddle prosthesis and the remaining ilium and lends stability during subsequent hip motion (Figure 28.6).

Preparation of the Proximal Femur

The proximal femur is prepared as for a standard femoral component. The proximal femur intramedullary canal is reamed to accept the largest diameter stem and allow for a 2-mm circumferential cement mantle. Once reaming is completed, and the appropriate-sized stem (diameter and length) is selected, a distal femoral cement plug is inserted to a depth of 2 cm below the tip of the selected femoral stem. The femoral canal is then irrigated with saline and packed with gauze. Once the cement (PMMA) is prepared, the gauze is removed and femoral prosthesis is cemented within the proximal femur.

Trial Reduction (Figure 28.7)

A reduction using trial components is critical in assessing the accurate length of the base component (intercalary segment) and determining optimum soft-tissue tension. The base component length selected should be determined by the distance between the ilium and femoral neck cuts, as the length indicated on the base component is the total length from the notch of the saddle to the femoral collar. A base component should be selected where reduction is barely possible with minimum "play" in the reduced joint. The surgeon should be able to reattach the abductor mechanism to its anatomic position on the osteotomized greater trochanter.

A trial reduction can also determine areas where the saddle component may impinge on the existing notch during intraoperative range of motion. These areas can be further contoured with a high-speed burr to prevent impingement (which may result in limited motion or dislocation). Hip motion (flexion to at least 90 degrees, extension to 30 degrees, abduction to 45 degrees, adduction to neutral, and rotation) should be possible without evidence of impingement or dislocation.

Abductor Mechanism Reconstruction (Figure 28.8)

The osteotomized greater trochanter and abductors are reattached to their original location using cables. If the greater trochanter was included in the resected

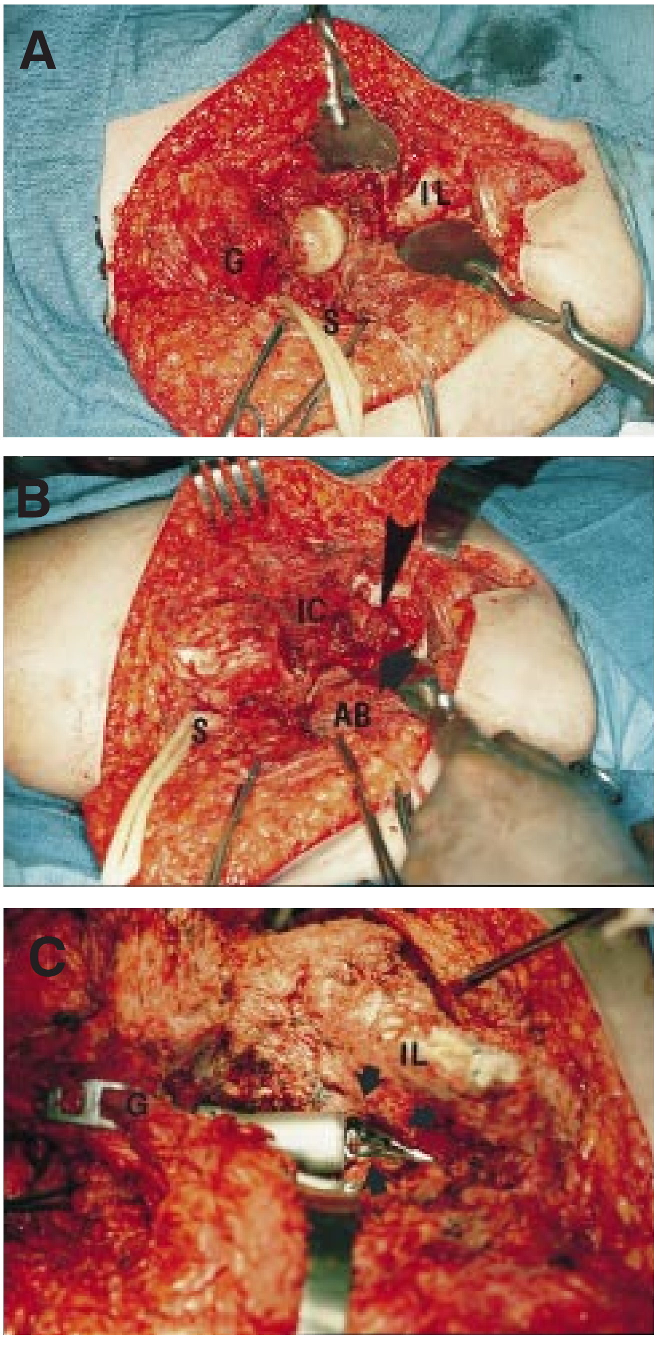


Figure 28.6 (**A**) Photograph following a periacetabular resection showing the remaining ilium (IL), sciatic nerve (S), the greater trochanteric osteotomy (G), and the femoral head. This defect is reconstructed with a saddle prosthesis. This necessitates removal of the femoral head with the insertion of the femoral component, a base element, and a saddle that articulate with the notch (made by the surgeon) in the ilium. (**B**) Intraoperative photograph demonstrating the creation of the deep notch (large arrows). The notch gives immediate stability to the prosthesis and permits an articulation between the saddle and the ilium. The saddle is not cemented or otherwise fixed into this notch. The tension of the muscles and the body of the prosthesis creates the tension that is required. The abductors, psoas, and iliacus muscles must be placed under appropriate tension to maintain stability of the prosthesis (AB shows abductor muscles; IC shows the iliacus muscle; S shows the sciatic nerve). (**C**) Reduction of the saddle prosthesis into the iliac notch (IL). The notch (solid arrows) must be as deep as the saddle and permit approximately 45° of flexion and extension, as well as abduction and adduction. The gluteal muscles have already been opposed to the greater trochanter with a cable grip system. Closure then consists of reattaching the abductors and closing the ilioinguinal incision.

specimen the abductor mechanism is reattached to the prosthesis using 3 mm Dacron tapes. Soft-tissue tension and prosthetic stability are again tested once the abductor mechanism reconstruction is complete. The piriformis and short external rotator muscles are brought forward and reattached to the proximal femur (or prosthesis). The gluteus maximus muscle is then reattached to its insertion using nonabsorbable suture.

Wound Closure

The wound is copiously irrigated with saline. A large chest tube drain is inserted beneath the fascial closure. The subcutaneous tissue is closed over suction drains using absorbable suture. The skin is closed with suture or staples.

Functional and Rehabilitation Considerations

Function

In general, patients who undergo resection and reconstruction for a periacetabular tumor are able to ambulate (with or without a cane) following rehabilitation. It may take up to 1 year to regain motor strength, especially if the hip abductors were reconstructed or a more extensive resection was required (Type II/III).

Rehabilitation

The rehabilitation process is dependent on the extent of tumor resection (bone and soft tissue), the required

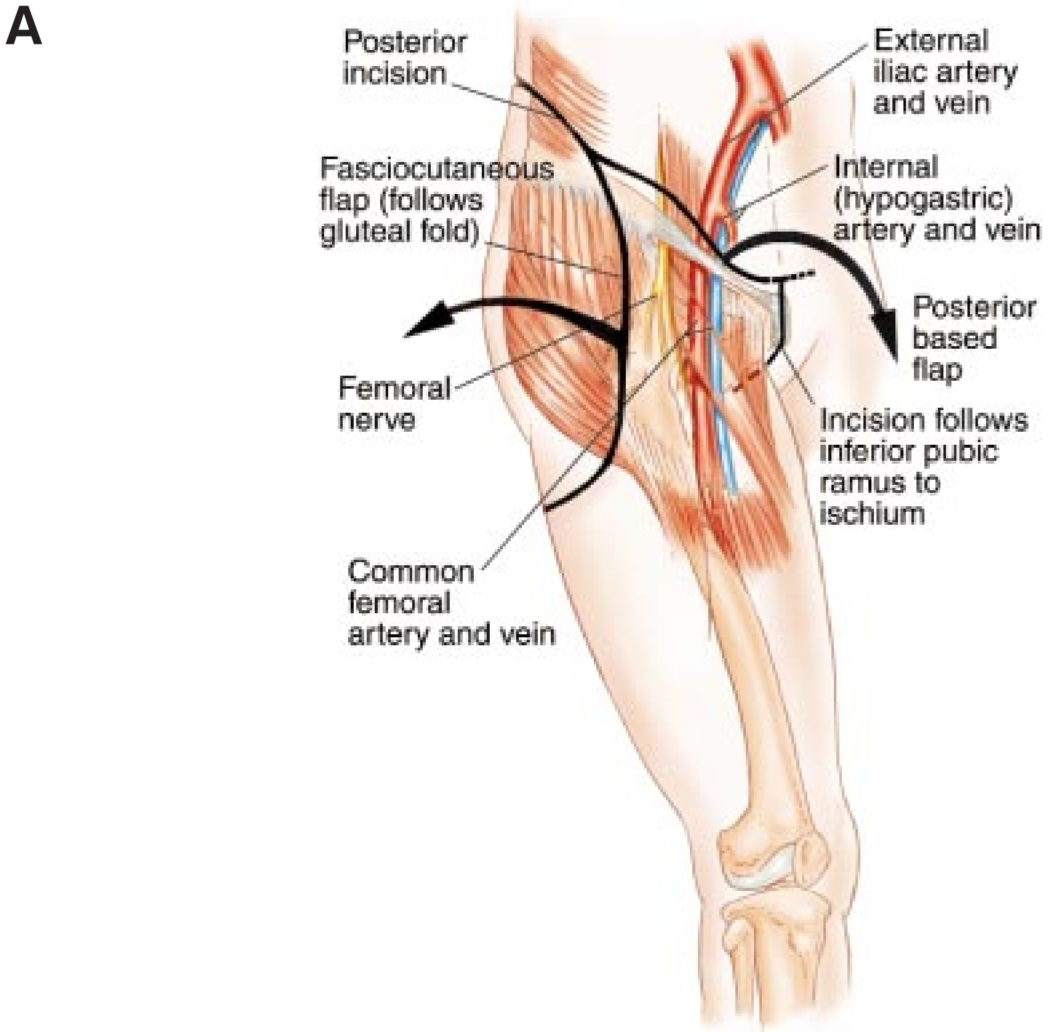


Figure 28.7 *(see also following pages)* (**A**) Surgical exposure. Utilitarian pelvic incision. The ilioinguinal incision permits exposure of the retroperitoneal space and mobilization of the iliac vessels, femoral nerve, and sciatic nerve. This permits exposure of the medial wall of the acetabulum as well as the ilium and the superior pubic ramus. (**B**) A large posterior fasciocutaneous flap based medially permits the release of the gluteus maximus. The gluteus maximus muscle is detached from the iliotibial band and the femur, and it is rotated posteriorly. This provides exposure of the ilium, sciatic notch, sciatic nerve, and hip joint. Through this posterior incision the proximal iliac osteotomy is performed, as well as ischial osteotomy. The periacetabular tumor is removed through this incision following the release of the sacrotuberous ligament. (**C**) Schematic diagram of the mobilization of the periacetabular structures and the three osteotomies which are necessary for a complete resection of the acetabulum. The superacetabular osteotomy is performed through the sciatic notch, the superior pubic ramus is transected at the level of the retracted femoral vessels, and the infra-acetabular osteotomy is performed above the level of the ischium. Once all three osteotomies are completed the acetabulum can be removed through the posterior incision by detaching the sacrospinous ligament. (**D**) Schematic of the "close-up" of the superior pubic ramus osteotomy. The femoral triangle and nerve are identified and retracted. The superior pubic ramus is identified and the pectineus muscle is transected. This permits exposure of the superior pubic ramus which is then protected by a Cobra retractor and is osteotomized with a high-speed drill. (**E**) *(page 431)* Schematic diagram of the infra-acetabular osteotomy. The osteotomy is performed through the posterior incision above the level of the origin of the biceps femoris. A Cobra retractor is inserted along the inferior border of the ischium and is placed into the obturator foramen in order to protect the adjacent soft tissues. Once these osteotomies are performed, the sacrospinous ligament can be palpated and released off of the spine. (**F**) *(page 431)* A notch is made in the supra-acetabular roof or remaining ilium for the saddle prosthesis to sit in. A high-speed burr is used. (**G**) *(page 431)* Schematic diagram of the saddle prosthesis reduced into the notch. The femoral stem is cemented into the femur. The size of the base element is chosen to make a tight fit on reduction. The greater trochanter is fixed with cables. The abductor and psoas muscle tension keeps the prosthesis reduced. (**H**) *(page 431)* Schematic diagram of the saddle prosthesis following a periacetabular resection (Type II) for a sarcoma and radical curettage for a large acetabular metastasis.

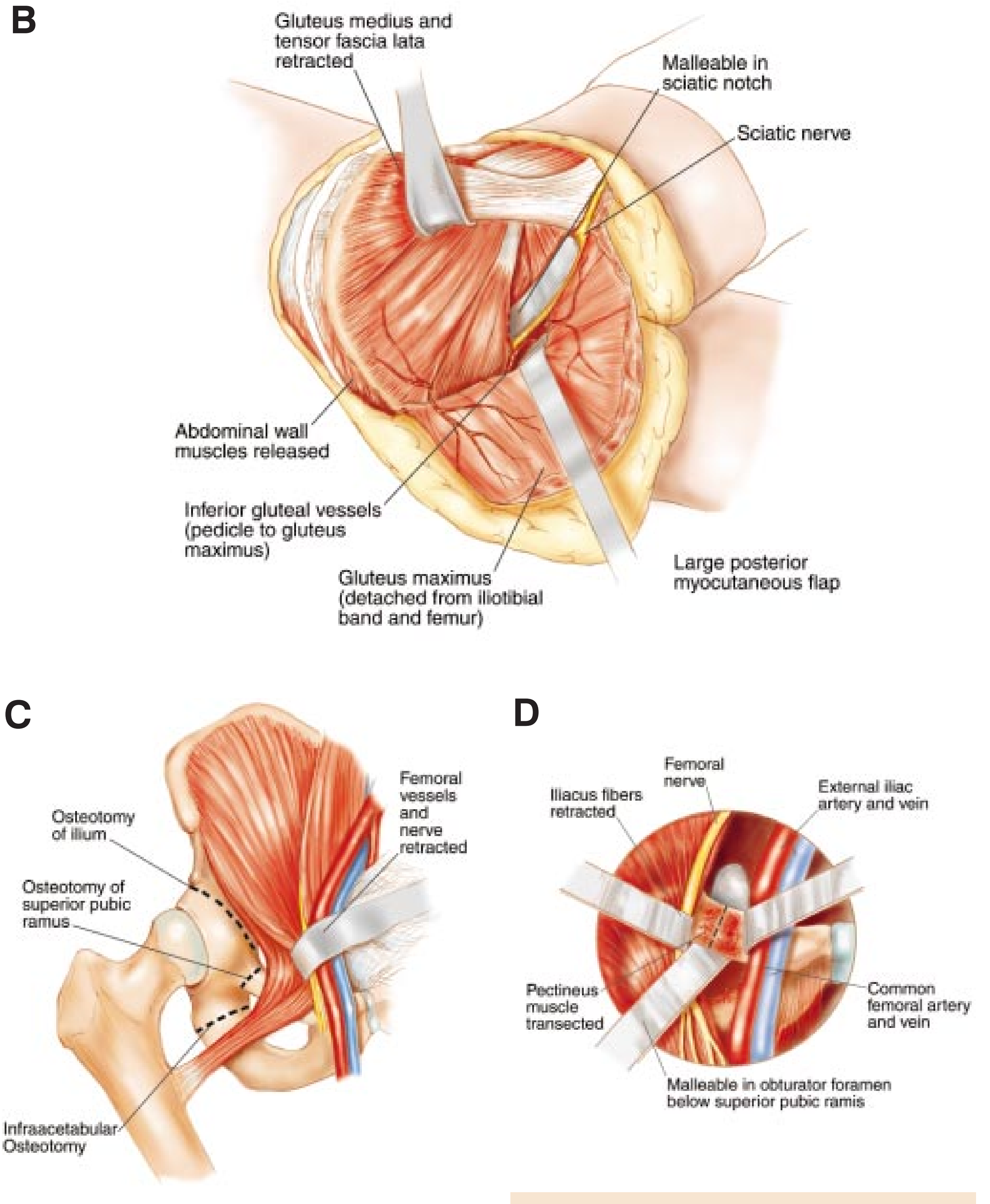
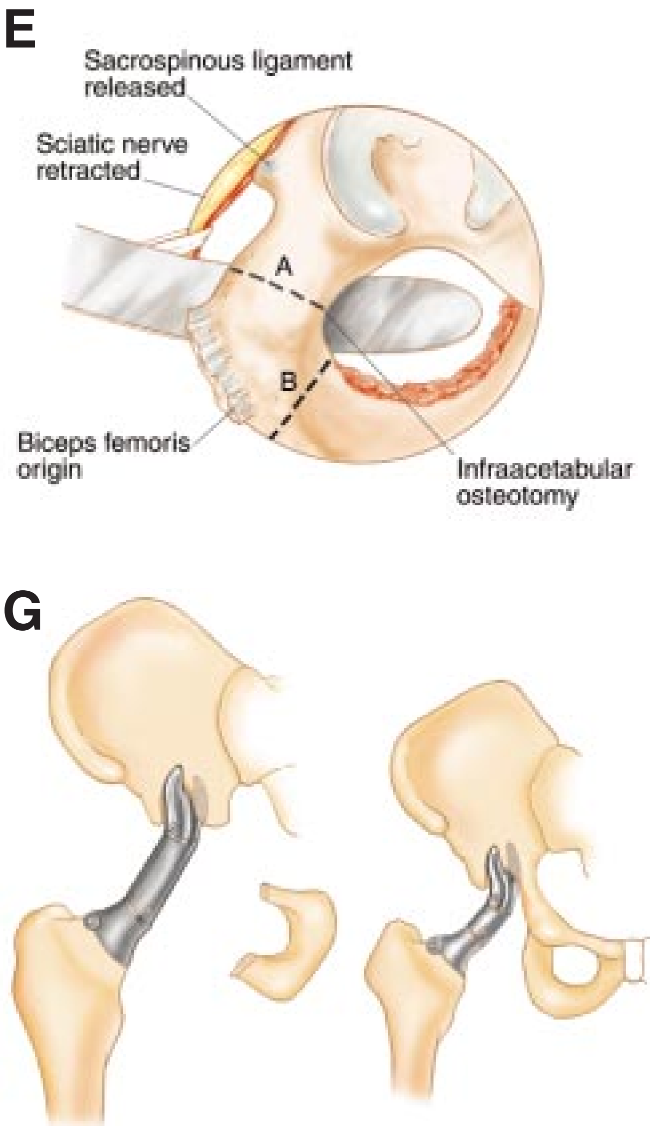
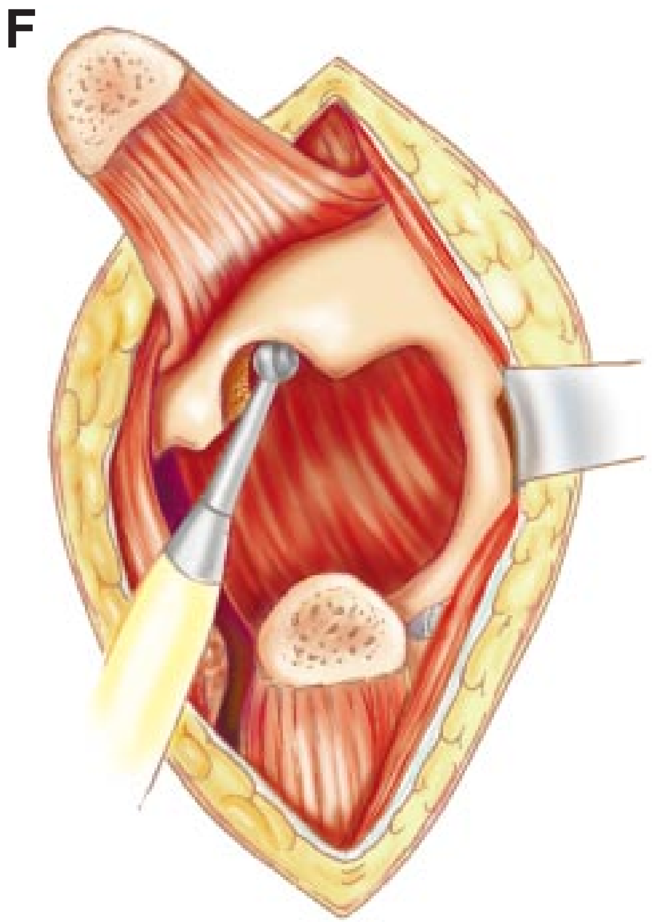


Figure 28.7 B–D





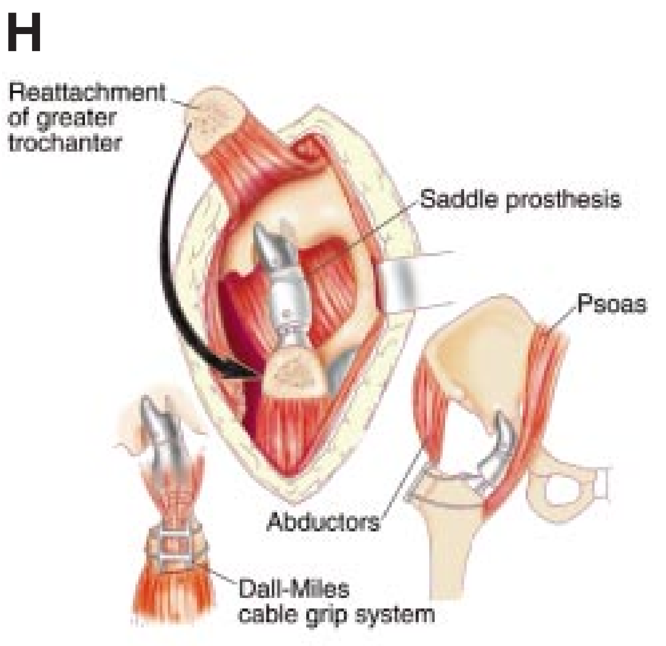
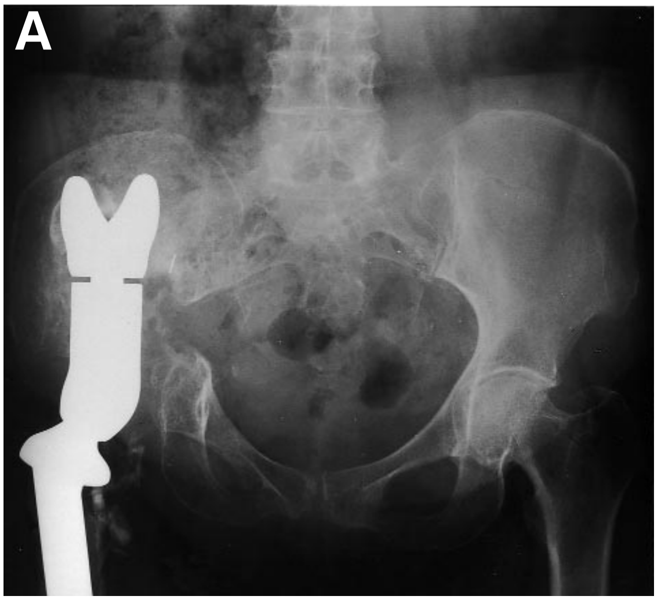


Figure 28.7 E–H



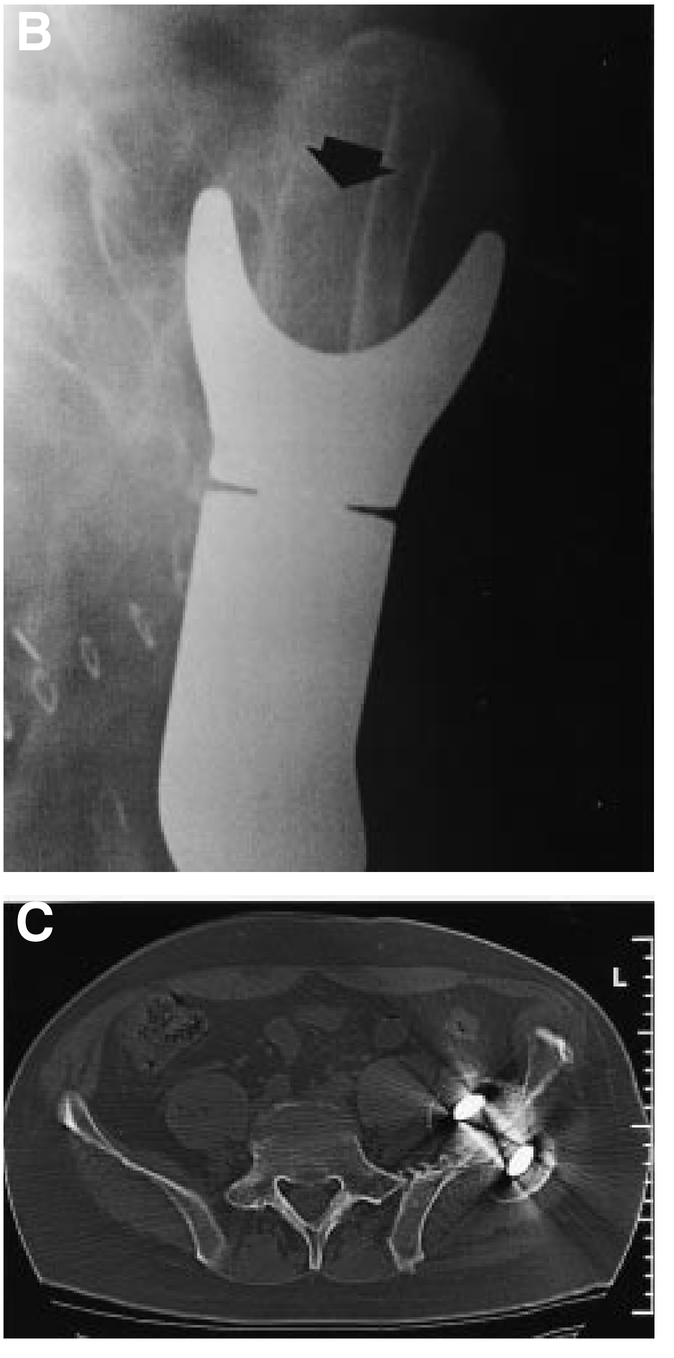


Figure 28.8 Postoperative radiographs and CT scans demonstrating common postoperative radiographic findings. (**A**) AP radiograph of the pelvis with a saddle prosthesis in place. Note the reactive bone around the saddle component. This is commonly seen 6 months following surgery. It often increases the stability of the prosthesis by creating a painless pseudoarthrosis. Despite the AP radiograph appearance, one cannot be certain that the saddle is actually reduced within the notch (one prong anterior and one prong posterior to the wing of the ilium). Therefore, (**B**) a 45° oblique radiograph of the affected side of the pelvis is required. This photograph demonstrates that the saddle is in excellent position to the remaining wing of the ilium (IL) (arrow). (**C**) CT scan showing a typical saddle prosthesis in good position. Despite the artifact from the metal, one can visualize the anterior and posterior prongs of the saddle on opposite sides of the ilium. This scan correlates with the plain radiograph. If there is any question of reduction of the saddle, both an oblique radiograph and a CT scan are required. Note, it is not uncommon to see a large "mass" around the saddle prosthesis body several months after surgery. This is routinely seen and represents a large pseudocapsule filled with reactive fluid (similar to that seen around symptomatic non-unions).

reconstruction, and the overall condition of the patient.

Initially, patients who have undergone a periacetabular tumor resection and reconstruction are kept in bed with the operative extremity placed in balanced suspension. This provides more reliable elevation of the extremity and minimizes mobility while the incision begins to heal. This is continued for 3–4 days or until the wound is checked and all of the drains removed. All wound drainage tubes are left in place until the drainage is less than 30–50 ml per 24 h period. Once the incision is healing, and the drains have been removed, the patient is placed in a hip abduction orthosis with a pelvic band (if the hip abductors were reconstructed) and gait training is initiated.

Patients who have undergone a saddle prosthetic reconstruction begin ambulation with a walker or crutches, weight-bearing as tolerated. Although weight-bearing is progressed as tolerated, patients who have undergone a hip abductor repair are encouraged to protect the soft-tissue reconstruction (and remain in the brace) for approximately 6 weeks. Initially, motion is encouraged within the limits of the brace (60 degrees of flexion, no extension, abduction, or adduction). Patients are encouraged to perform straight-leg raises and knee and ankle motion exercises. Once the brace is removed, range of motion is progressed and hip flexor and abductor strengthening is begun. Patients are instructed on "total hip precautions" and discouraged from flexing the hip greater than 90 degrees or crossing their legs.