Hip Fractures

Background

Hip fractures are one of the most common injuries requiring hospital admission. In the United States, fractures of the hip result in hospitalization, disability, and loss of independence for more than 300,000 persons annually. The incidence of hip fractures is approximately 80 per 100,000, with the incidence increasing with age. Delayed recognition of hip fractures can result in increased morbidity and mortality. One-year mortality rates after a hip fracture are approximately 15 to 20%. Approximately 50% of patients who lived independently before injury are unable to reestablish an independent lifestyle.

Risk Factors

The incidence of hip fractures increases with age, doubling for each decade after 50 years of age. White women are two to three times more likely to sustain a fracture than non-white women. Other risk factors include sedentary lifestyle, excessive consumption of alcohol and caffeine, low body weight, smoking, and the use of psychotropic medications. Osteoporosis is also an important contributing factor because it decreases the bone’s resistance to injury. Dizziness, stroke, polypharmacy, and peripheral neuropathies can disturb balance and predispose elderly patients to injury. Approximately 90% of hip fractures in the elderly result from a simple ground-level fall.
History

Patients often report a fall followed by a decreased ability to ambulate. A characteristic symptom is groin or buttock pain that worsens with walking. Occasionally, the patient will complain of referred pain to the knee.

Clinical Examination

Patients with a displaced hip fracture usually lie with the limb externally rotated, abducted, and shortened. The typical patient is often an elderly female with dementia who sustains a fall and is unable to walk. The patient usually has localized tenderness over the hip and limited range of motion (ROM) of the affected limb during passive and active ROM of the hip. Patients with nondisplaced or stress fractures may have no obvious deformity.

Diagnostic Evaluation

In patients who report hip pain after a fall, hip fracture should be considered in the differential diagnosis until proven otherwise. An X-ray in an anteroposterior (AP) view obtained while the hip is internally rotated 15 to 20° will provide an optimal image of the femoral neck not evident in the standard AP view. If radiographs are normal and there is still high clinical suspicion of a hip fracture, a bone scan or magnetic resonance imaging (MRI) may be appropriate.

Classification

Hip fractures are classified according to anatomic location. They are typically separated into intracapsular (femoral neck fracture; see Table 1) or extracapsular (intertrochanteric [Table 2] or subtrochanteric fractures). Fractures that occur less than 5 cm below the top of the lesser trochanter are considered subtrochanteric fractures. Fractures distal to this are considered femoral shaft fractures.

Treatment

Most patients with hip fractures require surgical intervention. The surgical intervention chosen depends on the type of fracture, the preference of the surgeon, the severity of the injury, the age of the patient, and the prognosis for recovery. Femoral neck fractures can be treated by either internal fixation with multiple screws or prosthetic placement. Internal fixation is used in patients with nondisplaced or minimally displaced fractures, and occasionally in younger patients with displaced fractures. Displaced frac-
tures have a higher incidence of nonunion and osteonecrosis. Therefore, prosthetic replacement is generally preferred in displaced fractures, especially in the older patients, to minimize complications. Intertrochanteric fractures are usually treated by internal fixation with a sliding hip screw or a trochanteric fixation nail. Subtrochanteric fractures are treated most commonly with intramedullary devices. The most common site of pathological femur fractures is in the subtrochanteric region.

Rehabilitation

Early ambulation and ROM is important to prevent the complications associated with immobilization. Rehabilitation should begin the first day after surgery with basic bed-to-chair transfers, along with deep breathing exercises. Chair-level exercises, such as active quadriceps exercises and ankle pumps, are utilized. The program should progress to consist of pre-gait activities, such as sit-to-stand transfers and static standing balance. Progression to walking with an assist device (parallel bars or walker) can usually be accomplished on the first or second postoperative day. If stable fixation of the fracture cannot be achieved, weight-bearing may be limited to avoid instrumentation failure.

During postoperative days 2 to 5, the patient should continue ambulation exercises, along with activities of daily living (ADLs) training with continued ROM and strengthening exercises. Advanced transfer techniques, such as car and tub transfers and stair training, usually begin by postoperative
day 6. Once discharged, an outpatient or home physical therapy program typically continues for another 2 to 8 weeks. The primary goal of any rehabilitation program is to maximize function and, thus, allowing the patient to return to his or her prior level of activity.

**Complications**

The highest risk of mortality after a hip fracture occurs in the first 4 to 6 months, with an overall mortality rate of approximately 15 to 20% at 1 year.

Orthopedic complications after hip fractures include dislocations/subluxations, leg-length discrepancies, prosthetic loosening, heterotopic ossification, wound infections, nerve injuries, and hemorrhage. The peroneal portion of the sciatic nerve is the most common nerve injured in these fractures.

Heterotopic ossification is the deposition of bone in ectopic locations usually around the hip capsule, which results in loss of motion. Irradiation of the hip, use of nonsteroidal anti-inflammatory drugs, and use of etidronate with controlled ROM have been shown to be effective in the prophylaxis of heterotopic ossification.

Medical complications after hip fractures include urinary tract infections, pneumonia, atelectasis, deep vein thrombosis, skin breakdown, and delirium.

**Total Hip Replacements**

**Background**

Total hip replacement (THR) is surgically replacing the femoral head and acetabular surface of the hip. Hemiarthroplasty refers to the replacement of the femoral head only. The father of the modern-day hip replacement is Sir John Charnley, who, in 1961, developed the first low-friction arthroplasty. His success spawned the widespread use of hip replacements in the 1970s. Today, there are more than 300,000 THRs implanted worldwide annually.

**Indications**

Indications for THR are pain-limiting function secondary to osteoarthritis, rheumatoid arthritis, avascular necrosis, or congenital dysplasia of the hip. Sepsis of the involved joint is always an absolute contraindication.

**Prosthetic Design**

The prosthesis attempts to reproduce normal joint anatomy. The femoral component is usually made of a variety of materials, including titanium
alloys, ceramics, and cobalt–chrome alloys. The acetabular component is usually composed of ultra-high-molecular-weight polyethylene. Fixation techniques include polymethylmethacrylate cement, porous coating, hydroxyapatite coating, and press-fit stabilization. Cement fixation is strongest immediately after curing, whereas cementless fixation is at its weakest immediately after insertion of the device. Micromotion should be avoided for at least 6 weeks in cementless systems. Studies have shown that cementless systems offer stronger long-term fixation and thus longer life of prosthesis before revision.

**Rehabilitation**

Education of the surgical process and outcomes are given to the patient before surgery. The patient should be instructed on total hip precautions (based on a posterior surgical approach), which are no hip flexion past 90°, no adduction of the leg past midline, and no internal rotation of the leg. With an anterior approach, the hip precautions are reversed, with limitations on extension past neutral, no external rotation, and no adduction of the leg past midline. An abduction pillow or a knee splint is often utilized to enforce total hip precautions, especially while the patient is in bed. Patients with a high risk of dislocation or with a history of recurrent dislocations are often treated with a hip brace to maintain hip precautions. With cemented THRs, the patient is immediately weight-bearing as tolerated (WBAT). See Table 3 for definitions of weight-bearing precautions. With bony ingrowth THRs, the patient is toe-touch weight-bearing for approximately 6 weeks, then advanced to WBAT.

On postoperative day 1, the patient should perform bedside exercises, such as ankle pumps, quadriceps sets, and gluteal sets. Bed mobility and transfer training should begin at this time. The patient should be reminded of their weight-bearing and total hip precautions. On postoperative day 2, the patient should initiate gait training with the use of an assistive device.

### Table 3

**Weight-Bearing Precautions**

<table>
<thead>
<tr>
<th>Definitions</th>
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<tbody>
<tr>
<td>Nonweight-bearing:</td>
<td>No weight allowed</td>
</tr>
<tr>
<td>Toe-touch weight-bearing:</td>
<td>Approximately 10% of normal weight</td>
</tr>
<tr>
<td>Partial weight-bearing:</td>
<td>Less than 50% of normal weight allowed</td>
</tr>
<tr>
<td>Weight-bearing as tolerated:</td>
<td>As much weight as the patient will allow</td>
</tr>
<tr>
<td>Full weight-bearing:</td>
<td>100% Weight allowed</td>
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**Orthopedic Rehabilitation**

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Functional transfer training should continue. Postoperative days 3 to 5 should include progression of ROM and strengthening exercises as tolerated. The patient should continue ambulation on level surfaces and progress to stairs. ADL techniques, such as using a long-handled reacher, a raised toilet seat, a sock aid, a dressing stick, and a long shoe horn, should be mastered. After postoperative day 5, the patient will continue aggressive strengthening and stretching exercises targeting the hip. Ambulation usually progresses from household distances to community distances. The patient should eventually be modified-independent in ADLs and achieve ambulation within the first few weeks.

At 6 weeks after the operation, most patients are walking with a cane (always using the cane on the side opposite the replaced hip). With advancing levels of independence, the patient may begin driving. Hip precautions should be maintained for a total of 3 to 6 months.

**Results**

Long-term retrospective studies show that most patients are completely pain free. Of all hip replacements, 90 to 95% are successful at the 10-year mark. The major long-term problems are loosening or wear. Loosening occurs because the cement crumbles or because the bone resorbs away from the cement. By 10 years, 25% of artificial hips will have evidence of aseptic loosening on an X-ray. A little less than half of these patients will have enough pain to require a revision of the implant. Over a prolonged period, wear can occur in the plastic acetabular socket. Wear particles can induce inflammation resulting in the thinning of the bone and thus, increase the risk for periprosthetic fracture.

**Complications**

Complications of THRs, like most orthopedic procedures, include aseptic loosening, infection, deep vein thrombosis (DVT), heterotopic bone formation, urinary tract infections, dislocations, and neurological deficits. Most surgeons opt for DVT prophylaxis after surgery because more than 50% of patients have DVT without intervention. Prophylactic regimens include warfarin, with international normalization ratio goals between 1.5 and 3.0, aspirin, low-molecular-weight heparin, or sequential compression devices.

**Total Knee Replacements**

**Background**

Total knee replacements (TKRs) are one of the most common procedures performed in orthopedic surgery today. TKR was introduced in the
1960s by Gunston, who realized the knee was not a single axis like a hinge, but rather the femoral condyles roll and glide on the tibia with multiple instant centers of rotation. Approximately 200,000 TKRs are performed annually in the United States alone.

**Indications**

Indications for TKRs are disabling pain and deformity secondary to osteoarthritis, rheumatoid arthritis, or traumatic arthritis. Sepsis of the knee joint is an absolute contraindication.

**Prosthetic Design**

Nonconstrained knee implants are the most common type of artificial knee. It is called nonconstrained because the artificial components inserted into the knee are not connected to each other, as it has no inherent stability. The system relies on the person’s own ligaments and muscles for stability. The semiconstrained implant is a device that provides more stability for the knee. This type of knee prosthesis has some stability built into it. Constrained or hinged knee protheses are not used as a first choice. The two components of the knee joint are linked together with a hinged mechanism. This type of knee replacement is used when the knee is unstable and the patient’s own ligaments will not be able to support the other types of knee replacements. The fully constrained knee prosthesis is useful in treating severely damaged knees—especially in elderly people. A unicompartmental knee replacement replaces only half of the knee joint. Although it is performed if the damage is limited to one side of the joint, many surgeons prefer performing a TKR on these patients.

Fixation of the joint is usually performed with a cemented procedure. Both the femoral and tibial components of the implant are fixed to the bone with polymethylmethacrylate. The cement allows the implants to have a perfect fit to the irregularities of the bone. The advantage is that the knee replacement is immediately stable. Noncemented hybrid designs are also available. Hybrid designs usually involve a noncemented femoral component, along with a cemented tibial component.

**Rehabilitation**

On the first two postoperative days, the patient is to begin transfer and ambulation activities. The patient begins quadriceps and hamstring isometric exercises and is placed in a continuous passive motion (CPM) machine. On postoperative days 3 to 5, the patient should being straight leg raises and strengthening and ROM exercises. The patient is taught basic ADL tech-
niques, joint protection, energy conservation, and work simplification techniques. Resistive exercise should be avoided until full knee extension is present and as straight leg raises can be performed against gravity. In cemented prosthesis, the patient can begin WBAT immediately, whereas the patient is usually toe-touch weight-bearing or partial weight-bearing for 6 weeks for noncemented arthroplasties. The surgeon will usually obtain an X-ray approximately 5 to 6 weeks postoperatively to evaluate if the patient’s weight-bearing status should be upgraded.

During the second week of rehabilitation, the patient should reach $90^\circ$ of knee flexion. Ninety degrees of knee flexion is required for sitting and transferring into a car. Manipulation under anesthesia is considered when the knee ROM is severely compromised. During the fourth- to sixth-week postoperative period, the patient is usually advanced to a cane as tolerated. Progressive resistance exercises for the quadriceps/hamstrings and hip flexors continue during this period. Driving can usually be safe around the sixth week for right-sided total knee replacements.

The use of the CPM machine has been controversial. Studies have shown that with the CPM machine, $90^\circ$ of knee flexion is gained faster and fewer manipulations are needed. However, in follow-up after discharge, there was no difference in ROM between patients with CPM and patients without CPM. Length of rehabilitation hospital days may be shorter with CPM. Using CPM machines 5 hours per day produces the same effect as 20 hours per day.

**Results**

Retrospective studies have shown 85 to 95% satisfactory results in 5- to 10-year studies. Noncemented prosthesis showed no difference in pain outcomes when compared with cemented prosthesis.

**Complications**

Complications of TKRs are similar to other orthopedic procedures. Common complications include aseptic loosening, joint sepsis, lack of flexion requiring manipulation, DVT, and extensor lag. The risk of DVT without prophylaxis is 55% for unilateral TKRs and 75% for bilateral TKRs. Aspirin, warfarin, or low-molecular-weight heparin are commonly used for DVT prophylaxis after TKRs.

**Fractures of the Ankle**

**Background**

Ankle fractures can be divided into three areas of injury: the lateral malleolus, the medial malleolus, and the posterior lip of the tibia (posterior
malleolus). Stable fractures involve only one side, whereas unstable fractures involve at least two areas. They are classified as bimalleolar or trimalleolar (involving the posterior aspect of the tibia).

Clinical Examination

Patients may feel immediate pain and have difficulty walking. Swelling is often associated with ankle fractures, with marked tenderness over the fracture site. There may be some instability with passive ROM. Neurovascular status of the ankle should also be assessed.

Diagnostic Evaluation

AP and lateral radiographs should be obtained. A mortise view should also be obtained (15° internally rotated AP view), which will most clearly show the relationship of the fibula, tibia, and talus.

A Maisonneuve fracture, which is usually secondary to an external rotation injury of the ankle, is associated with a fracture of the proximal third of the fibula. On examination, the patient will not only have pain in the ankle but also in the area of the proximal fibula. Therefore, patients with tenderness over the proximal fibula associated with a twisting ankle injury should have AP and lateral views of the proximal fibula and tibia.

Treatment/Rehabilitation

Stable fractures of the distal fibula can be treated with a weight-bearing cast for approximately 4 to 6 weeks. Unstable, nondisplaced fractures require immobilization with a nonweight-bearing leg cast for 4 to 6 weeks. If proper healing occurs, these patients can be upgraded to a walking cast/boot for the next 2 weeks. In patients treated nonoperatively, follow-up radiographs must be obtained weekly for the first 2 to 3 weeks following the injury to rule out fracture displacement. Strengthening and ROM exercises can begin once fracture healing occurs. Patients with a displaced ankle fracture will require open or closed reduction. These patients will typically require immobilization and nonweight-bearing for 4 to 8 weeks following surgery.

Other Fractures of the Lower Extremity

Pelvic Fractures

Pelvic fractures can be divided into stable and unstable fractures. Stable fractures involve only one side of the pelvic ring, such as a unilateral fracture of the inferior and superior pubic ramus. Unstable fractures disrupt the pelvic ring at two sites. Treatment of stable pelvic fractures includes appropriate pain management, gait training that is usually WBAT, and appropri-
ate DVT prophylaxis. Unstable pelvic and acetabular fractures usually require surgical intervention.

**Femoral Shaft Fractures**

The shaft of the femur is the portion between the subtrochanteric region and the distal supracondylar area of the knee. Fractures of the femoral shaft are most commonly caused by high-energy trauma. Adverse outcomes are usually associated with fat embolism, acute respiratory distress syndrome, and arterial injury secondary to the severity of the initial insult.

**Knee Fractures**

Knee fractures are classified as supracondylar, condylar (lateral or medial), or tibial plateau fractures. Older patients with osteoporosis can sustain fractures about the knee from low-energy trauma. In younger patients, these fractures usually involve high-energy force. Nonoperative treatment is usually indicated for nondisplaced fractures. Displaced fractures usually require open reduction and internal fixation.

**Fractures of the Foot**

The calcaneus is the most common fractured tarsal bone and usually occurs from falls onto the heel. Most fractures require surgery and may require nonweight-bearing for 8 to 12 weeks. Posttraumatic arthritis is common in these fractures. The talus is the only foot bone without muscular attachments. It also bears the most weight of all bones in the body. The talus has a tenuous blood supply and is predisposed to avascular necrosis and fracture nonunion. Surgery is commonly indicated in talar fractures, although certain nondisplaced fractures heal with a short leg cast for 12 weeks with nonweight-bearing, usually for the first 6 weeks.

**Shoulder Instability**

**Background**

The shoulder joint has great mobility secondary to its shallow glenoid fossa and loose capsule. Joint instability is most common at the shoulder joint. The most common direction of instability is anterior and multidirectional. Anterior instability can be described by the mnemonic TUBS—traumatic, unidirectional, Bankart lesion (a tear of the anterior glenoid labrum), often requiring surgery. Multidirectional instability can be described by the mnemonic AMBRI—atraumatic, multidirectional, bilateral, rehabilitation, and inferior capsular shift if surgery is necessary. Pos-
terior dislocations occur less frequently, and are often secondary to a pos-
teriorly directed force while the shoulder is in the adducted and internally
rotated position.

**Clinical Examination**

After an acute dislocation, movement of the shoulder will cause consid-
erable pain, limiting the physical examination. Anterior instability can be
confirmed by the apprehension sign. The examiner places the arm in 90° of
abduction and then externally rotates the arm. In a patient with anterior
instability, there will be a sense of increased mobility and apprehension
secondary to the pain. A posteriorly directed force by the examiner will
decrease the apprehension and is therefore known as the relocation test. The
sulcus sign is indicative of inferior laxity. The examiner applies an inferior-
ly directed traction to the shoulder. In patients with inferior laxity, this
will cause inferior subluxation, seen as widening of the gap between the
humeral head and the acromion. The neurovascular function of the upper
extremities should be assessed before reduction. The axillary nerve is com-
monly involved in shoulder injuries.

**Diagnostic Evaluation**

AP and axillary X-ray views of the shoulder should be obtained. A
common finding in anterior dislocations is a Hill-Sachs lesion, which is a
compression fracture of the posterior humeral head. This occurs when the
humeral head is compressed against the anterior edge of the glenoid. An
MRI or shoulder arthrogram can also be ordered to assess the rotator cuff.

**Treatment**

Most shoulder dislocations should be reduced. Postreduction films
should be obtained to confirm the reduction. The arm should be put in a
sling after reduction.

**Rehabilitation**

Although the patient is immobilized in a sling, the patient should
remove the sling and extend the elbow several times a day to prevent elbow
contractures. Isometric exercises for the rotator cuff should begin almost
immediately. Rehabilitation for the shoulder usually involves ROM restric-
tions the first several weeks. During the first 2 weeks, ROM is usually lim-
ited to 90° of forward flexion and 0° of external rotation. Strengthening
exercises should begin around the second or third week mainly focusing on
the external and internal rotators of the shoulder. ROM to 140° of forward
flexion and 30° of external rotation usually occurs around the third week. At approximately 6 weeks, more vigorous exercises can be performed.

Rehabilitation for the shoulder can be divided into two phases: stretching and strengthening. In general, stretching exercises should begin first. Once ROM is restored, strengthening exercises are added.

Before stretching exercises, the patient should loosen up the shoulder by applying moist heat. Pain medications or nonsteroidal anti-inflammatory drugs should be taken approximately 30 minutes before the initiation of the exercise. Stretching of the shoulder usually begins with the pendulum (Codman’s) technique. The patient leans forward and, while letting the arm hang freely, the patient uses his or her truncal muscles to cause a passive circular motion in the shoulder. Subsequently, passive stretching can be performed with a stick, a towel, or a pulley. It is important to hold the stretch for at least 5 seconds.

Exercises to strengthen the rotator cuff muscles can be performed easily with elastic bands that come in different degrees of resistance. Other strengthening exercises include the shoulder shrug to strengthen the trapezius, push-ups to strengthen the serratus anterior and rhomboids (and pectoralis muscles), and press-up exercises from a chair to strengthen the latissimus dorsi (and triceps).

**Proximal Humerus Fractures**

**Background**

Proximal humerus fractures can be divided into two general categories, the first being nondisplaced or minimally displaced, which occur in approximately 80% of cases. Nondisplaced proximal humerus fractures are usually secondary to low-energy insults in the older age group, especially in patients with osteoporotic bone. Displaced fractures occur in approximately 20% of cases, especially in the younger age group and usually from a high-energy trauma.

**Clinical Examination**

Swelling, ecchymosis, and discoloration in the shoulder and upper arm region are common. It is important to assess the function of the neurovascular structures, especially the radial and axillary nerves and the radial pulse.

**Diagnostic Evaluation**

Routine radiographs of the shoulder should be obtained. Axillary views are often helpful in making the diagnosis.
**Treatment/Rehabilitation**

Minimally displaced fractures (<1 cm) are usually treated with a sling and rehabilitation. After the first week, the patient can begin an exercise program consisting of pendulum exercises. After 3 weeks, the sling can be removed or worn part-time for comfort. Progressive stretching and then strengthening exercises should be aggressively performed after the third week.

Displaced fractures with greater than 1 cm separation require surgical intervention. Displaced four-part fractures disrupt blood supply to the humeral head and usually require prosthetic replacement of the humeral head, rather than an open reduction internal fixation.

**Scaphoid Fractures**

**Background**

The scaphoid is the most commonly injured carpal bone, accounting for 60 to 70% of all carpal fractures. If adequately treated, 90 to 95% will go on to union (thus, in 5–10% nonunion may occur in spite of treatment). Scaphoid fractures can be divided by anatomic location: distal pole, middle or waist, and proximal pole. The scaphoid receives its blood supply from branches of the radial artery. The blood supply to the scaphoid is tenuous because the major blood supply enters the bone in the distal third of the bone. Injuries proximal to the major blood supply may disrupt vascularity to the proximal scaphoid, resulting in nonunion and osteonecrosis.

**Clinical Examination**

Palpation over the anatomic snuffbox reveals tenderness. Pressure over the scaphoid tubercle on the palmar aspect of the wrist will produce pain. Pain can usually be elicited by wrist dorsiflexion and radial deviation. It is also important to assess the neurovascular integrity of the hand and wrist.

**Diagnostic Evaluation**

At the time of injury, a scaphoid fracture may not be visible on routine posteroanterior (PA) and lateral films of the wrist. It is often necessary to obtain a PA view with the wrist in ulnar deviation and an oblique view to further visualize a suspected scaphoid fracture. If the initial radiographs are normal, but the pain continues to persist, another PA and oblique view should be obtained in 2 to 3 weeks. A bone scan and MRI may be helpful if the diagnosis is in doubt.
Treatment/Rehabilitation

The wrist should be immobilized in the neutral position with a long-arm thumb spica cast for at least 6 weeks. If X-rays show a healing fracture after 6 weeks, the cast can be downgraded to a short-arm thumb spica cast. It should be noted that if a scaphoid fracture is suspected, the patient should be placed in a thumb spica splint, despite initial negative X-rays. Repeat X-rays should be ordered 2 to 3 weeks after the initial injury. If the radiographs are still normal and the patient continues with pain, a bone scan or MRI should be considered.

Healing times vary depending on the location of the scaphoid fracture. Nondisplaced fractures of the distal pole usually require 6 to 8 weeks, whereas fractures of the proximal pole can take as long as 3 to 6 months secondary to its poor vascularity. Fractures of the middle portion usually require 2 to 3 months for adequate healing. All patients with displaced fractures of the scaphoid will need early evaluation for possible surgical intervention. Furthermore, patients with nondisplaced fractures that have failed to heal after 2 months of immobilization will need surgical evaluation for possible intervention.

Other Fractures of the Upper Extremity

Humeral Shaft Fractures

Fractures of the humeral shaft often occur secondary to a traumatic insult. Most humeral shaft fractures can be treated non-operatively, with good union after closed reduction. Radial nerve injuries are often associated with this fracture. The radial nerve function can be quickly assessed by asking the patient to extend the wrist or fingers or by checking sensation on the dorsum of the wrist or posterior aspect of the forearm.

Most patients are prescribed a splint, followed by a fracture brace to the arm. ROM of the shoulder, elbow, and wrist should be encouraged while in the brace. The fracture brace is worn for at least 6 weeks until there is appropriate healing on X-ray.

Forearm Fractures

Isolated radial shaft fractures and both forearm bones (ulna and radius) require open reduction and internal fixation (ORIF). An undisplaced ulna shaft fracture can be treated with plaster immobilization. It is important to remember not to immobilize in a long arm cast or splint for more than 3 weeks. Usually the cast is set at 90° of flexion. If the fracture is aligned, the cast should be converted to a removable forearm brace around 2 weeks.
ROM should begin by this time. The extremity usually remains nonweight-bearing until approximately 6 weeks if adequate callus formation is present. A displaced ulna shaft fracture requires ORIF.

Two special types of forearm fractures, the Galeazzi and the Monteggia fracture usually require ORIF. A Galeazzi fracture is a distal radial shaft fracture that is associated with a distal radioulnar dislocation and is difficult to treat nonoperatively secondary to mechanical forces that tend to displace the distal radial fragment. A Monteggia fracture is a proximal ulna shaft fracture with dislocation of the radial head. Ulna shaft fractures should include radiographs of the elbow to rule out associated dislocations.

**Wrist Fractures**

Distal radial fractures are very common, especially after falls in adults. Colles fracture is the most common type with dorsal angulation of the distal fragment (silver fork deformity). A Smith fracture is the opposite of a Colles fracture, with the distal fragment anguluating in the volar (downward) direction. The Barton fracture is an intra-articular fracture of the distal radius associated with dislocation/subluxation of the carpus. For nondisplaced and minimally displaced fractures, the wrist is immobilized with a sugar-tong splint followed by a short arm cast for a total of about 4 to 6 weeks. After the cast is removed, a removable splint should be worn for approximately 1 month. Shoulder and finger ROM should be performed to prevent stiffness. Displaced fractures are often unstable and require internal or external fixation. Weight-bearing is typically allowed at about 6 weeks if there is adequate callus formation.

**Key References and Suggested Additional Reading**


