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## CHAPTER 10.5

# Knee Surgery

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## Arthroplasty of the Knee

### Surgical Considerations

**Description:** In this procedure, an arthrotomy of the knee joint is performed, and metallic and plastic components are used for replacement of the knee joint surfaces (**total knee replacement**). The femur, patella, and tibia are exposed; cartilage and minimal bone are excised with a saw. The new components may be cemented or uncemented. Alternatively, arthroplasty may be performed on only one compartment of the knee (i.e., medial/lateral **unicompartmental knee replacement**). In **revision procedures**, one or more components of the old joint are removed and new components are placed. In **resection or excision arthroplasty** of the knee, (usually for infection of the prosthesis), the components are removed, but not replaced.

**Usual preop diagnosis:** Arthritis of knee; arthrosis of knee; loose (or malpositioned) knee prosthesis; infected knee

## Summary of Procedures

	Knee Replacement	Revision	Resection/Excision
<b>Position</b>	Supine		
<b>Incision</b>	Anterior or anteromedial over patella		
<b>Special instrumentation</b>	Appropriate prostheses and instrumentation	Special instruments for excising cement	
<b>Unique considerations</b>	± Tourniquet; ± SCD Cefazolin 1 g iv q 6–8 h × 24 h (vancomycin or clindamycin for 24 h if penicillin allergic)		
<b>Surgical time</b>	2 h	3–4 h or more	3 h
<b>Closing considerations</b>	In infected or complex revision cases (rare), a local or free flap is required.		
<b>EBL</b>	300–500 mL	500–1,000 mL	
<b>Postop care</b>	Bulky dressing or splint; continuous passive motion (CPM) may begin in the PACU or ward		Splint/cast
<b>Mortality</b>	Rare		
<b>Morbidity</b>	DVT, without prophylaxis: 50–75%		
	DVT, with prophylaxis (e.g., low-molecular-weight heparin, coumadin, SCD, antiembolism)		

stockings): 2–3%		
Postop subluxation/dislocation of patella: 20%	> 30%	–
Superficial wound necrosis: 10–15%	> 10–15%	≥ 10–15%
Wound infection: Primary rheumatoid or psoriatic arthritis, diabetes: 5–10%	> 5–10%	Rare
Primary osteoarthritis (OA): 1%		
PE: 1–7%		
Postop subluxation/dislocation of knee joint: 1–6%	≥ 1–6%	–
Late aseptic loosening requiring revision after 10 yr:	–	–
5%		
Peroneal nerve injury: 1–5%	> 1–5% (more common in difficult revisions)	1–5%
Urinary retention requiring catheterization: Common	–	–
Hematoma requiring reoperation: Rare	–	–
Hypotension	–	–
Knee stiffness	–	–
Intraoperative fracture: Rare		
Wound dehiscence: Rare	–	–
Fat embolism: Rare	–	–
Vascular injury to popliteal vessels: Rare	–	–
<b>Pain score</b>	7	8
		9

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## Patient Population Characteristics

<b>Age range</b>	Generally, > 60 yr. Arthritis of the knee (e.g., rheumatoid arthritis or juvenile rheumatoid arthritis); hemophilia, ≥ 18 yr
<b>Male:Female</b>	1:1
<b>Incidence</b>	Common (~ 400,000/yr in the United States)
<b>Etiology</b>	Arthrosis of the knee (degenerative joint disease [DJD] or OA); seropositive or seronegative arthritis; traumatic arthritis; hemophiliac arthropathy of the knee
<b>Associated conditions</b>	Dependent on primary condition (e.g. osteoarthritis)

## Anesthetic Considerations

See [Anesthetic Considerations for Knee Procedures \(p. 1026\)](#).

## Suggested Readings

- Blaster RB, Matthews LS: Complications of prosthetic knee arthroplasty. In: *Complications in Orthopaedic Surgery*, 3rd edition. Epps CH Jr, ed. JB Lippincott, Philadelphia: 1994, 1057–86.



2. Burke DW, O'Flynn H: Primary total knee arthroplasty. In *Chapman's Orthopaedic Surgery*, 3rd edition. Chapman MW, ed. Lippincott Williams & Wilkins, Philadelphia: 2001, 2869–96.
3. Guyton JL: Arthroplasty of the ankle and knee. In: *Campbell's Operative Orthopaedics*, 9th edition. Crenshaw AH, ed. Mosby-Year Book, St. Louis: 1998, Vol 1, 232–94.
4. Insall JN: Total knee replacement. In: *Surgery of the Knee*. Insall JN, ed. Churchill Livingstone, New York: 1984, 587–695.
5. Kuper M, Rosenstein A: Infection control in total knee and total hip arthroplasties. *Am J Orthop* 2008; 37(1):E2–5.
6. NIH Consensus Statement on total knee replacement. *NIH Consens State Sci Statements*. 2003; 20(1):1–34.
7. Vince KG: Revision knee arthroplasty and arthrodesis of the knee. In *Chapman's Orthopaedic Surgery*, 3rd edition. Chapman MW, ed. Lippincott Williams & Wilkins, Philadelphia: 2001, 2897–2952.

## Arthrodesis of the knee

### Surgical Considerations

**Description:** In this procedure, the femur is fused to the tibia, obliterating the knee joint. Through a midline incision and anterior or median parapatellar arthrotomy, the cartilage surface and a small amount of bone are excised. The cut ends are opposed and aligned in 0–20° of flexion and 5–10% of valgus. The bones are stabilized with plates, screws, an intramedullary rod, or an external fixator.

**Usual preop diagnosis:** Arthritis or other arthrosis of the knee; previous septic arthritis of the knee; failed or infected knee arthroplasty

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## Summary of Procedures

<b>Position</b>	Usually supine
<b>Incision</b>	Anterior midline over knee
<b>Special instrumentation</b>	External fixator; internal fixation with plates and screws or intramedullary nail
<b>Unique considerations</b>	Intraop radiographs or I.I.; tourniquet
<b>Antibiotics</b>	Cefazolin 1 g iv q 6–8 h × 24 h (vancomycin or clindamycin for 24 h if penicillin allergic)
<b>Surgical time</b>	3 h (+ 1 h, if necessary, to excise total knee arthroplasty)
<b>Closing considerations</b>	Cast or splint while anesthetized < 100 mL, if tourniquet and local fixation used. 500–1000 mL, if no tourniquet used, or if intramedullary procedures are used.
<b>EBL</b>	Rare, but depends primarily on age and medical condition of patient. Thromboembolism ≥ incidence following total knee replacement: DVT (without prophylaxis): 50–75% DVT (if prophylaxis used): 10–20% PE (if no prophylaxis; reduced if anticoagulation or SCDs used): 1–7% Failure of fusion (nonunion), malunion: 10%
<b>Mortality</b>	

## Morbidity

After failed knee replacement: 19–44%  
With Charcot joint: as high as 50%  
Pin tract infection: ≥ 1–10%  
Wound infection: 5%  
Deep infection and osteomyelitis  
Urinary retention requiring catheterization, UTI: Common  
Breakage or failure of internal or external fixation: Rare  
Fat embolism: Rare  
GI bleed, MI: Rare  
Hematoma: Rare  
Hypotension: Rare  
Intraop femoral or tibial fracture: Rare  
Neurological injury, usually popliteal nerve or peroneal nerve: Rare  
Superficial wound necrosis and wound dehiscence: Rare  
Vascular injury to popliteal vessels: Rare  
Amputation: Extremely rare (usually 2° acute arterial occlusion or uncontrollable local sepsis)

9

## Pain score

# Patient Population Characteristics

Age range	Any age
Male:Female	1:1
Incidence	Rare
Etiology	Failed or infected total knee replacement (probably most common etiology); trauma to knee—unreconstructable, intraarticular fractures; total unstable knee or failed ligament repairs with severe DJD in a young patient

## Anesthetic Considerations

See [Anesthetic Considerations for Knee Procedures \(p. 1026\)](#).

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## Suggested Readings

1. Blaster RB, Matthews LS: Complications of prosthetic knee arthroplasty. In: *Complications in Orthopaedic Surgery*, 3rd edition. Epps CH Jr, ed. JB Lippincott, Philadelphia: 1994, 1057–86.
2. Carnesale PG, Stewart MJ: Complications of arthrodesis surgery. In: *Complications in Orthopaedic Surgery*, 3rd edition. Epps CH Jr, ed. JB Lippincott, Philadelphia: 1994, 1279–1308.
3. Christian CA, Donley BG: Arthrodesis of the ankle, knee, hip. In: *Campbell's Operative Orthopaedics*, 9th edition. Canale ST, ed. Mosby-Year Book, St. Louis: 1998, Vol 1, 145–88.
4. Mize R, Johnson EE, Hohl M: Complications of fractures and dislocations of the knee. In: *Complications in Orthopaedic Surgery*, 3rd edition. Epps CH Jr, ed. JB Lippincott, Philadelphia: 1994, 525–56.
5. Vince KG: Revision knee arthroplasty and arthrodesis of the knee. In: *Chapman's Orthopaedic Surgery*, 3rd edition. Chapman

MW, ed. Lippincott Williams & Wilkins, Philadelphia: 2001, 2897–2952.

## Open Reduction and Internal Fixation (ORIF) of Patellar Fractures

### Surgical Considerations

**Description:** In ORIF of patellar fractures, a short incision over the patella is used to perform a reduction by direct visualization of the fracture fragments of the patella. Since this is generally an intraarticular fracture, the fragments should be reduced precisely. The torn quadriceps retinaculum is also repaired. Part or all of the patella may be excised; pins, wires, and/or screws are normally used to fix the patellar fragments together internally. Thereafter, the knee is casted, or early motion of the knee is started.

**Usual preop diagnosis:** Fracture of patella; severe degenerative arthritis of patellofemoral joint

### Summary of Procedures

<b>Position</b>	Supine
<b>Incision</b>	Anterior over patella
<b>Special instrumentation</b>	Wire, pins, screws as necessary
<b>Unique considerations</b>	Intraop radiographs may be obtained; tourniquet
<b>Antibiotics</b>	Cefazolin 1 g iv q 6–8 h × 24 h (vancomycin or clindamycin for 24 h if penicillin allergic)
<b>Surgical time</b>	1.5–2 h
<b>Closing considerations</b>	Splint or cast usually applied.
<b>EBL</b>	< 100 mL
<b>Mortality</b>	< 1%
<b>Morbidity</b>	Late degenerative arthritis of patellofemoral joint: 50–60% DVT: 5% Wound infection, septic arthritis, osteomyelitis: 5% Delayed union, nonunion, malunion: 2–5% Knee stiffness: Common Weakness: Common Avascular necrosis: Rare Complex regional pain syndrome: Rare Following patellectomy—quadriceps strength: 75% of normal
<b>Pain score</b>	7

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### Patient Population Characteristics

<b>Age range</b>	Any age; frequently seen in young, active, healthy adults.
<b>Male:Female</b>	1:1
<b>Incidence</b>	1% of all skeletal injuries
<b>Etiology</b>	Trauma: falls (60%); motorcycle and motor vehicle accidents (25–35%); industrial injury (6%); degenerative arthritis of patellofemoral joint (rare)

### Anesthetic Considerations



See [Anesthetic Considerations for Knee Procedures \(p. 1026\)](#).

## Suggested Readings

1. Callaghan JJ, O'rourke MR, Saleh KJ. Why knees fail: lessons learned. *J Arthroplasty* 2004; 19(4 Suppl 1):31–4.
2. Mize R, Johnson EE, Hohl M: Complications of fractures and dislocations of the knee. In: *Complications in Orthopaedic Surgery*, 3rd edition. Epps CH Jr, ed. JB Lippincott, Philadelphia: 1994, 525–56.
3. Whittle AP: Fractures of lower extremity. In: *Campbell's Operative Orthopaedics*, Vol 3, 9th edition. Canale ST, ed. Mosby-Year Book, St. Louis: 1998, 2042–2180.
4. Whittle AP: Malunited fractures. In: *Campbell's Operative Orthopaedics*, Vol 3, 9th edition. Canale ST, ed. Mosby-Year Book, St. Louis: 1998, 2537–78.
5. Wiss DA, Watson JT, Johnson EE: Fractures of the knee. In: *Rockwood and Green's Fractures in Adults*, 5th edition. Rockwood CA Jr, Green DP, Bucholz RW, Heckman JD, eds. Lippincott-Raven, Philadelphia: 1996, 1919–71.

## Repair or Reconstruction of Knee Ligaments

### Surgical Considerations

**Description:** Collateral ligaments usually are repaired by direct suture or by stapling the torn ligaments to bone. Cruciate tears are generally repaired only if bone is avulsed at one end of the ligament, again with direct suture, staples, or screws. For collateral ligament repair, a longitudinal incision is made directly over the ligament medially or laterally. The ligament is exposed by deep dissection and elevation of skin flaps. The torn ligament is repaired by direct suture or by fixing it to bone with a screw or staple. Following closure, the knee is immobilized with a long leg splint or cast. Cruciate ligaments are repaired in similar fashion, except for the approaches: medial parapatellar (with anterior arthrotomy) for the anterior cruciate ligament (ACL) and posteromedial (with posterior arthrotomy) for the posterior cruciate ligament (PCL). Cruciate ligament reconstruction is performed for instability 2° intrasubstance tears of these ligaments. Homografts, such as a portion of the patellar tendon or semitendinosus tendon, normally are used, but allografts or synthetics also are available. (The ligaments of the knee are illustrated in [Figs 10.5-1](#) and [10.5-2](#).)

**Usual preop diagnosis:** Trauma

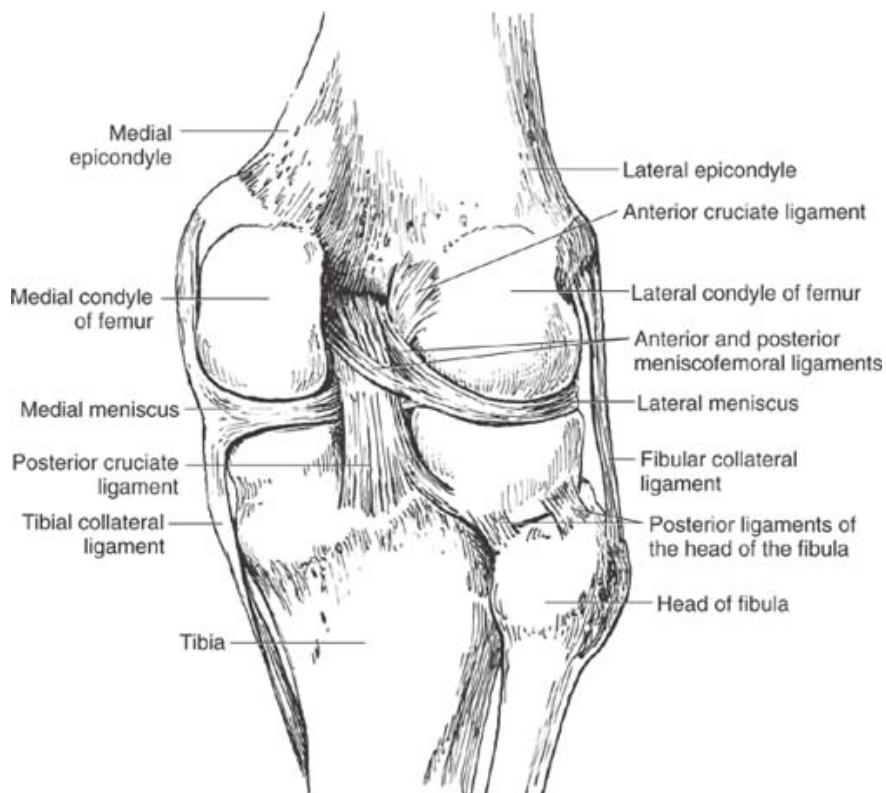
## Summary of Procedures

	Repair or Collateral Reconstruction	Repair or Cruciate Reconstruction
<b>Position</b>	Supine	
<b>Incision</b>	Over collateral ligament	Anterior and lateral ACL or medial PCL
<b>Special instrumentation</b>	Staples	Drill guides, staples, screws
<b>Unique considerations</b>	Often arthroscopically assisted; tourniquet	
<b>Antibiotics</b>	Cefazolin 1 g iv (vancomycin or clindamycin if penicillin allergic)	
<b>Surgical time</b>	2 h	
<b>Closing considerations</b>	Splint or cast while anesthetized	
<b>EBL</b>	100 mL	
<b>Postop care</b>	PACU → room or home	
<b>Mortality</b>	Minimal	
<b>Morbidity</b>	Infection: < 1% Thrombophlebitis: < 5%	

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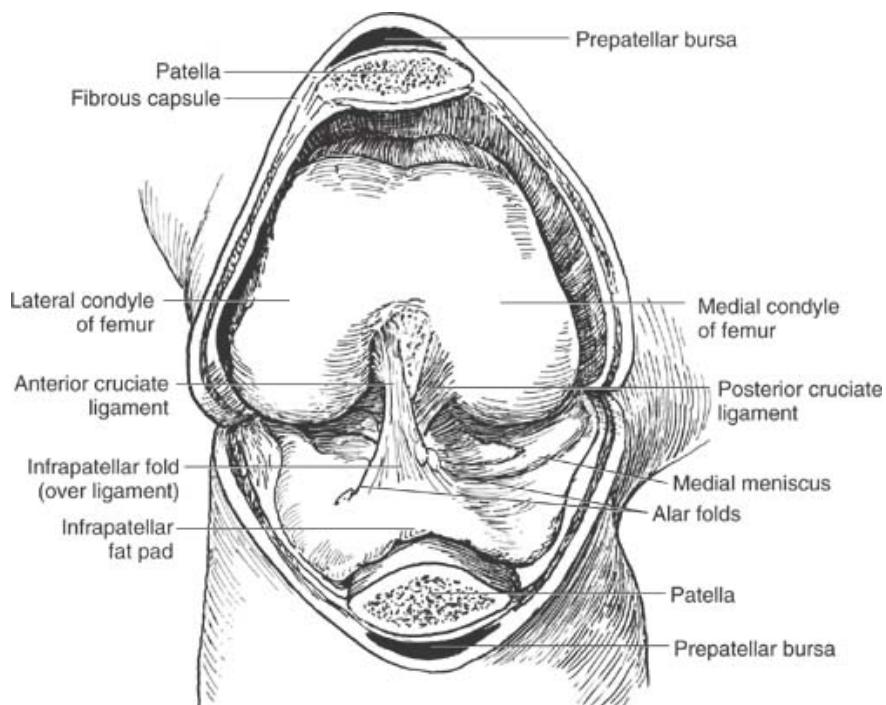
## Patient Population Characteristics

Age range	Young adult
Male:Female	2:1
Incidence	Common
Etiology	Trauma: 100%



**Figure 10.5-1. 1.** The cruciate ligaments (posterior view). (Reused with permission from Clemente CD. *Clemente's Dissector*, 2nd edition. Baltimore: Lippincott Williams & Wilkins, 2007: 270.)

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**Figure 10.5-2.** 2. The knee joint opened anteriorly. (Reused with permission from Clemente CD. *Clemente's Dissector*, 2nd edition. Baltimore: Lippincott Williams & Wilkins, 2007: 269.)

## Anesthetic Considerations

See [Anesthetic Considerations for Knee Procedures \(p. 1026\)](#).

## Suggested Readings

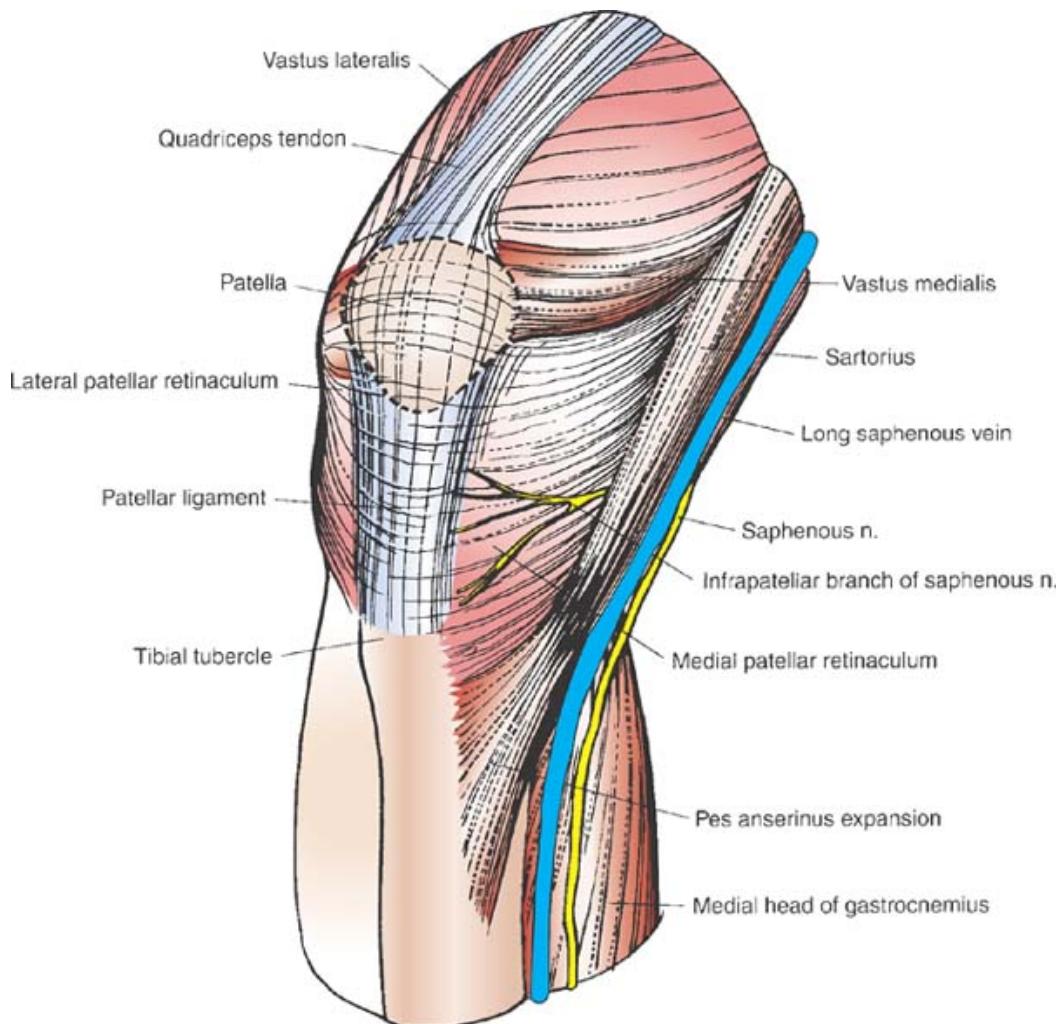
1. Canale ST, ed: *Campbell's Operative Orthopaedics*, 10th edition. Mosby, St. Louis: 2003.
2. Marder RA, Ertl JP: Dislocations and multiple ligamentous injuries of the knee. In *Chapman's Orthopaedic Surgery*, 3rd edition. Chapman MW, ed. Lippincott Williams & Wilkins, Philadelphia: 2001, 2417–34.
3. McCulloch PC, Lattermann C, Boland AL, et al: An illustrated history of anterior cruciate ligament surgery. *J Knee Surg* 2007; 20(2):95–104.

## Patellar Realignment

### Surgical Considerations

**Description:** The goal of this procedure is prevention of chronic subluxation or dislocation of the patella. Soft tissue components of the surgery include incision (release) of the lateral patellar retinaculum and reefing or tightening of the medial retinaculum ([Fig. 10.5-3](#)). In cases of severe malalignment of the extensor mechanism, the insertion of the patellar tendon may be moved to a new, more medial location (**tibial tubercle transfer**). In this procedure, the tibial tubercle generally is detached with a saw or osteotomes, leaving a bone pedicle attached distally. The tubercle is then rotated medially on the pedicle and fixed in its new position with a screw. Many surgeons routinely perform an **anterior compartment fasciotomy** to prevent postop compartment syndrome.

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**Figure 10.5-3.** Outer layer of anteromedial aspect of the knee joint. Shows anatomy of the patellar retinaculum. (Reproduced with permission from Hoppenfeld S, deBoer P: *Surgical Exposures in Orthopaedics: The Anatomic Approach*. Lippincott Williams & Wilkins: 1994.)

**Usual preop diagnosis:** Chronic patellar subluxation or dislocation

## Summary of Procedures

	Patellar Realignment	Tibial Tuber Transfer
<b>Position</b>	Supine	
<b>Incision</b>	Anteromedial or anterolateral to knee	
<b>Special instrumentation</b>	None	Screws or staples
<b>Unique considerations</b>	Tourniquet	
<b>Antibiotics</b>	Cefazolin 1 g iv (vancomycin or clindamycin if penicillin allergic)	
<b>Surgical time</b>	1 h	1.5 h
<b>Closing considerations</b>	None	Splint or cast while anesthetized
<b>EBL</b>	50 mL	100 mL
<b>Postop care</b>	PACU → room or home	
<b>Mortality</b>	Minimal	
<b>Morbidity</b>	Hemarthrosis: 100% Redislocation: 20% Thrombophlebitis: 10–20% Compartment syndrome: < 1%	5% 25%

Pain score	Infection: < 1%
	6      7

## Patient Population Characteristics

Age range	Usually young adult
Male:Female	1:2
Etiology	Trauma (70%); congenital (30%)
Associated conditions	Patellofemoral dysphasia (60–70%)

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## Anesthetic Considerations

See [Anesthetic Considerations for Knee Procedures \(p. 1026\)](#).

## Suggested Readings

1. Epps CH Jr, ed: *Complications in Orthopaedic Surgery*, 3rd edition. JB Lippincott, Philadelphia: 1994.
2. Griffin LY, Duralde XA: Adolescent sports injuries. In: *Chapman's Orthopaedic Surgery*, 3rd edition. Chapman MW, ed. Lippincott Williams & Wilkins, Philadelphia: 2001, 2493–2536.

## Arthroscopy of the Knee

### Surgical Considerations

**Description:** **Knee arthroscopy** is used to diagnose and treat intraarticular problems, most commonly torn meniscus, but the procedure is also used for ligament injuries ([Fig 10.5-1](#), [10.5-2](#)), osteochondral fractures, loose bodies, arthritis, and infections. In knee arthroscopy, multiple portals or entry points for the arthroscope and instruments generally are used. The most common portals are anteromedial and anterolateral adjacent to the patellar ligament. Other portals may be suprapatellar, parapatellar, and posterior. Portals are made by making a stab wound with a knife and then entering the joint with a combination of sharp and blunt trochars. A diagnostic inspection from one of the anterior portals is normally performed at the outset. A second portal is used with a nerve hook to manipulate intraarticular tissues. If resection or repair is performed, the appropriate instruments are inserted through one of the portals. Meniscus repair and cruciate reconstruction may require separate longitudinal incisions, which are usually posteromedial or posterolateral, for placement of sutures and/or drill holes.

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**Meniscectomy** and/or **debridement** often are performed in conjunction with arthroscopy. **Cruciate ligament reconstruction** usually is performed with arthroscopic assistance. At the end of the procedure, the knee joint is copiously irrigated with NS or LR solution through one of the portals. Portals are closed with a single suture and Steri-Strips®; compression bandages are applied; and often a knee immobilizer is used.

**Usual preop diagnosis:** Torn meniscus; cruciate ligament tear; arthritis

## Summary of Procedures



	Arthroscopy	Meniscectomy/Debridement	Cruciate Reconstruction
<b>Position</b>	Supine		
<b>Incision</b>	3–4.5 cm portals		+ anterior midline and lateral
<b>Special instrumentation</b>	Arthroscopic video system; small biters and graspers	+ shaver	+ drill guides and drills; fixation screws
<b>Unique considerations</b>	Thigh holder; foot of table 90°; ± tourniquet		
<b>Antibiotics</b>	Cefazolin 1 g iv (vancomycin or clindamycin if penicillin allergic)		
<b>Surgical time</b>	0.5 h	1–2 h	2–3 h
<b>Closing considerations</b>	No splint; local anesthetic injected		
<b>EBL</b>	Minimal		50 mL
<b>Postop care</b>	PACU → home		or overnight
<b>Mortality</b>	< 0.1%		
<b>Morbidity</b>	Hemarthrosis: 5–20% Thrombophlebitis: < 2% Infection: 0.1% Stiffness: < 0.1%	5%	
<b>Pain score</b>	3	4	6

## Patient Population Characteristics

<b>Age range</b>	10–70 yr (usually 20–40 yr)
<b>Male:Female</b>	2:1
<b>Incidence</b>	The most common arthroscopic procedure (85% of total)
<b>Etiology</b>	Trauma ( 85%); arthritis ( 10%); infection ( 5%)
<b>Associated conditions</b>	Usually healthy; systemic arthritis (< 5%)

## Anesthetic Considerations

See [Anesthetic Considerations for Knee Procedures \(p. 1026\)](#).

## Suggested Readings

1. Coward DB: Principles of arthroscopy of the knee. In *Chapman's Orthopaedic Surgery*, 3rd edition. Chapman MW, ed. Lippincott Williams & Wilkins, Philadelphia: 2001, 2269–98.  
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2. McGinty JB, ed: *Operative Arthroscopy*. 3rd edition. Lippincott Williams & Wilkins, Philadelphia: 2002.
3. Silvis ML, Clinch CR, Tillett JS, et al: Clinical inquiries. What is the best way to evaluate an acute traumatic knee injury? *J Fam Pract* 2008; 57(2):116–8.

## Knee Arthrotomy

## Surgical Considerations

**Description:** Arthrotomy of the knee is the opening of the joint for drainage, excision of intraarticular tissue (synovium, meniscus, loose bodies), ligament repair/reconstruction, or fracture fixation. The knee generally is opened with a parapatellar incision, either medial or lateral, and the joint capsule is incised just adjacent to the patella. After the intra-articular pathology is addressed, a tight capsular closure is performed, followed by subcutaneous tissue and skin closure.

**Variant procedure or approaches:** Arthrotomy with debridement may be used for infection or arthropathy which produces debris. In both cases, synovectomy may be necessary.

**Usual preop diagnosis:** Infection; trauma (fracture, sprain, torn meniscus); arthritis

## Summary of Procedures

	Arthrotomy	Arthrotomy with Debridement	Arthrotomy with Synovectomy
<b>Position</b>	Supine		
<b>Incision</b>	Medial or lateral parapatellar		
<b>Special instrumentation</b>	Tourniquet		
<b>Antibiotics</b>	Cefazolin 1 g iv (vancomycin or clindamycin if penicillin allergic)		
<b>Surgical time</b>	1 h	2 h	2 h
<b>Closing considerations</b>	Compressive dressing; may be splinted; suction drain		
<b>EBL</b>	100 mL		
<b>Postop care</b>	PACU → room		
<b>Mortality</b>	Minimal		
<b>Morbidity</b>	Hemarthrosis: 100% Degenerative arthritis: 5–20% Stiffness: 5% Thrombophlebitis: 5%		
<b>Infection: 1 %</b>	10%		20%
<b>Pain score</b>	7	7	8

## Patient Population Characteristics

<b>Age range</b>	Infant–elderly (usually young adult)
<b>Male:Female</b>	1:1
<b>Incidence</b>	Common
<b>Etiology</b>	Infection; trauma; arthritis
<b>Associated conditions</b>	Inflammatory arthritis (20%)

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## Anesthetic Considerations

See [Anesthetic Considerations for Knee Procedures \(p. 1026\)](#).

## Suggested Reading

1. Epps CH Jr, ed: *Complications in Orthopaedic Surgery*, 3rd edition. JB Lippincott, Philadelphia: 1994.

## Repair of Tendons—knee and leg

### Surgical Considerations

**Description:** Acute ruptures of tendons in the lower limb are repaired by **direct suture** and sometimes reinforced with part of another tendon. At the knee, patellar tendon ruptures are most common; at the ankle, Achilles tendon ruptures are most common. A longitudinal incision generally is made directly over the tendon. The tendon sheath is opened and tendon ends reapproximated with a nonabsorbable tendon stitch. If necessary, the repair may be augmented by synthetic tape or fascia, or protected with a wire that takes tension off the repair. The tendon sheath is closed separately from the skin incision; and a cast or splint is applied. **Achilles tendon repair** and **posterior tibial tendon repair** require different positioning. For an Achilles tendon repair, the patient is placed prone, and a longitudinal incision is made just medial to the tendon, spanning the rupture. The tendon sheath is incised and carefully protected. Torn ends of the tendon are approximated with multiple tendon stitches and may be protected with a fascial flap developed from the gastrocnemius fascia. The tendon sheath is closed carefully, followed by skin wound closure. A splint or cast is applied with the foot in equinus (plantar flexion).

**Usual preop diagnosis:** Tendon rupture

### Summary of Procedures

	Posterior Tendon Repair	Achilles Tendon Repair
<b>Position</b>	Supine	Prone
<b>Incision</b>	Over tendon	
<b>Special instrumentation</b>	Wire or synthetic tape for augmentation	
<b>Unique considerations</b>	Tourniquet	
<b>Antibiotics</b>	Cefazolin 1 g iv (vancomycin or clindamycin if penicillin allergic)	
<b>Surgical time</b>	1 h	
<b>Closing considerations</b>	Splint or cast while anesthetized	
<b>EBL</b>	Minimal	
<b>Postop care</b>	PACU → room or home	
<b>Mortality</b>	Minimal	
<b>Morbidity</b>	Weakness: 10% Wound slough: 5% Adhesions: < 1% Infection: < 1% Rerupture: 5–10%	
<b>Pain score</b>	3	3

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### Patient Population Characteristics

<b>Age range</b>	Any age
<b>Male:Female</b>	1:1
<b>Incidence</b>	Uncommon
<b>Etiology</b>	Trauma (90%); chronic tendinitis (10%)
<b>Associated conditions</b>	Obesity; diabetes mellitus (DM); inflammatory arthritis

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## Anesthetic Considerations for Knee Procedures

(Procedures covered: arthroplasty; arthrodesis; ORIF of patellar fractures; repair/reconstruction of ligaments; patellar realignment; arthroscopy; arthrotomy; tendon repair—knee and leg)

### Preoperative

Trauma and osteoarthritis (OA) are the most common indications for these procedures. Trauma patients (e.g., those with sports injuries) are often young and healthy, whereas arthritic patients are often elderly, and anesthetic management must be tailored to any concurrent disease. Patients with rheumatoid and other inflammatory arthritides form another group of candidates for these procedures; the special anesthetic considerations for these patients are described in [Anesthetic Considerations for Hip Procedures, p. 997](#). A final group of patients undergoing these procedures are hemophiliacs, who develop arthritis from recurrent bleeding into their joints. The hematologic management of these patients is discussed below.

### Respiratory

These patients often have **rheumatoid arthritis** and associated pulmonary conditions. For example, pulmonary effusions are common. Limited respiratory reserve warrants further evaluation. Pulmonary fibrosis (rare) often manifests as a cough and dyspnea. Rheumatoid arthritis involving the cricoarytenoid joints may manifest as hoarseness, glottic narrowing, and difficult intubation. Arthritic involvement of the TMJ and cervical spine may further complicate airway management.

**Tests:** As indicated from H&P.

The severity of the arthritis often limits exercise and makes assessment of cardiovascular status difficult. Dobutamine stress ECHO, and dipyridamole thallium imaging may be necessary for an adequate cardiac evaluation. Rheumatoid arthritis is associated with pericardial effusion, cardiac valve fibrosis, cardiac conduction abnormalities and aortic regurgitation (AR).

**Tests:** ECG and others as indicated from H&P.

In arthritic patients, a thorough preop neurological exam often yields evidence of cervical nerve root compression. After the stability of the neck has been established, the full range of neck motion should be evaluated for evidence of nerve compression or cerebral ischemia (suggesting vertebral artery compression). Consider preop lateral neck films to determine stability of atlantooccipital joint and evidence of vertebral spurs that may interfere with intubation.

**Tests:** As indicated from H&P.

Pain and ↓ joint mobility may make positioning and regional anesthesia difficult in this patient population.

**Hemophiliacs** require restoration of clotting factors preop. Administer 1 U of factor concentrate/kg body weight for each 2% increase necessary to achieve clotting factor activity of 40% normal. FFP contains 1 U/mL and cryoprecipitate 20 U/mL. Hemophilia B (Factor IX deficiency), but not hemophilia A (Factor VIII deficiency), can be treated with prothrombin complex concentrate; however, these products can activate clotting factors and → DIC. Approximately 10% of hemophiliacs develop antibodies to exogenous clotting factors, and the care of these patients should be guided by a hematologist.

**Tests:** Hct; other tests as indicated from H&P.

Other tests as indicated from H&P.

Standard premedication (see [p. B-1](#)). Preop patellar pain is treated effectively with a femoral nerve block at the inguinal ligament, using 10 mL of lidocaine 1.5% with epinephrine 1:200,000.

### Cardiovascular

### Neurological

### Musculoskeletal

### Hematologic

### Laboratory

### Premedication



## Intraoperative

**Anesthetic technique:** For many of these patients, regional anesthesia may be the preferred technique, offering the advantages of ↓ blood loss, ↓ DVT, minimal respiratory impairment, and effective postop analgesia. Patients with rheumatoid arthritis rarely have involvement of the lumbar spine. Because rheumatoid arthritis frequently affects the C-spine, however, these patients may have limited range of neck motion, an unstable atlantooccipital joint, and cricoarytenoid and TMJ arthritis. Careful airway evaluation, therefore, is important to determine the appropriateness of special intubation techniques (e.g., fiber optic).

**Regional anesthesia:** A continuous peripheral nerve block (CPNB) provides similar effect on postop length of hospital stay and rehabilitation compared to an epidural pain management but has a lower incidence of side effects (urinary retention, hypotension, and dysesthesia). A combined femoral and sciatic nerve block provides superior pain control in the first 36 postoperative hours over a single, femoral nerve block. In addition to the nerve block, either a GA or a SAB is needed for the intraoperative phase since a CPNB does not reliably provide surgical anesthesia. Both nerves can be localized conventionally using a nerve stimulator or with ultrasound-guidance. A typical initial local anesthesia dose for each nerve is 20 mL of 0.5% bupivacaine or 0.75% ropivacaine.

An epidural block provides both intraop surgical anesthesia and postop pain control but it is contraindicated in patients receiving Coumadin postop. If the patient prefers not to receive a peripheral nerve or an epidural block, a subarachnoid block provides a useful alternative regional anesthesia technique, depending on the patient population (e.g., younger patients may be at ↑ risk of spinal headache following SAB). Anesthesia extending from S2 to T12 (T8, if tourniquet is used) is adequate for knee surgery. Full motor blockade is essential for fixation of the patella, or placement of the joint prosthesis and assessment of the passive ROM of the prosthesis. Typical drugs and doses include: subarachnoid—12.5–15 mg of 0.75% bupivacaine with morphine 0.2 mg; epidural—15–20 mL 2% lidocaine with epinephrine 1:200,000 in divided doses.

### General anesthesia:

#### Induction

Standard induction (see [p. B-2](#)) is appropriate for patients with normal airways.

#### Maintenance

Standard maintenance (see [p. B-2](#)). Neuromuscular relaxation facilitates the placement of the prosthesis. Hemophiliacs will require infusion of clotting factors. For hemophilia A and von Willebrand's disease, 1.5 U/kg/h; for hemophilia B, 0.75 U/kg/h. The tourniquet is deflated around the time of emergence. In patients with moderate-to-severe lung disease, controlled ventilation should be continued until after the lactic acid that has accumulated in the leg has been metabolized (3–5 min), because these patients may be unable to increase ventilation to buffer this acid load.

#### Emergency

A tourniquet blocks intraop blood loss. When it is deflated, prepare for a 1–2 U blood loss over the ensuing h; more if the posterior tibial artery has been damaged in the dissection.

Avoid under-resuscitation.

Inflation pressure is typically 100 mmHg + systolic pressure. Maximum tourniquet time is 2 h, followed by a 30 min reperfusion interval, if further tourniquet time is necessary.

#### Blood and fluid requirements

IV: 14–16 ga × 1  
NS/LR @ maintenance during the case, and 5–10 mL/kg bolus prior to tourniquet deflation

#### Control of blood loss

Tourniquet

A CVP line is indicated if monitoring the CVP trend is expected to affect anesthetic care.

Additional monitoring (CVO<sub>2</sub> Sat, PA cath, TEE) may be indicated in special cases.

#### Monitoring

Standard monitors (see [p. B-1](#)).

± CVP line

± Arterial line

## Positioning

and pad pressure points.  
eyes.

In rheumatoid arthritic patients,  
meticulous padding of the  
extremities is mandatory.

Posterior tibial artery trauma  
Peroneal nerve palsy

A 20% ↓MAP is common on  
tourniquet deflation. Additional  
crystalloid (5–10 mL/kg) may  
be necessary to replace edema  
fluid and blood loss to the leg.

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## Postoperative

### Complications

Hemorrhage from the posterior tibial artery

surgical drain output.

Peroneal nerve palsy → foot drop

Examine patient for evidence of neurologic  
dysfunction and notify surgeons as  
necessary.

Tourniquet-related nerve injury

PTS is a self-limiting condition in which  
the affected limb is edematous, pale, and  
weak.

Post-tourniquet syndrome (PTS)

Epidural bupivacaine 0.0125% infused at  
6–8 mL/h with hydromorphone 50 mcg/mL  
infused at 100–250 mcg/h provides good  
analgesia.

Neuraxial regimens:

Prior to removal of the epidural catheter a  
0.2 mg bolus of hydromorphone may be  
given. Epidural catheters are typically  
removed on the morning of postop day 2.  
Low-molecular-weight heparin may be  
started 2 h after catheter removal.

- Epidural anesthesia

Intrathecal morphine 0.2–0.3 mg provides  
analgesia for up to 24 h. May be  
administered along with bupivacaine for  
surgical anesthesia.

• SAB

Peripheral regimens:

These nerves may be blocked preop or  
postop as a pain rescue measure. A typical  
dose for each nerve is 20 mL of 0.5%  
bupivacaine or 0.75% ropivacaine.

- Single-shot peripheral nerve block  
(femoral or combined femoral/sciatic  
block)

Continuous infusion of bupivacaine  
0.125% through a standard infusion pump  
or a portable/disposable pump. Foley  
catheters are not required with peripheral  
nerve catheters.

- CPNB

Oral pain management with acetaminophen  
should be initiated immediately  
postoperatively (if not contraindicated).  
Patient-controlled analgesia (PCA) with IV  
morphine or hydromorphone may be  
initiated as alternative to neuraxial blocks  
or to supplement peripheral regimens.

Systemic regimens:

Patients with coagulopathies require  
replacement therapy for 6–10 d.

### Pain management

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Patients with coagulopathies require  
replacement therapy for 6–10 d.

### Tests

Hct; other studies as indicated.

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## Suggested Readings

1. Choi PT, Bhandari M, Scott J, et al: Epidural analgesia for pain relief following hip or knee replacement. *Cochrane Database Syst Rev* 2003; 3:CD003071.
2. Epps CH Jr, ed: *Complications in Orthopaedic Surgery*, 3rd edition. JB Lippincott, Philadelphia: 1994.
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4. Kuper M, Rosenstein A: Infection control in total knee and total hip arthroplasties. *Am J Orthop* 2008; 37(1):E2–5.
5. Rosenberg AG: Anesthesia and analgesia protocols for total knee arthroplasty. *Am J Orthop* 2006; 35(7 Suppl):23–6.
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