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The KNEE

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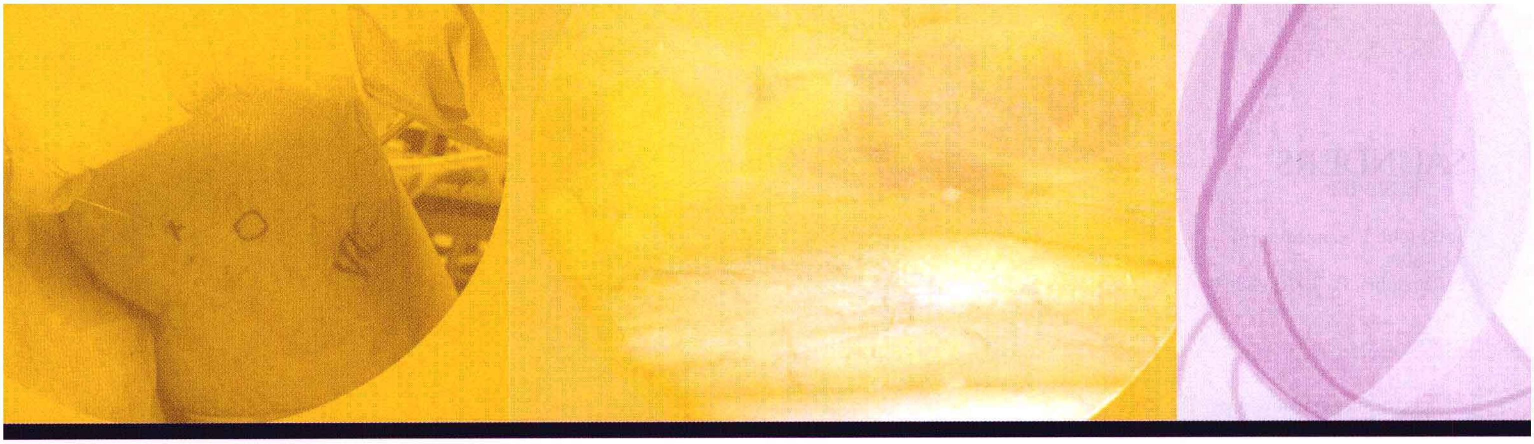

AANA Advanced Arthroscopy

The Knee

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AANA Advanced Arthroscopy: The Knee

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DEDICATION

To my wife, Patti, for her unconditional love and support,

and in memory of my father, Samuel W. Hunter, M.D.

Robert E. Hunter, MD

To Leslie, Nicholas, Caroline, Jonathan, and Matthew.

Thanks for all your patience and support.

Nicholas A. Sgaglione, MD

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Preface

The Arthroscopy Association of North America (AANA) is a robust and growing organization whose mission, simply stated, is to provide leadership and expertise in arthroscopic and minimally invasive surgery worldwide.

Towards that end, this five-volume series represents the very best that AANA has to offer the clinician in need of a timely, authoritative, and comprehensive arthroscopic textbook. These textbooks covering the shoulder, elbow and wrist, hip, knee, and foot and ankle were conceived and rapidly consummated over a 15-month timeline. The need for an up-to-date and cogent text as well as a step-by-step video supplement was the driving force behind the rapid developmental chronology. The topics and surgical techniques represent the cutting edge in arthroscopic philosophy and technique, and the individual chapters follow a reliable and helpful format in which the pathoanatomy is detailed and the key elements of the physical examination are emphasized in conjunction with preferred diagnostic imaging. Indications and contraindications are followed by a thorough discussion of the treatment algorithm, both nonoperative and surgical, with an emphasis on arthroscopic techniques. Additionally, a Pearls and Pitfalls section provides for a distilled summary of the most important features in each chapter. A brief annotated bibliography is provided in addition to a comprehensive reference list so that those who want to study the most compelling literature can do so with ease. The supporting DVD meticulously demonstrates the surgical techniques, and will undoubtedly serve as a critical resource in preparing for any arthroscopic intervention.

I am most grateful for the outstanding effort provided by the volume editors: Rick Angelo and Jim Esch (shoulder), Buddy Savoie and Larry Field (elbow and wrist), Thomas Byrd and Carlos Guanche (hip), Rob Hunter and Nick Sgaglione (knee), and Ned Amendola and Jim Stone (foot and ankle). Their collective intellect, skill, and dedicaton to AANA made this series possible. Furthermore, I sincerely thank all the chapter contributors whose expertise and wisdom can be found in every page. Elsevier, and in particular Kim Murphy, Ann Ruzycka Anderson, and Kitty Lasinski, was a delight to work with, and deserves our gratitude for a job well done. I would be remiss if I did not acknowledge that the proceeds of this five-volume series will go directly to the AANA Education Foundation, from which ambitious and state-of-the-art arthroscopic educational initiatives will be funded.

Richard K.N. Ryu, MD
Series Editor

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SECTION

A

Basics

CHAPTER 1

Knee Arthroscopy: Setup, Diagnosis, Portals, and Approaches

Vipool Goradia

Performing successful arthroscopic surgery with a low complication rate begins during the preoperative planning phase. When evaluating a patient for arthroscopy, the surgeon must consider the preoperative diagnosis, anatomic variants, and risk factors for complications. Each of these can be ascertained by obtaining a careful history and performing a thorough physical examination, as well as appropriate diagnostic testing. Depending on surgeon preference, the planning phase will likely affect operating room setup, request for special instruments, patient positioning, and portal placement.

Although some surgeons prefer to use the same setup and portals for every arthroscopic procedure, it can be more efficient to customize these based on the planned procedure and the pathology identified during diagnostic arthroscopy. Failure to do so may result in greater length of operation and risk for perioperative morbidity.

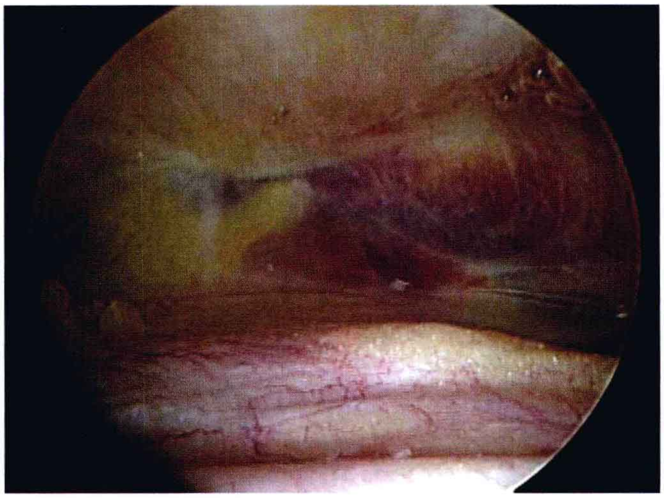

FIGURE 1-1 Arthroscopic view of suprapatellar pouch from high anterolateral portal.

ANATOMY

The knee joint, as other joints, is composed of a synovial lining within the capsule. Superior to the patella the synovium extends to form the suprapatellar pouch (Fig. 1-1).[1] Superior medial or lateral portals are commonly placed within this pouch. A layer of fat separates the pouch from the distal anterior femoral shaft. The pouch extends medially and laterally along the femoral condyles into the medial and lateral gutters. The suprapatellar pouch and gutters are frequent locations for loose bodies.

Articular cartilage covers the tibial plateau and anterior, distal, and posterior condyles of the femur, along with the patella. Iatrogenic injury to articular cartilage should be avoided at all times. Most injury is caused by forceful insertion and movement of the arthroscopic camera and/or instruments during arthroscopy. A knowledge of anatomy, portal placement, and constant visualization of instruments is also required to avoid iatrogenic injury to articular cartilage and other structures.

The bony anatomy of the knee relevant to arthroscopic knee surgery includes the distal femur, the proximal tibia, and the patella. With the knee at 60 degrees of flexion, the inferior pole of the patella is located above the lateral joint line and is an important guide for anterolateral portal place-

FIGURE 1-2 Photograph of knee showing inferior pole of patella relative to high anterolateral portal placement.

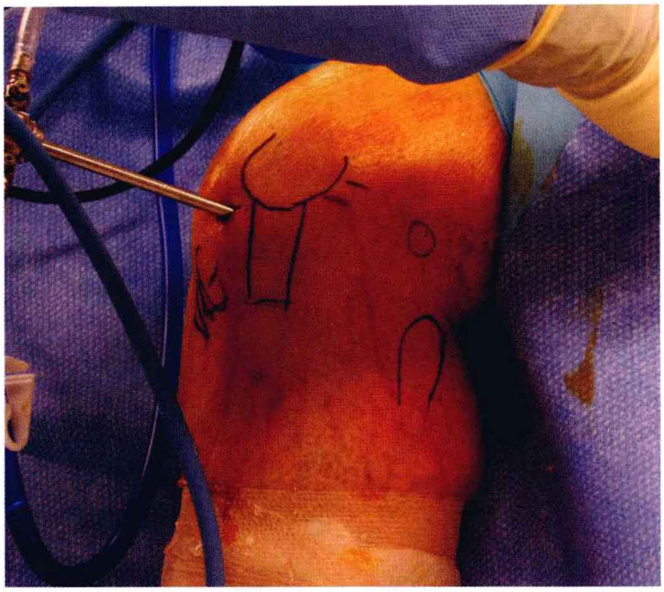

FIGURE 1-3 Direction of camera insertion toward intercondylar notch.

ment (Fig. 1-2). Exceptions to using this landmark, however, occur in cases of patellar alta, baja, dysplasia, or congenital absence. These conditions should be identified preoperatively with physical examination and standard radiography.

The femoral trochlea consists of medial and lateral trochlear ridges that arise from the corresponding femoral condyle.[1] The medial femoral condyle is larger than the lateral from proximal to distal and anterior to posterior. The lateral femoral condyle, however, is wider at the level of the femoral notch. Distally, the femur opens into a notch that contains the femoral origins of the anterior and posterior cruciate ligaments. The notch serves as a target for careful, controlled introduction of cannulas and instruments from anterior portals to avoid injury to articular cartilage (Fig. 1-3). When using the scalpel for anterior portal placement, the blade should be pointed toward the notch but blind insertion beyond the skin and capsule should be avoided, because this would risk injury to the cruciate ligaments.

The medial tibial plateau is larger than the lateral plateau; the two are separated by an intercondylar sulcus or fossa.[1] Adjacent to the fossa is a medial and lateral tibial spine that separates the fossa from the corresponding tibial plateau. The femoral condyles and tibial plateaus are incongruous without the medial and lateral menisci. The fibula, although extra-articular, has direct relevance to arthroscopic knee surgery, because it serves as a landmark for portals and surgical approaches. The proximal fibula forms a joint with the proximal posterior surface of the tibia (tibiofibular joint). It also serves as an insertion for the lateral collateral ligament and biceps femoris tendon.

A knowledge of neurovascular anatomy around the knee joint is important for preventing iatrogenic injury during portal placement and surgical approaches.[2] Posteriorly, in the midthigh, the sciatic nerve branches into the tibial (or popliteal) and common peroneal nerves. At the posterior joint line of the knee just posterior to the joint capsule, the tibial nerve passes between the two heads of the gastrocnemius muscles, along with the popliteal artery and vein. From medial to lateral, the structures include the nerve, artery, and vein (Fig. 1-4).[1] Although Matava and colleagues[3] have shown that knee flexion increases the distance between the tibial insertion of the posterior cruciate ligament (PCL) and the popliteal neurovascular structures, other studies have not confirmed this. At 100 degrees of knee flexion, they reported a maximum distance of slightly less than 1 cm between the popliteal artery and PCL insertion.

The common peroneal nerve passes posterior to the biceps femoris tendon and courses between it and the lateral head of the gastrocnemius toward the fibular head (Fig. 1-5).[1,2] It then courses laterally around the fibular neck and into the peroneus longus tendon. In most individuals, the biceps femoris tendon insertion onto the fibular head can be palpated in 90 degrees of knee flexion. Placing incisions, portals, and retractors anterior to this landmark will help avoid injury the common peroneal nerve.

On the medial aspect of the knee, the saphenous nerve and its infrapatellar branch are at risk for injury during placement of medial and posteromedial portals, as well as during all medial approaches to the knee. The nerve and its branch have a variable course and number of terminal branches.[1,2] In general, the saphenous nerve passes between the gracilis and sartorius muscles approximately 3 cm posterior to the medial femoral epicondyle. The infrapatellar branch courses beneath the sartorius (i.e., posterior to it) and runs along the anteromedial aspect of the knee, where it can terminate medially or laterally to the medial border of the patellar tendon (Fig. 1-6).

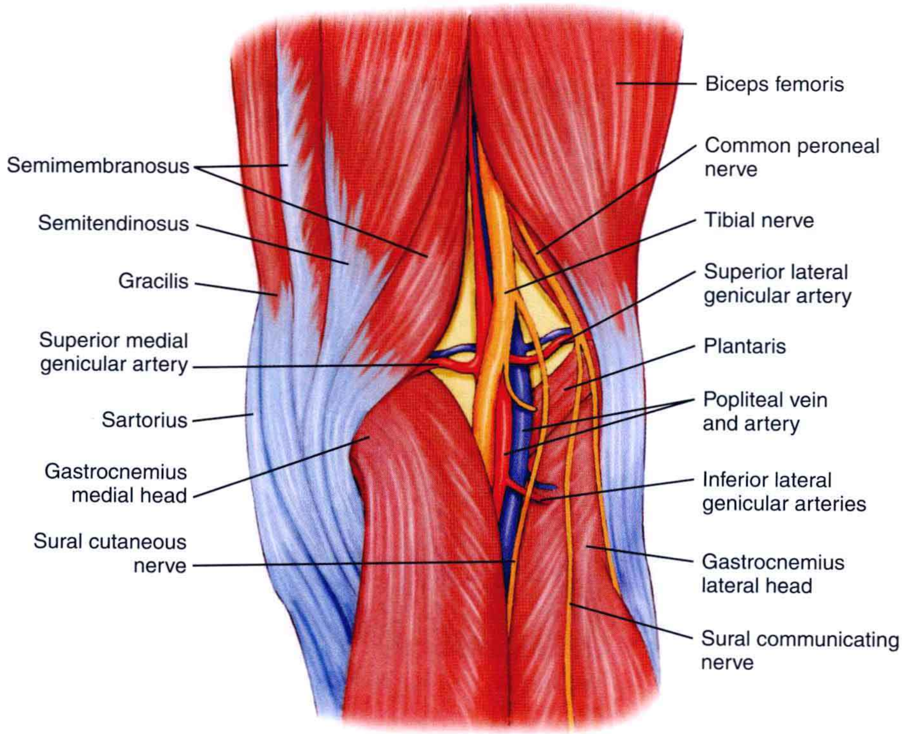

FIGURE 1-4 Posterior aspect of knee showing tibial nerve, popliteal artery, and vein within popliteal fossa.

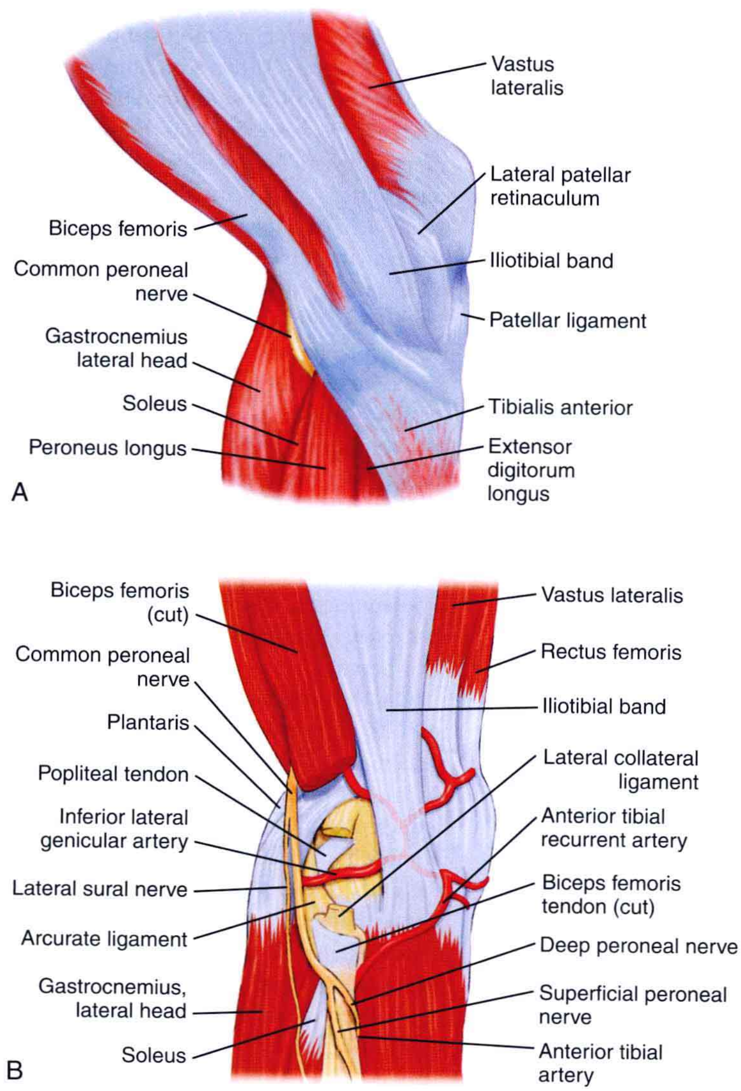

FIGURE 1-5 Lateral aspect of knee. **A,** Common peroneal nerve passing posterior to biceps femoris tendon. **B,** Common peroneal nerve passing laterally around the fibular neck.

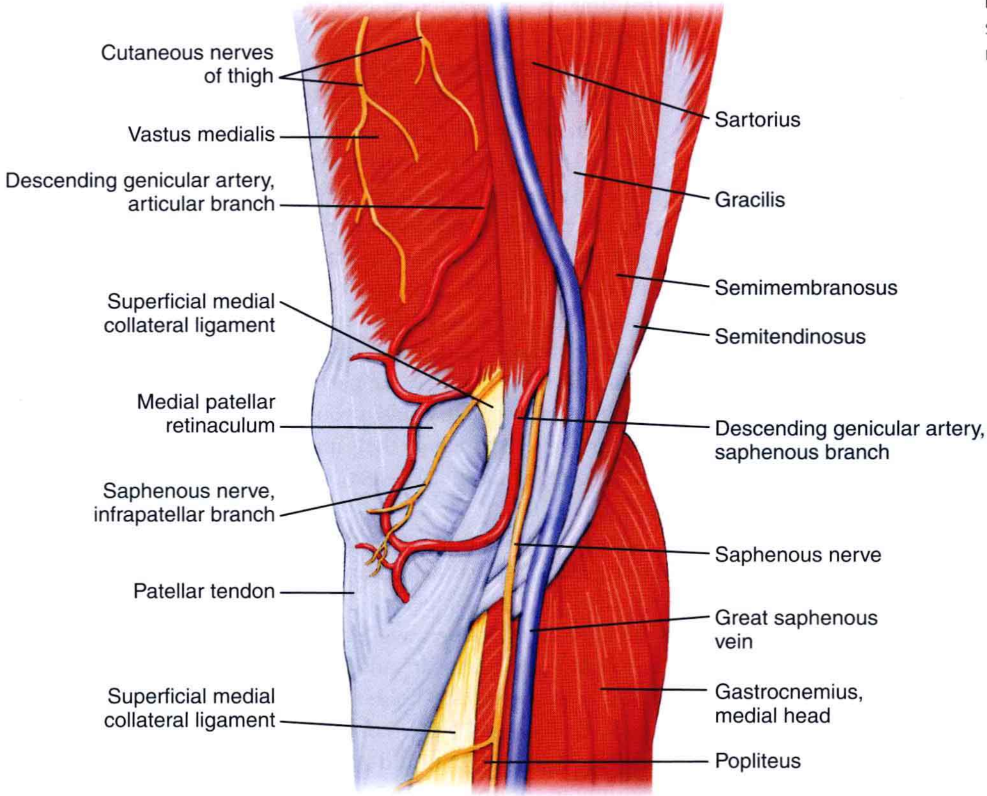

FIGURE 1-6 Anteromedial superficial structures of knee showing saphenous nerve and its infrapatellar branch.

PATIENT EVALUATION

History And Physical Examination

Each patient undergoing knee arthroscopy should have a complete history, physical examination, and informed consent that are well documented. Anesthetic, medical, and deep venous thrombosis risks should be identified and addressed preoperatively. Details of the history and examination for specific diagnoses will be covered in the appropriate chapters elsewhere in this text.

Diagnostic Imaging

At a minimum, all patients should have preoperative radiography, including a standing posteroanterior (PA) view with the knees flexed 45 degrees, a lateral view, and a Merchant or sunrise view. These x-rays can be useful for identifying degenerative joint disease, osteochondral or other fractures, tumors, loose bodies, and patellar pathology, such as patella alta or baja, bipartite, or dysplasia.

The need for magnetic resonance imaging, computed tomography, and other imaging is based on the initial history, examination, radiographs, and response to prior treatment and will be discussed in the appropriate chapters.

TREATMENT

Anesthesia Options

Knee arthroscopy can be performed under general, spinal, or local anesthesia. The choice primarily depends on surgeon and patient preference, but in some cases may be influenced by the patient's medical history. In a prospective randomized study of 400 patients, Jacobson and associates[4] compared three anesthesia options and concluded that local anesthesia was technically feasible in 92% of patients undergoing elective knee arthroscopy. However, when comparing patient satisfaction, the local anesthetic group had 90% satisfaction versus 97% for the general anesthesia group. Horlocker and Hebl[5] performed an evidence-based review of published studies comparing various anesthetic methods for knee arthroscopy. They reported that the results of most studies were biased by surgeon and patient expectations as well as by differences in postoperative management. They concluded that a single method of anesthesia could not be recommended for all surgeons performing or patients undergoing knee arthroscopy.

Arthroscopic Technique

Operating Room Setup

One or more video monitors are required. Traditionally, cathode ray tube (CRT) monitors have been the standard. New flat screen liquid crystal display (LCD) monitors are increasingly being used (Fig. 1-7) and currently most manufacturers of arthroscopic video equipment also offer high definition (HD) monitors. Although only one monitor is needed, many operating rooms use two or more monitors (see Fig. 1-8). Although there is less benefit of multiple monitors for knee arthroscopy, they can be very useful for shoulder and hip arthroscopy.

The control boxes for the arthroscopic camera, shavers, pump, and other devices can be placed on a mobile tower (Fig. 1-8A) that is easily moved from room to room or can be con-

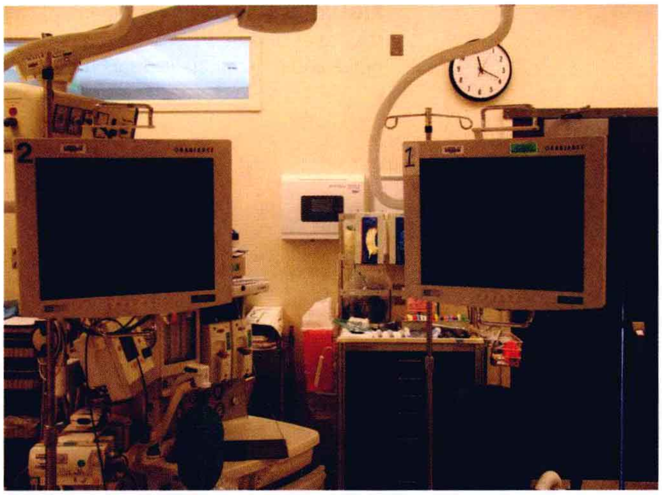

FIGURE 1-7 The use of two LCD video monitors permits the surgeon and assistant to work and comfortably view the arthroscopic video.

tained on a boom (see Fig. 1-8B). The advantage of the boom is that there are less electrical cords across the floor and that the monitor(s) can be positioned independently of the tower.

Most basic arthroscopic knee procedures, such as meniscectomies, chondroplasties, lateral releases and loose body removals, can be performed by the surgeon with the assistance of a single surgical scrub technician. More advanced procedures such as ligament reconstructions, meniscal repairs, cartilage restoration, and osteotomies, can be easier to perform with a second surgical assistant.

Similarly, all members of the operating room team should be informed well in advance of possible variations in the planned procedure(s) and the instruments required. It is important to discuss required instruments in advance with the surgical team and/or coordinator. Staff in the room must also know where instruments are located in case they are requested during the surgery.

Proper patient positioning is extremely important in terms of patient safety and surgical efficiency. A standard operating room bed is needed, with a leg portion that lowers. If fluoroscopy is planned, a radiolucent table may be needed. It is important to make certain that you can obtain the needed fluoroscopic images prior to prepping and draping the patient. It is the surgeon's responsibility to oversee the positioning of the patient. In situations in which you frequently perform surgery at a given center or hospital, you may want to train the staff to position patients for you. Even if you delegate this task, it is still your responsibility to make sure that they are positioned correctly. When training staff, it is important to explain your rationale for patient positioning instructions because they may not readily understand the importance of specific instructions relative to surgical efficiency and patient safety.

The use of leg holders or posts is determined by the preoperative diagnosis, surgical plan, and surgeon preference. A variety of different commercial leg holders are available for the operative and nonoperative leg. When operating on both knees, bilateral leg holders are also available (Fig. 1-9A). In most cases, a unilateral leg holder (see Fig. 1-9B and C) or lateral post (see Fig. 1-9D) is used for the operative leg. Leg holders may include padding, and some others require you to apply padding to the leg prior to securing it within the holder. Some holders are designed to hold the leg with a tourniquet (see Fig. 1-9B) and others require the tourniquet to be outside the holder (see Fig. 1-9C). If you prefer a unilateral holder or lateral post, it will be important to determine how to protect the contralateral leg. The use of a leg holder for the nonoperative leg has been shown to increase the risk of compression to the peroneal nerve as courses around the fibular neck.[2] Nonoperative leg holders can also cause a stretch injury to the femoral

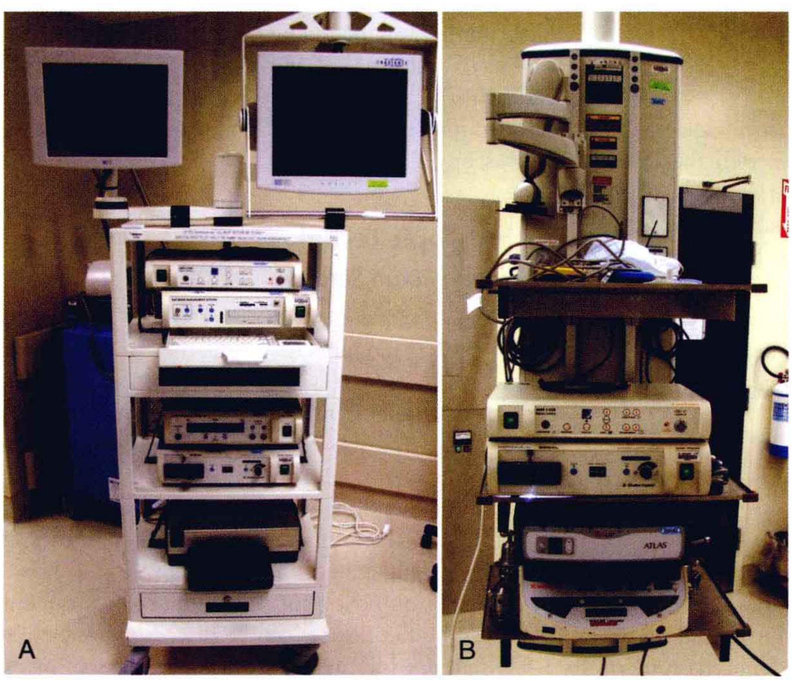

FIGURE 1-8 A, Arthroscopic boom. **B,** Mobile arthroscopic tower.

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