Role of Magnetic Resonance Imaging In Post Knee Surgery

Essay
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INTRODUCTION

The knee joint is a complex weight-bearing joint situated between the ends of the longest levers in the body with little bony congruence. It is subjected to extremely high forces during sport and some occupational activities and its supporting soft tissue are therefore vulnerable to injury. Injuries frequently involve either the ligaments or cartilages, or both [Arroll and Robb, 2003].

The increased number of patients undergoing arthroscopy or surgery of the knee for injuries is leading to increased numbers of patients who require imaging after surgery because of failure to improve, recurrent symptoms, or new injury [McCauley, 2005].

As in preoperative patients, magnetic resonance (MR) imaging is the most valuable imaging method for postoperative evaluation of the knee [McCauley, 2005].

The most common arthroscopic repair procedures include partial meniscectomy and meniscal repair, anterior cruciate ligament reconstruction, and cartilage repair procedures [Recht and Kramer, 2002].

Anterior cruciate ligament (ACL) reconstruction is one of the most commonly performed procedures. Patients with postoperative symptoms are frequently imaged to evaluate for complications [Meyers et al., 2010].

It is incumbent on radiologists to be familiar with the different surgeries performed for ACL reconstruction, the normal postoperative appearance, and complications that can be diagnosed with imaging [Meyers et al., 2010].

Both conventional knee MRI and MR arthrography can be used to diagnose recurrent tears of the menisci after repair or resection of a tear [De Smet et al., 2006].

Recognition of the normal postoperative MR imaging appearance of the structures in the knee and of abnormalities is essential to accurate MR imaging evaluation of these patients [McCauley, 2005].

Aim of the work

The aim of this work is to emphasize the role of magnetic resonance imaging in post knee surgery outcomes.

Chapter One

Gross and Radiological Imaging Anatomy of the Knee joint

Anterior Cruciate Ligament (ACL):

Anatomy:

Description of the anterior cruciate ligament (ACL) can be dated back to 3000 B.C. when the ACL was mentioned on an Egypt papyrus scroll. It was probably Claudius Galen of Pergamon who named the ligaments within the knee as ‘‘ligamenta genu cruciate’’ (129–199 B.C.) [Zantop et al., 2006].

The anterior cruciate ligament (ACL) runs in an oblique course from the tibia to the lateral femoral condyle. It is an intra-articular extrasynovial ligament composed of fibres running from the anterior intercondylar region of the proximal tibia to the medial aspect of the lateral femoral condyle within the intercondylar groove. The fibres of the ACL are arranged into two bundles known as the anteromedial and posterolateral bundle according to their tibial insertion (figure 1-1) [Yasuda et al., 2011].

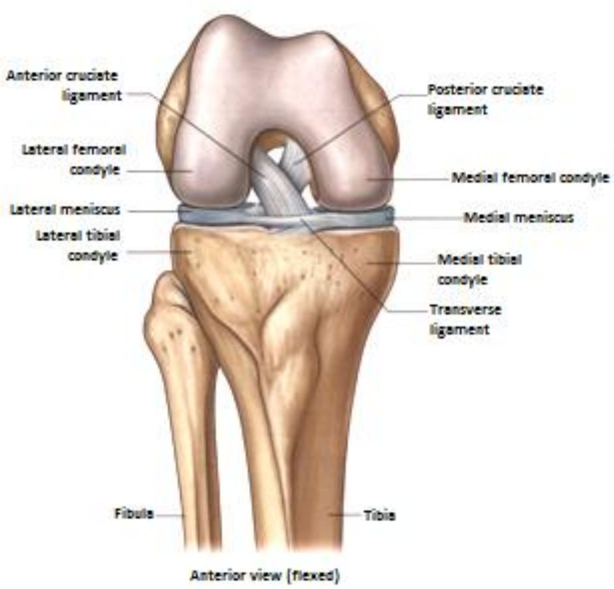

Figure 1-1 Right knee joint, Anterior view (flexed). [Drake et al., 2008]

The anteromedial bundle inserts at a more medial and superior aspect of the lateral femoral condyle while the posterolateral bundle inserts at a more lateral and distal aspect of the lateral femoral condyle. Occasionally there is an additional intermediate bundle in between these two bundles [Amis and Dawkins, 1991].

The primary blood supply to the ACL derives from arteries to the surrounding synovial membrane. These, in turn, derive from branches of the middle geniculate artery piercing the posterior capsule. The central core of the ACL is relatively avascular. This may partly account for the generally ineffective healing of ACL tears. Tibial nerve terminal branches innervate the ACL [Resnick, 1995].

Anterior Cruciate Ligament Functions:

The anterior cruciate ligament (ACL) is a key structure in the knee joint, as it resists anterior tibial translation and rotational loads [Matsumoto et al., 2001].

Under normal conditions, the ACL restricts anterior neutral-position shift, but in chronic ACL-deficient knees this anterior translation of the tibia relative to the femur is four times greater than in normal knees [Beynnon et al., 2002].

The ACL also functions as a major secondary restraint to internal rotation, particularly when the joint is near full extension. In addition, the ACL functions as a minor secondary restraint to external rotation and varus–valgus angulation, particularly under weightbearing conditions [Beynnon et al., 1997].

Anterior Cruciate Ligament Injury:

The role of the ACL in knee joint stability is important. A rupture of the ACL leads to significant knee instability and secondary knee damage including meniscus tears and articular cartilage injuries. However, results following ACL reconstructions reveal a high risk of osteoarthritic joint changes[Zantop et al., 2006].

ACL is the most frequently injured large ligament in the knee [Swenson and Harner, 1995].

Partial ACL tears occur in 10-43% of all ACL injuries [Lee et al., 1999].

Mechanisms of anterior cruciate ligament (ACL) injury are numerous. ACL tears occur with or without contact and with the knee in any position from flexed to fully extended. A common contact mechanism of injury is the valgus-abduction clip injury [Stoller, 1997] .

Hyperextension or varus-hyperextension from an anterior blow (eg, injury from a motor vehicle accident or contact sports) is the second most common contact mechanism of ACL injury [DeMorat et al., 2004].

A combination of forces contributes to noncontact ACL injury. It is likely that an external impulsive axial force is the primary force resulting in noncontact ACL injury [Boden et al., 2010].

Noncontact mechanisms account for 70-80% of ACL tears. The pivot-shift mechanism is most commonly implicated: the slightly flexed knee incurs a valgus load, with internal rotation of the tibia or external rotation of the femur. This twisting injury often occurs with rapid simultaneous deceleration and directional movements in skiers, football, basketball, or soccer players. Marked quadriceps loading at the time of injury has been implicated [DeMorat et al., 2004].

It is well known that adolescent and adult female athletes have a 4- to 8-fold higher incidence of sustaining a serious noncontact anterior cruciate ligament (ACL) injury compared with male athletes participating in the same sport or activity [Mountcastle et al., 2007].