Role of Musculoskeletal Ultrasonography in Evaluation of Knee Emergencies

Essay Submitted for partial fulfillment

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By

Eman Ahmed El-Sayed Elwediny

(M.B., B. Ch.)

Faculty Of Medicine ,Ain Shams University

Supervised by

Prof. Dr. Lobna Abdel Mon′em

Professor of Radiodiagnosis

Faculty of Medicine – Ain Shams University

Dr. Hossam Moussa Sakr

Assistant Professor of Radiodiagnosis

Faculty of Medicine – Ain Shams University

Radiodiagnosis Department

Faculty of Medicine

Ain Shams University

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Eman Ahmed Alwediny

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List of Abbreviations

ACL	Anterior cruciate ligament
EFOV	Extended field-of-view imaging
HRUS	High resolution ultrasonography
LCL	Lateral collateral ligament
LHG	Lateral head of gastrocnemius
LM	Lateral meniscal
MCL	Medial collateral ligament
MRI	Magnetic resonance imaging
PCL	Posterior cruciate ligament
PRF	Pulse repetition frequency
PT	Patellar tendon
QT	Quadriceps tendon
QTR	Quadriceps tendon rupture
SMCL	Superficial medial collateral ligament
THI	Tissue harmonic imaging
US	Ultrasound
3DUS	Three-dimensional ultrasound

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CHAPTER I

THE INTRODUCTION

The knee is a complex joint with many components, making it vulnerable to a variety of injuries.

The knee is vulnerable to a wide variety of acute and chronic injuries sustained during sporting activity. Acute knee injuries most frequently involve the bone, menisci, articular cartilage and ligaments. They are particularly common in sports involving twisting movements and sudden changes of direction ***(Melanie et al., 2010).***

A variety of disorders involving tendons, vessels, nerves, joints and para articular structures of the knee can be accurately assessed with US ***(Grobbelaar and Bouffard 2000)*** *and* ***(Friedman et al.,2001).***

There are many Knee joint emergencies like: Medial Collateral Ligament injuries which are the most commonly damaged ligamentous stabilizer of the human knee ***(Heitmann et al., 2013).*** And The Lateral Collateral Ligament is one of the more commonly injured ligaments in the knee ***(Orthogate, 2006).*** Because of its location, it is common to injure in conjunction with other ligaments in the knee.

Also meniscal injury, especially medial one, is common not only in elite athletes but also in the general population ***(Grifka et al., 1994).***

Rupture of a Baker's cyst which results in a swollen, painful leg that is clinically indistinguishable from acute deep venous thrombosis ***(Osamu Sato et al., 2001).***

Though uncommon when all types of injuries of the knee joint are considered, injury to the quadriceps tendon is the second most common injury to the extensor mechanism after patellar fracture ***(Nance and Kaye, 1982).***

In recent years some reports have focused on the ability of US to assess the anterior ***(Fuchs and Chylarecki, 2002)*** and posterior ***(Miller, 2002)*** cruciate ligaments. US detection of a localized fluid collection at the posterocranial portion of the anterior cruciate ligament seems to correlate with acute tears ***(Ptasznik et al., 1995).***

Furthermore, US can give an indirect assessment of the integrity of the cruciate ligaments by estimating the degree of tibial subluxation during stress maneuvers ***(Gebhard et al., 1999).***

Ultrasound can be used to identify hemarthrosis (generally anechoic or hypo-echoic collections) and to evaluate the synovium for signs of inflammation. Inflamed synovium demonstrates increased flow with colour and power Doppler imaging and it may be seen to be thickened and nodular ***(Zukotynski et al., 2007)***.Ultrasound can distinguish between hemarthrosis and synovial hypertrophy, which helps determine when factor replacement therapy is necessary.

Disorders of the knee are responsible for a major source of referrals to the musculoskeletal radiologists. Most cases have suspected abnormalities within the joint either following an acute injury or a more insidious development of symptoms ***(Ostlere, 2003).***

The recent exponential improvement in medical ultrasound technology has revolutionized the field of musculoskeletal imaging. Cutting-edge technology using state-of-the-art machines and high-frequency transducers have placed it ahead of magnetic resonance imaging (MRI) in many aspects of musculoskeletal imaging ***(Jacobson, 2005) and (Sofka , 2004).***

What is particularly surprising to some is that it has far better resolution than MRI allowing for detailed evaluation of soft tissues. The multiplanar and dynamic capabilities of ultrasound along with its lack of ionizing radiation now make it the first-line imaging modality for many soft tissue pathologies. It offers a low cost, non-invasive method of evaluating orthopedic trauma patients, particularly for patients with metallic hardware in situ, which can degrade computed tomography and magnetic resonance images ***(Weiss et al., 2005)***.

But perhaps one of its most important diagnostic advantages over other techniques is its real-time imaging capability, allowing for dynamic evaluation. The real-time imaging feature of sonography is of particular interest because some disorders of muscles, tendons, nerves, and joints are better -or in some cases only- seen dynamically, that is during motion of the extremity, muscle contraction, probe compression, or position change of the patient ***(Khoury et al, 2007).***

When performing musculoskeletal sonography, the proper equipment is essential to facilitate optimal image quality and diagnostic examinations. In general, the structures examined will be superficial; therefore, high frequency (7-12 MHz) linear array transducers are usually the most appropriate choice. The high resolution attainable allows detailed anatomic depiction of pertinent structures.

Proper positioning of the patient is of paramount importance in obtaining high quality studies. Different sonographic techniques have been described, with the universal goal of optimizing the visualization of structures of interest ***(Lin et al, 2000).***

CHAPTER II

Anatomy Of The Knee Joint

Gross anatomy of the knee joint:

The knee, one of the largest and most complicated joints in the body, is a synovium-lined, diarthrodial articulation consisting of two hinge-type joints between the femoral condyles and the medial and lateral tibial plateaus, and a gliding-type joint between the patella and the trochlear groove of the anterior distal femur ***(fig.1).*** The tibiofibular articulation, although often considered a part of the knee, is in fact not a portion of the true knee joint. The knee is protected anteriorly and posteriorly by muscles with special ligamentous attachments to the capsule ***(Frick et al., 2007)***.

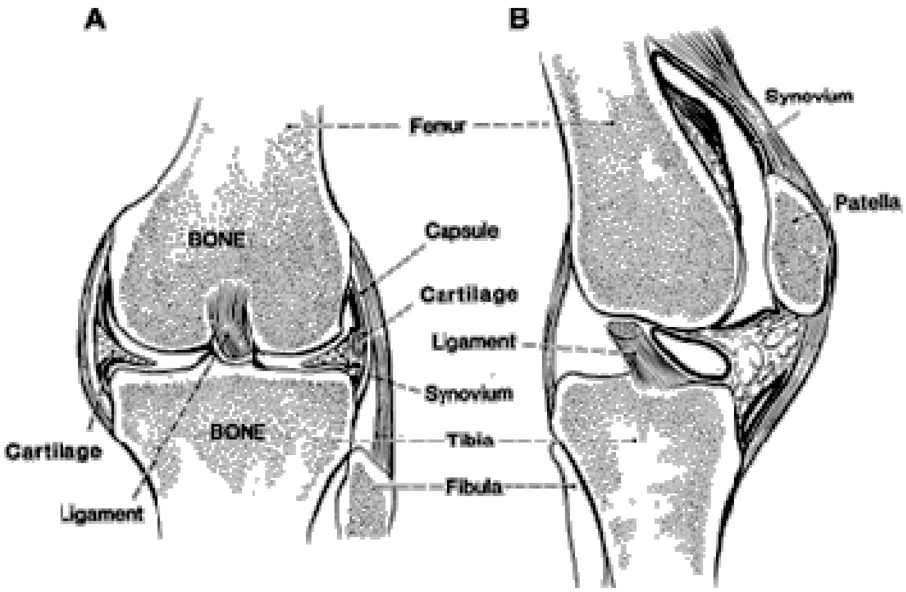

Fig.1. The knee capsule and synovium. Coronal and sagittal illustrations demonstrate the relationship between the knee capsule, the synovium and the supporting structures of the knee ***(Quoted from Frick et al., 2007).***

Bone and articular surfaces:

The articular surfaces of both the femoral and tibial condyles are covered with hyaline cartilage. The femoral condyles are oval anteriorly and rounded posteriorly to provide increased stability in extension and increased motion and rotation in flexion. The medial femoral condyle is larger and important in load transmission across the knee ***(Clemente, 1985).***

Medial and lateral tibial condyles, from the expanded articular portion of the tibia are separated by the