Learning Solutions from

GE Medical Systems

Program Supplement

MR: Imaging of Sports Injuries

TiP-TV™

GE Training in Partnership Television

GEMS 985

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PRESENTER BIOGRAPHIES

Susan Hooper, RT R(MR) - GE Medical Systems MR Applications Development Manager

Susan joined GE Medical Systems as a West Region MR Field Applications Specialist in 1996. She became the MR TiP-TV program Manager in 1999, and moved to the MR Applications Development Manager position in 2000. She received her certification in Radiologic Technology in 1987, from the Gaston School of Radiologic Technology in North Carolina. She earned her advanced certification in Magnetic Resonance Imaging in 1995. Before joining GE Medical Systems, Susan was a MRI technologist at Valley Presbyterian Hospital in Van Nuys, California.

Jaynne Leverentz, RT R (CT) – GE Medical Systems MR TiP-TV Program Coordinator

Jaynne joined GE Medical Systems in 1998 as a Certified Customer BlackBelt Consultant. She became the MR TiP-TV Program Coordinator in 2000. Jaynne began work as an X-ray Technologist in 1976 and began working in CT and MRI in 1986. Before joining GE Medical Systems, she worked as an Applications Specialist and Customer Education at Siemens Medical Systems in Iselin, New Jersey. Jaynne holds a bachelor degree from Metropolitan State Minneapolis, MN.

PROGRAM OBJECTIVES, TARGET AUDIENCE, AND PRODUCTIVITY STATEMENT

Program Objectives

By the end of this program, the viewer should be able to:

- Discuss mechanics of various injuries of the upper and lower extremities
- Review preferred MR imaging protocols
- Discuss surgical correlation
- Talk with some of the top orthopedic surgeons and radiologists

Target Audience

Course objectives for this program specifically target all magnetic resonance (MR) technologists. While not limited to this audience group, the technical content will be most effective when applied to people with this training.

NOTE: Viewers who apply for continuing education (CE) credit and meet the application requirements are eligible for credit, regardless of their audience status.

Productivity Statement

This program was developed to enhance your professional and educational level, and increase your productivity and skills.

PROGRAM OUTLINE

MR: Imaging of Sports Injuries

I. Introduction

II. Normal Anatomy Review
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INTRODUCTION

Sports Injury is one of the most frequent reason patients are referred for magnetic resonance imaging (MRI). Whether professional athletes, or “weekend warriors,” these patients are seen for an extensive range of injuries and pathology. In this program, we’ll discuss the mechanics of injury to the upper and lower extremities and the preferred magnetic resonance (MR) imaging protocols. Surgical correlation will be included along with discussion from some of the top orthopedic surgeons and radiologists.

NORMAL ANATOMY REVIEW

SHOULDER

MR Imaging Considerations and Anatomy

We'll begin our anatomic review of the shoulder with the structures comprising the rotator cuff. The rotator cuff is actually not one, but four different tendons.

- Supraspinatus
- Infraspinatus
- Teres minor
- Subscapularis tendons

The rotator cuff is, in essence, a group of tendons whose primary function, along with their associated muscles, is to stabilize the shoulder joint, hold the humeral head in position within the glenoid fossa, and limit superior translation with abduction.

Notes:

Classification of Rotator Cuff Tears (RCT)

- RCT of the shoulder can be difficult to evaluate
- Partial tears – involving the articular and bursal surfaces, and the tendons themselves to varying degrees of depth
- Complete tears – extends through the entire thickness of the rotator cuff

Notes:

Common Labral Lesions

The labrum is a structure formed by the attachment of the glenohumeral ligaments and joint capsule to the rim of the glenoid fossa. Tears of the labrum are another common indication for MR evaluation of the shoulder joint.

These are some of the more common labral lesions you may encounter:

- Bankart lesion – represents avulsion of the inferior glenohumeral ligament labral complex from the glenoid rim
- Perthes lesion – presents as an avulsion of the labroligamentous complex
- Gleno-labral Articular Disruption (GLAD) lesion – involves a tear of the anterior inferior labrum, this is also commonly associated with cartilage injury.
- Superior Labrum from Anterior to Posterior (SLAP) lesion – includes several different classifications from type I to type VII

Notes:

KNEE

Coronal images are often obtained to demonstrate the collateral ligaments, as well as the posterior femoral condyles and the menisci.

Notes:

The medial meniscus is much less mobile than its lateral counterpart due to its attachment to the deep layers of the medial collateral ligament (MCL) and the joint capsule, interestingly enough, it's this lack of mobility that makes the medial meniscus more susceptible to injury.

Notes:

Sagittal images best demonstrate the anterior and posterior cruciate ligaments. These ligaments are considered intracapsular and extra synovial. Both the anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) are enclosed within a synovial fold that originates in the posterior intercondylar area of the knee. The ACL is attached proximately to the posteromedial aspect of the lateral femoral condyle, and distally to a fossa just anterior and lateral to the tibial spine.

Notes:

- Indications for MR imaging the knee
  - Popliteal cysts
  - Osteonecrosis
  - Tumor
  - Infection
  - Osgood-Schlatter Disease
  - Bone infarction
  - Plicae Syndrome

Osteonecrosis can occur spontaneously, or secondary to steroid use or certain medical conditions, such as renal transplant, alcoholism, Gaucher's Disease, or Lupus. Those occurring secondary to steroid use tend to be larger than those that occur spontaneously.

The spontaneous presentation of the disease tends to occur in the older female patient population and will usually affect the weight-bearing surface of the knee, which includes the medial femoral condyle and the medial tibial plateau.

Notes:

Patients with synovial plicae will usually present with anterior knee pain and associated clicking, catching, or locking of the joint. Plicae are actually remnant structures from embryologic development of the three septal divisions of the knee, and are most commonly observed in one of three locations: suprapatellar, medial patellar, or infrapatellar.

REV 1

MR FILES

VIRTUAL ARTHROGRAPHY IN MR

Gregory R. Applegate, M.D., Assistant Clinical Professor, Department of Radiology, University of California, San Diego

Three-dimensional MR Data Sets

The shoulder arthroscope is to be used as though we're looking in through the arthroscope driving through the shoulder.

Notes:

COMMON SPORTS RELATED INJURY

KNEE

- The most common mechanism of injury is one of a hyperextension and rotation towards that side.

Notes:

- Probably the most common mechanism of injury to the medial meniscus is repetitive micro injuries over a period of time.
  - The lateral meniscus appears to be slightly more mobile and it tends to slide back and forth, even if it has a certain tendonous attachments where the medial meniscus appears to be a little more fixed.
  - It is probably the anatomy and the forces involved which increase the incidence of tears.
  - We used to talk about the incidence of tears sometimes of 10 to 1 medium meniscus to lateral.
    - At this point, it's probably 3 to 1, and that has to do with the aspects of MR.

Notes:

- The ACL deficient knee, or the chronically torn anterior cruciate ligament

The anatomy of the knee basically consists of a ball sitting on a flat surface. Muscles and ligaments hold the ball in place as it constantly slides back and forth while rotating.

The knee is probably the most complex joint in the body, because it's a hinge joint. It produces a side-to-side action, also rotating and gliding. It's not simply a ball in socket joint, but is held together with basically four little rubber bands, some muscles, and their tendonous attachments. When one of those rubber bands, such as the anterior cruciate ligament, is torn, the instance of that movement starts to change, and it starts to just slide and move back and forth.

Notes:

Methods of ACL Reconstruction

Notes:

Some of the more common indications for the inversion recovery pulse sequence

- Short Tau Inversion Recovery (STIR) sequence

Notes:

MR signal characteristics of some of the more common methods of ACL reconstruction

- The appearance of the ACL graph on the ACL reconstruction can be variable, depending on what type of graph is utilized.
- Some of the semimembranosus and semitendinosis tendon graphs that are utilized may have some heterogeneity in signal intensity, because it's actually a strand of four tendons braided together. During some phases of graph healing, and incorporation of the graph, you may see some increase in signal intensity. In our experience, that has really been quite minimal. Most signal intensity change within a graph tends to be abnormal.
- Recommendations for intact ACL patient positioning and/or protocols
  - Position the knee in 5 to 10 degrees of external rotation, and perform your sagittal images in a direct sagittal plane. Additional oblique imaging can be performed in either the oblique coronal or oblique sagittal plane using thin 2 mm sections.
- Variation of signal intensity of the postoperative meniscus
  - In the postoperative meniscus, we can have grade three signal intensity changes. That is increased signal intensity within the meniscus that communicates with an articular surface. Unfortunately, that grade three change can be a healed meniscus, or a recurrent tear within the meniscus. So the appearance can be quite confusing.
- Gadolinium or T2 weighted scanning
  - We introduce a contrast agent into the knee, or native joint fluid. If enough contrast agent is present and extends into an area of grade three signal alteration, there is a mechanical defect. This mechanical defect, or the meniscal tear, would then fill in with contrast.

MR Arthrography

Notes:

SHOULDER

Various classifications of labral tear

- The anterior inferior labrum is an important stabilizing mechanism for the shoulder, an important anatomic stabilizer for the shoulder. When somebody falls, typically on an outstretched arm, the inferior capsule and the labrum, which are considered as one unit, become tightened, in an effort to prevent your shoulder from coming out.

Notes:

Abduction External Rotation (ABER) View

Notes:

Gadolinium

Notes:

FAT SATURATION (FAT/SAT)

- FAT/SAT is a value in imaging in the shoulder primarily so we can decrease the signal intensity of fat. The fat over line the subcorneal-subdeltoid bursa on some sequences might mimic the signal intensity from fluids. So if we suppress that, the only thing that will be left bright on the image would be the fluid we are trying to see in the subcorneal-subdeltoid bursa.

Intra-articular Contrast Agent

Notes:

Rotator Cuff Tear (RCT)

Notes:

MRI in the Evaluation of Rotator Cuff

- Assessment of the quality of tendon that is available for repair
- Assessment of muscles

Notes:

Considerations When Imaging a Ganglion Cyst

Notes:

MR UPLINK

SOUTHERN CALIFORNIA ORTHOPEDIC INSTITUTE (SCOI)

www.scoi.com

Notes:

CASE STUDIES

KNEE

Notes:

SHOULDER

Notes:

MR ARTHROGRAPHY

Notes:

SURGICAL CORRELATIONS

KNEE

- MEDIAL MENISCUS (MM)

Notes:

- Anterior Cruciate Ligament (ACL)

Notes:

SHOULDER

- Rotator Cuff Tear (RCT)

Notes:

- Impingement

Notes:

TALKBACK

Notes: