Clinical interpretation & advanced imaging

Hip Imaging

Florian M. Buck, MD
Balgrist University Hospital Zurich
buckfm@mskradiology.ch

Introduction

Hip imaging experienced a couple of technological and conceptual innovations in recent years. There are two topics that need to be mentioned in this context:
1) Imaging of hip impingement syndromes
2) Postoperative imaging after total hip joint replacement.

Part I - Imaging of hip impingement syndromes

Hip impingement syndromes can be categorized as follows:
- Internal hip impingement syndromes (femoroacetabular impingement):
    - Cam type
    - Pincer type
    - Mixed type
- External hip impingement syndromes
    - Subspine impingement
    - Ischiofemoral impingement
    - And more rare conditions

Internal hip impingement - femoroacetabular impingement

Factors influencing internal hip impingement are: pelvic tilt, acetabular version, acetabular depth/acetabular coverage, femoral torsion, and presence of a cam deformity. For all these factors several measurement techniques, qualitative signs on plain films, and normal values have been proposed. However, it seems that a specific measurement of one factor can be normal or pathologic depending on the combination of the other factors. Thus, measurement values can be misleading.
Keep in mind that hip impingement is a clinical diagnosis. All radiology can contribute is to identify a situation that favors a hip impingement syndrome (impingement configuration).

Imaging of secondary degenerative changes

MR-arthrography in combination with traction applied to the leg and high volume injection of contrast agent and local anesthetic provides superior visualization of subtle labral and cartilage changes. Cartilage defects are generally first seen at the anterior and lateral aspect of the acetabulum. Delamination, cartilage fraying, thinning and cartilage loss can be found. At the femoral head cartilage defects are often located parafoveal. Labrum defects and tears are most often seen in an anterosuperior location.

Postoperative imaging after impingement surgery

Postoperative imaging is often needed in patients with persistent or recurrent hip pain. Adhesions, persistent cam deformity, joint capsule gaps and secondary degenerative changes are important findings.

Part II - Postoperative imaging after total hip joint replacement

Advances in MR imaging technology enable to scan the hip region despite the presence of a hip prosthesis. Imaging results heavily depend on the alloy the prosthesis consists of, the scanner used, and the sequences employed. The use of these new techniques confronts radiologists with completely new imaging findings, which can be normal or pathologic.

Surgical approaches
There are different surgical approaches orthopedist choose to implant hip prostheses. In most cases it is possible to identify the approach that was chosen. Each approach is associated with specific findings:

- Posterior approach: Detachment of the short external rotators of the hip and fatty muscle change.
- Lateral / transgluteal approach: Damage to the gluteus medius tendon. Partial tendon rupture and fatty muscle change.
- Anterolateral / Röttinger approach: Denervation of the tensor fascia latae muscle and fatty muscle change.
- Anterior / Hueter approach: Minimal invasive. Tensor fascia latae muscle unchanged.

Acetabular cup malpositioning
The position of the acetabular cup is best evaluated on plain films, CT images or based on biplanar radiographs. An acetabular cup that projects anteriorly over the bony contour in the region of the iliopsoas tendon may lead to iliopsoas tendinitis, fraying and rupture of the tendon. The projection of the acetabular cup can sometimes be seen on sagittal MR images if special sequences are used to suppress susceptibility artifacts. Additionally edema and fluid along the iliopsoas tendon in combination with edematous changes in the tendon substance reinforce the diagnosis of acetabular projection induced iliopsoas tendinitis. Malpositioning of the acetabular cup is a risk factor for prosthesis luxation. Often there is a marked difference of the acetabular cup position with respect to the prosthesis head in an upright standing position as opposed to a supine position due to changes in the pelvic tilt. The pelvic parameters can easily be evaluated on plain films acquired in an upright standing position two-dimensionally or using biplanar radiographs three-dimensionally.

Abductor tendon degeneration / avulsion fractures
The insertion of the abductor tendons at the major trochanter is often of interest in preoperative and in postoperative situations. In postoperative patients the insertion can now easily be evaluated on MR images. Especially in postoperative situations where the orthopedist took a transgluteal approach the tendons are often substantially altered. Other possible findings are avulsion fractures or abductor tendon bursitis.

Metallosis and pseudotumor due to inlay wear
Metallosis after metal-on-metal prosthesis implantation and pseudotumor due to inlay wear is of major interest in patients with postoperative painful hip syndrome and signs of prosthesis loosening. Prosthetic loosening may be difficult to evaluate especially in the early postoperative course because it takes several month for the prosthesis to heal into the bone. Using new MR sequences (MARS) pseudotumors can be identified and bony erosions become visible. However, there are specific prosthesis types (e.g. McMinn prosthesis) that still cause a lot of susceptibility artifact due to their geometry and alloy they are composed of.

References / Suggested Readings

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