Multimodality Imaging Approach to Hip Arthroplasty Complications

Poster No.: P-0260
Congress: ESSR 2017
Type: Educational Poster
Authors: S. Naqvi¹, M. A. Syed¹, S. B. Gagrani², R. Bhatt¹; ¹Leicester/UK, ²Birmingham/UK
Keywords: Prostheses, Complications, MR, CT, Conventional radiography, Musculoskeletal joint
DOI: 10.1594/essr2017/P-0260
Learning objectives

This pictorial essay will demonstrate the common complications post total hip arthroplasty. We broadly categorize them into

- Immediate post-operative complications.
- Medium to long term complications.

The best imaging modality to assess the complications.

Challenges related to the diagnosis of complications.
Background

The low friction arthroplasty developed by Chanley has progressed in design, operative techniques and clinical applications over the last 50 years. It is one of the most common surgical procedures performed in UK emphasizing the importance of assessing potential complication by radiologists.

The various complications following arthroplasty include aseptic loosening, particle disease (osteolysis), infection, component wear, dislocation, fracture, heterotopic ossification, metal-induced reactive mass (pseudo tumour/ALVAL), abductor muscle tear, iliopsoas impingement and muscle atrophy.
Instability and Dislocation:

This is the most common complication leading to revision hip arthroplasty. The incidence ranges from 0.3% to 10% after primary and 10% -28% after revision hip arthroplasty. Posterior dislocation is more common than anterior with trauma and poor muscle tone as a risk factor. Mal position of the surgical implant is an important surgical factor.

Plain radiograph is the investigation of choice and often occurs in the immediate post op period due to haematoma or a few years after the surgery due to wear of implant.

Osteolysis And Aseptic Loosening-

Second most common cause of morbidity and revision accounts for 19.7% of revision procedures. The contributing factors include wear of prosthetic components, poor initial position of implant and failure of fixation. It is clinically associated with pain and discomfort. Plain radiograph and CT supersede MRI in assessment of loosening. The radiological features are

- Uniform periprosthetic radiolucency of more than 2mm- Aseptic loosening.
- New lucency less than 2 mm which is not visible on previous imagining.
- Particle disease produces multifocal radiolucency related to localized osteolysis.
- Evidence of prosthesis movement- Varus orientation/rotation of component.
- Cement fracture.

Infection:

Infection is the third most common cause that contributes to 14.8% of all revisions hip arthroplasties. Infection can occur either early in the post operative period or present late in case of low grade infection. Ultrasound is useful in assessment of collections or hip joint effusion. Plain radiographs and CT are once again play the main role in diagnosis with loosening

- Infection can produce either pattern of radiolucency, Uniform/ Multifocal.
- Soft tissue abnormalities- such as joint distension and fluid collection (MR is superior but ultrasound may be easily accessible in certain circumstances)
· Arthrocentesis and synovial biopsy may be required to confirm the diagnosis in low grade infections.

· US guided aspiration and periarticular fluid assessment may be required.

· Nuclear medicine scan can be problem solving-

· Combined leucocyte-marrow imaging has 90% accuracy.

**Periprosthetic fracture:**

The incidence of periprosthetic fractures is less than 1% with femoral periprosthetic fracture being more common. Vancouver classification is used for classification and has very good interobserver and intraobserver reliability.

Vancouver type A fracture is located in the trochanteric region, type B fracture is located about the stem or the tip of the stem, and a type C fracture is well distal to the tip of the stem.

**Component failure:**

In rare circumstances, the metallic hardware can give way resulting in fracture of the femoral stem, dissociation of the modular femoral component and fracture of acetabular liner, which is more common with ceramic liners. Wear of the poly liner is a common long term sequale/complication presenting with dislocation.

**Heterotropic ossification** is seen in 15%-50% of patients after the hip arthroplasty. Patients typically present with hip stiffness. Detectable calcification density can be seen on radiographs and CT within weeks after surgery and ankylosis seen as early as 12 weeks after the surgery. A three phase bone scan is more sensitive and can be positive 4-6 weeks prior to calcification detected on plain radiograph or CT. incipient HO can be detected on blood pool images as early as 2.5 weks after injury and the delayed phase become positive a week later. Surgical excision is considered after maturation of HO and serial pre-operative bone scan can help quantify ratio of heterotrophic to normal bone activity to avoid delay and subsequent risk of ankylosis. Brooker classification is used for grading HO. Grade 1 represent island of bone in soft tissue. Grade 2 includes bone spur that arise from pelvis or proximal femur leaving >1cm between the opposing surfaces. Grade 3 is similar to grade 2 but < 1cm between the opposing surfaces, whereas, grade 4 is complete ankylosis.
**Pseudobursae** are irregular recesses that communicate with the joint and are typically detected at arthrography or cross sectional imaging. Inflammation of the bursae can also be seen post hip arthroplasty due to altered dynamics of the joint.

**Periprosthetic soft tissue adverse reaction** to metal debris is another significant complication seen in metal on metal hip arthroplasties. Increased local ion concentrations secondary to wear of implant can lead to hypersensitivity reactions and soft tissue derangement known as aseptic lymphocytic vasculitis associated lesion (ALVAL) or pseudotumour. Pseudotumours have been classified by Hauptfleish et al as type 1 characterised by periprosthetic fluid collection with a thin smooth wall measuring $<3\text{mm}$ in thickness. type 2 have irregular wall with thickness of $>3\text{mm}$ and contains multiple septations and debris whereas type 3 are predominantly solid mass.
Images for this section:

Fig. 1: Dislocated left THR

© - Leicester/UK
Fig. 3: Coronal reformats shows loosening of the left femoral stem

© - Leicester/UK
Fig. 2: Axial CT shows loosening of the left femoral stem
**Fig. 4:** Left THR periosteal bone destruction secondary to infection

© - Leicester/UK
Fig. 5: Bone destruction secondary to infection anterior to the tip of distal femur.

© - Leicester/UK
**Fig. 15:** Bilateral Brookes grade 1 heterotropic ossification.

© - Leicester/UK
Fig. 16: Brooker grade 2 heterotropic ossification on the left side and grade 4 on the right side

© - Leicester/UK
**Fig. 6:** T2WI shows collection overlying the right greater trochanter in axial and coronal planes

© - Leicester/UK

**Fig. 7:** There is periprosthetic fracture in the region of the trochanters in keeping with Vancouver A type
Fig. 8: There is periprosthetic fracture in the region of the trochanters in keeping with Vancouver A type

© - Leicester/UK
Fig. 10: There is periprosthetic fracture in the region of the femoral stem in keeping with Vancouver B type

© - Leicester/UK
Fig. 14: Osteolysis of right acetabular component

© - Leicester/UK
Fig. 21: Sinogram of discharging sinus shows communication with the femur indicating chronic infection.

© - Leicester/UK
Fig. 18: Metastases are not infrequent after hip arthroplasty as seen in this case in the medial calcar and lesser trochanter.

© - Leicester/UK
Fig. 17: Arthrogram demonstrating post THR pseudobursa.

© - Leicester/UK
Fig. 19: Bilateral pseudotumours post hip resurfacing

© - Leicester/UK
Fig. 20: Bilateral pseudotumours as seen on coronal view.

© - Leicester/UK
**Fig. 22:** T2WI coronal showing right gluteus medius atrophy post THR

© - Leicester/UK
**Fig. 23:** T2WI axial showing right gluteus medius atrophy post THR

© - Leicester/UK
Fig. 24: T1WI axial shows right trochanteric bursitis post THR

© - Leicester/UK
Fig. 25: T2WI axial shows right trochanteric bursitis post THR

© - Leicester/UK
Fig. 12: There is dislocation of the acetabular cup of the right THR- AP view

© - Leicester/UK
**Fig. 11:** There is periprosthetic fracture in the region of the femoral stem in keeping with Vancouver B type

© - Leicester/UK
Fig. 13: There is dislocation of the acetabular cup of the right THR- Lateral view

© - Leicester/UK
Fig. 9: Right greater trochanter avulsion

© - Leicester/UK
Conclusion

Awareness of the potential complications following THR and challenges presented by painful THR helps radiologist to choose appropriate investigation for making the diagnosis. This will aid the Orthopaedic surgeons in the management of complex cases.
References


