INTRODUCTION:

Periprosthetic osteolysis is a serious medium to long-term complication of total hip arthroplasty. Although often asymptomatic, osteolysis can lead to component loosening and periprosthetic fracture. These complications cause significant morbidity and require complex revision surgery. However, clinical decision-making as to whether or when to intervene surgically is hampered by a lack of knowledge about the progression of osteolysis. While computed tomography (CT) provides an accurate measure of osteolysis volume, it would be advantageous in general clinical practice if plain radiographs could be used to monitor osteolysis. Thus, the aims of this study were firstly, to use CT to determine the progression of osteolysis around cementless acetabular components and secondly, to determine the ability of plain radiographs to detect the presence of and determine the progression in size of osteolytic lesions around cementless acetabular components.

METHODS:

Nineteen hips were diagnosed with periacetabular osteolysis using a high-resolution multi-slice CT scanner with metal artefact suppression. Mean duration since arthroplasty was 14 years (range 10-15 years) at initial CT. A minimum of two repeat CT scans were undertaken over a five year period to determine the progression in size of osteolytic lesions over time. All patients gave informed consent and the study was approved by the institutional research ethics committee. Associations between volume of osteolysis and osteolysis progression were examined using the Mann Whitney U test. Osteolysis was more likely to be detected on plain radiographs if the lesion volume was greater than 10 cm³ in size (p=0.005). In the ten hips that progressed in size, osteolysis progression was detected on AP radiographs in six hips and on oblique radiographs in three hips. No correlation was found between the volume of osteolysis progression measured by CT and the area of osteolysis progression measured on AP (r²=0.16, p=0.37) or oblique (r²=0.37, p=0.15) or AP and oblique radiographs (r²=0.34, p=0.17).

RESULTS:

On CT, osteolysis progressed by more than 1 cm³/yr in 10 of 19 hips (55%) during the monitoring period. The mean volume of total osteolysis progression was 3.2 cm³/yr (range 1.1-7.5 cm³/yr). Progression in size of osteolytic lesions was significantly associated with hips with larger osteolytic lesions at the initial CT (p=0.0004). Osteolytic lesions greater than 10 cm³ in size at the initial CT were 2.6 times (95% CI 1.5-4.5) more likely to progress over one year than smaller lesions. In those hips that progressed markedly, however, osteolysis did not always progress steadily with the rate of osteolysis progression varying greatly between CT scans in some hips (Figure 1).

Figure 1. Longitudinal monitoring of periacetabular osteolytic lesions using CT. Osteolytic lesions that progressed in size by more than 1 cm³/yr (black) and those that did not progress in size over the monitoring period (grey) are shown.

DISCUSSION:

Sequential CT provides new insights into the natural history of periprosthetic osteolysis. Total osteolysis volume greater than 10 cm³ is associated with a high risk of progression and these lesions progress, on average, at a greater rate than those less than 10 cm³. Previous studies have shown that plain radiographs are not sufficiently sensitive for the detection of periprosthetic osteolysis, but that the detection rate increases as lesion volume increases. We found that plain radiographs may detect lesions more than 10 cm³ in size, but are poor in monitoring progression in size of periacetabular osteolytic lesions.

This study highlights the need for accurate information on the progression of osteolytic lesions when considering surgical treatment and for drug trials. Knowledge of how osteolysis develops and progresses will aid surgeons in evaluating the risk of osteolysis interfering with structural/supporting bone structures and the risk of fracture. Sufficiently powered, randomized controlled trials with the use of CT to determine if an osteolytic lesion has progressed in size is essential to evaluate future treatments designed to reduce or prevent periprosthetic osteolysis. The selection criteria for drug trials should likely include the presence of acetabular osteolysis more than 10 cm³ in size as measured by CT.

REFERENCES: