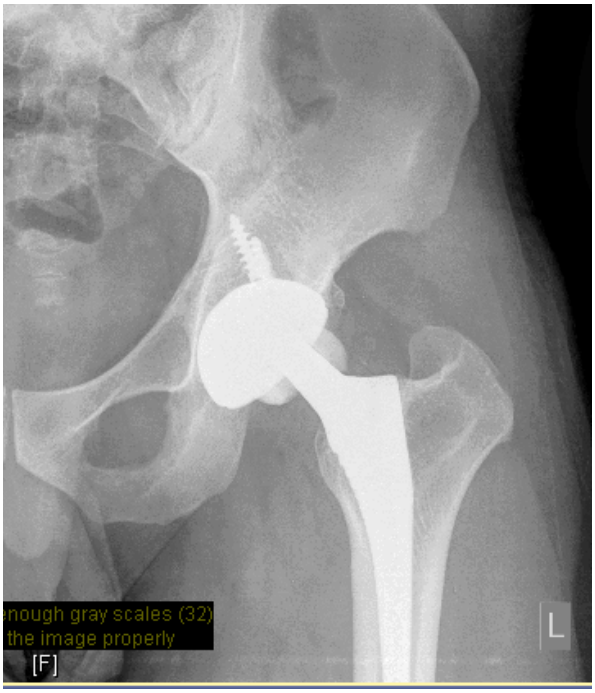
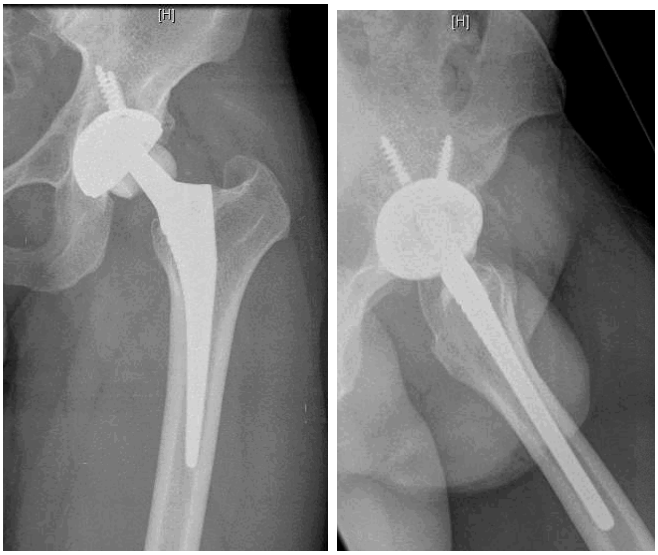
Case report: Pain L THR [post THR 2 years; with history of trivial fall]



Your Diagnosis?

Diagnosis: Ceramic head fracture



In the 1970's, Boutin implemented ceramic in modern total hip arthroplasty (THA). Although initial fracture rates of 13.4 % for ceramic heads were described before the 1990's, the inferior rate of wear and friction when compared to metallic heads, and optimized tribology was very promising in THA.

Gradual improvements in processing of the ceramic material led to a significant reduction of the fracture rate to below 0.1 % [Willman]. Thus, alumina ceramic heads have currently become the standard material in THA with ceramic bearing surfaces.

Nevertheless, multiple case reports have been published and the causes of fractures are diverse and vary from traumatic events, to impingement between the neck and the liner rim. Spontaneous fractures without any history of trauma have also been described [Holmer]

The advantages of all-alumina bearings are superb wear resistance, stability, and inertness demonstrated over 3 decades. The disadvantage is a small risk for brittle fracture, as described in this paper. Surveying the latest ceramic hip series reported in recent journal articles or presented at the 6th World Biomaterials Congress, there were 11 studies representing more than 35,000 cases followed for 3 to 25 years. There were 24 reported fractures. A unique survey of hip complications in the 1990s found a

fracture risk of approximately 1.4 per 1000 ceramic balls used in the United States. A company database holding more than 2.5 million records described the overall fracture risk as 1 per 10,000 cases.

Initial use of ceramic cup inserts indicated a 2% to 3% incidence of chipping during surgery. Beginning in 1997, the number of ceramic-metal cup-locking cases entered into a US Food and Drug Administration ceramics database was more than 2400, with no fractures reported by the FDA in July 2003.[Clarke Am J Orthop (Belle Mead NJ). 2008 Feb;37(2):E26]

In this report, we present a 46-year old patient who underwent primary THA and was a victim of low-energy trauma [fall in the shower] four years later. Initial radiographs showed nonconcentric relation of the neck of the femoral stem to metal liner and the ceramic fragment appeared to have been overriding the superior part of the neck.

Operation

Operation:

Posterior approach

Required extensive debridement of all synovial tissue

Extensive lavage

Convert to plastic on metal head; Or newer ceramic on ceramic

Revision surgery [Hwang]

Evaluation and investigation in a patient with ceramic implants presenting with sudden onset groin pain or hip injury. Early diagnosis is important.

Look for asymmetry of the femoral head component is one early radiological sign which may indicate failure.

Early cases:

As a new cup could have been cemented into the acetabular shell. There may also have been limited damage to the stem taper at that stage, allowing replacement of the failed ceramic head with a metal one without the need for stem revision.

Late cases

Erosion of the stem taper through both the polyethylene insert and its metal shell meant that a simple exchange of the polyethylene insert was not an option.

It also made intraoperative dislocation of the hip and subsequent retrieval of the acetabular component more difficult.

The stem taper had eroded into pelvic bone, and its subsequent movement created a small defect superiorly.

During its migration through the acetabulum, the femoral stem taper had become damaged and eroded, necessitating revision of the whole femoral component as opposed to replacement of the modular head alone.

Furthermore, bone ingrowth around the acetabular shell metal acetabular component complicated its removal, resulting in a much larger pelvic defect, which required bone grafting and use of a GAP ring implant.

Removal of uncemented acetabular components often results in large pelvic defects, as in this case, due to osteointegration of bone at its interface with the implant. Specialized techniques have now been developed, which reduce the amount of bone loss at the bone implant interface. These include use of the Explant device (Zimmer, Warsaw, Ind), which uses short followed by long blades to break the bone implant interface with minimal resection of surrounding bone.

Revision total hip arthroplasty after fracture of a ceramic femoral head is a challenging procedure.

Retrieval of all ceramic particles is crucial to the survivorship of the revision, as any retained fragments may cause subsequent abrasive wear and lead to osteolysis and loosening.

A study looking at the outcome of revision procedures following ceramic femoral head fracture gave a survival rate of 63% at 5 years [Kempe]. The most frequent cause of failure necessitating rerevision was implant loosening.

Factors identified as contributing to longer survival rates included exchange of any components, which may contain embedded ceramic particles, and extensive synovectomy, to remove as much ceramic debris as possible.

DISCUSSION

The "cracking sound" incident after trauma, as described by the patient, was probably due to the complete fracture of the ceramic head. It is not uncommon to misdiagnose this fracture unless a careful assessment performed on the initial X ray.

When diagnosis is missed and management is delayed, a major destruction of the ceramic head and extensive synovitis with metallosis could cause failure of implant fixation [Aghaie].

This raises the question of the need of a possible guideline or recommendation for patients suffering acute trauma of the lower limb with a total hip arthroplasty, especially those with ceramic bearing surfaces.

The patient's ability to walk without any pain originating from the hip does not rule out fracture of humeral head and a careful radiological assessment is essential.

It presents a challenge for the assisting physician to obtain a correct diagnosis. It has been suggest a close follow-up including repeat conventional radiographs several weeks after trauma. It is required to increase awareness among physicians and training staff who treat trauma patients who underwent previous ceramic total joint replacements, in order to pedite

the diagnosis of possible posttraumatic implant failures.

The most common cause of long-term failure of total hip arthroplasty is osteolysis and aseptic loosening secondary to wear debris. Combinations of hard materials such as ceramic-on-ceramic generate smaller volumes of particulate wear debris than traditional combinations such as metal-on-polyethylene. Periarticular tissue in both cases contained titanium wear debris due to impingement of the neck of the titanium femoral component against the rim of the titanium shell and ceramic debris from edge loading wear (stripe wear) of the ceramic. It is not clear whether the titanium debris, the ceramic debris, or both caused the osteolysis. These cases illustrate that the risk of osteolysis persists, even with third-generation alumina ceramics [Bonar].

References

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