Acetabular component stability using the replace-in-situ philosophy to treat acute acetabular fractures

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INTRODUCTION: Treatment of acute acetabular fractures with total hip arthroplasty (THA) is gaining popularity, but the long-term survival of these implants is not well established. The poor premorbid mobility of majority of patients with an acetabular fracture requiring an acute THA, which continues after treatment, makes it difficult to assess clinically which of these patients have failed surgical management and require revision surgery.

Plain radiographs have traditionally been used to assess implant stability, but the errors of measurements are +/- 5 mm. The migration of an acetabular implant in the first two-years, if measured accurately with Radiostereometric Analysis (RSA), was shown to be a surrogate for its long-term survival [1]. This study aimed to 1) measure the migration of acetabular components of THA used to treat acute acetabular fracture through the replace-in-situ technique using RSA and plain radiographs and 2) report patient clinical outcomes at a minimum of two years of follow-up

METHODS: 36 consecutive patients who consented to participate and underwent primary THA for an acute acetabular fracture in our institution between Nov 2011 and Nov 2019 through a replace-in-situ technique were prospectively recruited to the study. The mean age was 75 (range 54-97). There were 22 males and 14 females. 18 cases had an ACPHT, 16 had an ABC fracture, and there was one each with AC and TPW. Acetabular reconstruction was performed through a replace-in situ technique with pelvic distraction through an oversized trabecular metal acetabular component and, in most cases, a cup-cage technique [1]. Acetabular component migration was measured using RSA and plain radiographs, taken on day 2 post-op and then at six weeks, 3 and 6 months, 1, 2-, 3-, 5-, and 7-years post-surgery. More than 1mm of proximal component migration at 2 years was considered predictive of future loosening [2], and more than 3mm of proximal migration or 5° of sagittal rotation at any time point was deemed to be diagnostic of a loose component [3]. Patient-reported outcomes measures, including Harris Hip scores (HHS), Pain scores and SICOT activity scores, were recorded at the same time points.

RESULTS: Of the 36 patients, four patients died within two weeks of surgery, four patients could not attend follow-up in person due to frailty and remote location and one who was lost to follow-up. The mean follow-up was 3 years (2-8 years). All fractures healed radiologically by six months follow-up.

27 patients had RSA and plain radiographic migration measurements. Acetabular component migration at two-year follow-up exceeded the 1 mm threshold predictive of future loosening in 6 of 27 patients (22%) measured by RSA. Manual measurements reported that three of these components had very low migration and therefore was unable to detect that they may be at risk of loosening.

Four components (15%) were diagnosed loose (>3mm at any time point) when measured with RSA compared with 11 components (41%) respectively when measured manually on plain radiographs [3] (Figure 1). There was disagreement between the two methods in 9 cases with respect to the threshold for future loosening (measurement on plain radiographs underestimated proximal migration in 1 case and overestimated it in 8 cases).

Three patients underwent revision surgery, within two-years of follow-up: one for acetabular component loosening, at 17 months, when the acetabular component was confirmed loose and revised; and one for recurrent dislocation at 4 months and one for prosthetic joint infection at 17 months. In these two patients the acetabular component was found osseo-integrated with a constrained articulation being cemented into the original acetabular component.

Of the four patients with a radiographic loose cup, three were frail nursing home octogenarian/nonagenarians whose mobility was deemed to be similar to the one before their fracture, coping and not revised. The fourth patient, an active independent 71-year-old was symptomatic and as detailed above, revised at 17 months for primary THA when the acetabular component was confirmed loose.

The remaining 2 patients whose components moved more than the threshold predictive of future loosening but less than the threshold for diagnosing loosening had a pattern of migration represented by early migration during the fracture healing period followed by a stabilisation of the implant and no migration following the 1 yr follow-up.

The median HHS improved from 62 at 3 months post-op to 70 at 24 months. The patient-reported pain scores remained unchanged at 24 months compared with three months post-op (median 30; mean 30; range 10-44) at 3 months. The median patient reported SICOT activity at 3 and 24 months remained at the semi-sedentary level. There were no differences in scores noted between the ones with cup movement above and below the threshold.

DISCUSSION AND CONCLUSION: This study is the first to investigate the stability of large porous tantalum trabecular metal acetabular components used to treat acute acetabular fractures using the sensitive and accurate RSA technique and compared the results to manual measurement on plain radiographs. When using the currently accepted thresholds, 15% of cases were diagnosed loose and 22% at risk of becoming loose. Importantly measurements on plain radiographs were false negative and failed to diagnose migration of the component in 1 case and were false positive in 8 cases (30%). The migration pattern of the acetabular components in these series during the fracture healing raises questions about the possibility that some components could potentially gain stability after fracture healing although this will require future investigations.

[1] Solomon LB et al 2015 CORR, 473(12):3811-3819.
[2] Kim YS et al 2017 BJJ, 99-B (4):465-474.
[3] Abrahams JM et al 2017 BJJ, 99-B (4):458-464.