Longitudinal Evaluation of Time Related Femoral Neck Narrowing after Metal-on-Metal Hip Resurfacing


Introduction

Metal-on-metal hip resurfacing (MOMHR) was approved in the United States (US) by the Food and Drug Administration (FDA) in May 2006, buoyed by promising survivorship data from the United Kingdom (UK). The phenomena of neck narrowing after resurfacing has been said to stabilize after 2 years. However, Shimmin demonstrated that the mean time to fracture after MOMHR is 3 to 4 months. Isaac et al reported that bone mineral density is decreased significantly at 3 months postoperatively and back to normal at 1 year and 2 years. This solidified our interest of studying the short-term natural history of narrowing of the femoral neck after MOMHR. The purpose of this study was to track the short-term neck narrowing changes in MOMHR patients. We measured neck narrowing at 3 months, 1 year and 2 years postoperatively with a cohort of 63 patients (71 hips). It was hypothesized that neck narrowing occurs early after MOMHR and then stabilizes long before the 2 year time point.

Methods

This study is a retrospective longitudinal evaluation of prospectively collected patient data from our Center of Hip and Knee Replacement (CHKR) registry. From June 2006 to October 2008, 139 MOMHR were performed at our center by one of two surgeons (Birmingham Hip Resurfacing (BHR); Smith and Nephew, Memphis, TN). It is our standard to obtain low anteroposterior (LAP; digital) pelvis radiographs immediately after MOMHR procedure (in recovery room) and then at 3 months, 1 year and annual follow up office visits. Inclusion criteria for the present study included patients who came back for follow up office visit at the prescribed time points and underwent good quality LAP radiographs. Exclusion criteria include patients who missed more than one follow up time point and those with poor-quality LAP radiographs. Two orthopaedic residency trained research fellows reviewed the x-rays independently at 4 time points, i.e. immediate after surgery, 3 months, 1 year and 2 year. Neck-to-prosthesis ratio, as described by Spencer, was used as main outcome measure: diameter A is the diameter of the femoral neck exactly at the prosthesis; diameter B is the diameter of the implant at the level of its opening edge; the neck-to-prosthesis ratio (NPR)= A/B. Measurements were performed using Centricity software.

Statistical analyses were performed using SPSS 12.0 (SPSS for Windows, Rel. 12.0.0, 2003; SPSS Inc, Chicago, Ill). Intraclass correlation coefficient will be calculated to evaluate the reliability between two observers. Paired t-test will be used to evaluate the significant difference between different time points.

Results

The mean NPRs were 0.852 ± 0.056, 0.839 ± 0.052, 0.835 ± 0.051, 0.83 ± 0.04 immediately, 3 months, 1 year and 2 years post-op respectively. NPR at 3 months was significantly different from the immediate postoperative NPR (p=0.001). There was no difference between the 3 month and 1 year NPR (p=0.14) or 2 year NPR (p=0.53). FNN exceeding 10% of the diameter of the neck was observed in only 4 patients (5.6%) at two years follow up. None of these patients developed a femoral neck fracture (FNF).

Discussion

To our knowledge, this is the first longitudinal evaluation of time related femoral neck narrowing after MOMHR focusing on short term outcome. Previous studies have focused on neck narrowing at 2 years and more. This study demonstrates that femoral neck narrowing after BHR occurs as early as 3 months postoperatively. After 3 months, NPR stabilized. Also, neck narrowing occurred in our cohort less commonly than in previous studies and extreme narrowing occurred in only 4 cases. If it happened, it happened at 2 years.

The cause of neck narrowing after MOMHR is still unknown. Possible contributing factors include stress shielding, bone necrosis in the residual femoral head, wear debris and fluid pressure affecting the cancellous neck bone. Neck narrowing observed may be due to one or a combination of these factors.

The clinical significance of neck narrowing is not understood. The primary concern would be any correlation with femoral neck fracture, however there is no consistent evidence in the literature showing that neck narrowing can lead to fracture. In this cohort, we did not observe any fractures.

Limitation of this study: As all previous study, one major limitation of our study is that neck narrowing in the sagittal plane has not been measured. CT scan or roentgen stereophotogrammetric analysis (RSA) may provide more accurate information. However, routine use these modalities on every resurfacing patient is neither practical nor necessary. Consistent with previous studies, we showed that this method of measuring is statistically reliable. We demonstrated an intraclass correlation coefficient of greater than 0.8.

Conclusion

Femoral neck narrowing after BHR (in which the femoral component is cemented, but the stem is not) occurs as early as 3 months postoperatively, and stabilizes thereafter. Excessive FNN was not common in patients within the first two years of surgery and was not correlated with risk of FNF.

Reference

4. Poster No. 327, Graham Isaac et al. Bone Mineral Density Changes after Surface Replacement of the Hip: A Five Year DEXA Study. ORS 56 annual meeting, New Orleans