Ten-year investigation of pelvic inclination angle and cup anteversion after total hip arthroplasty

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Introduction

Acetabular cup positioning in total hip arthroplasty (THA) is important for preventing impingement and dislocation. Dislocation is reported in 1 to 3 percent of cases and is associated with cup anteversion and lateral opening. Other factors that have been documented include time after surgery and type of patient. Recently, several studies showed that the pelvic inclination angle (PIA) increased after THA; however, the follow-up period in those studies was short.

The purpose of this study was to examine PIA and cup anteversion after THA up to 10 years, and evaluate the characteristics of cases whose PIA and cup anteversion angle changed more than 10 degrees in the 10 years following THA.

Materials and Methods

This study consist of 67 joints of 52 patients who underwent THA at our institution from 1991-2000 and were followed up at our outpatient clinic for about 10 years (8 to 16). The cases included 43 women and 9 men with a mean age of 60.8 (range: 39-84) years. They were diagnosed as osteoarthritis (47 patients) and osteonecrosis (5 patients).

Anteroposterior (AP) radiographs of the pelvis were obtained in supine position, and the height of the pelvic foramen (H) was measured to calculate the PIA. In the current study, a simple method was used for assessing the PIA from AP radiographs using a formula based on a trigonometric function because pelvic inclination demonstrates a rotary motion. The PIA (θ) was obtained by the formula reported by Kitajima et al.¹ as follows: θ = arccos (H/165) for women, θ = arccos (H/157) for men (Figure 1). We also measured the cup angles (anteversion and inclination) by the method proposed by Lewinnek et al.² The PIA and cup angles were measured on radiographs taken preoperatively and at 3 months, 6 months, and every year postoperatively, and chronological changes were investigated. The rate and characteristics of cases whose PIA changed more than 10 degrees each year were evaluated.

Results

Postoperative change in PIA was a mean -1.6, -2.2, -2.5, -2.7, -2.5 degrees at 3 and 6 months, and 1, 5, and 10 years after THA. PIA increased significantly in the first 6 months after THA, but after 6 months did not increase with time (Figure 2). Change in cup anteversion angle from 3 months after THA was <0.1, 0.3, 0.3, and 0.6 degrees at 6 months, and 1, 5, and 10 years after THA, respectively.

The percentage of cases whose PIA changed more than 10 degrees was 0, 2, 7, 5, and 5% at 3 months, 6 months, 1, 5, and 10 years after THA, respectively. Those cases were all women with osteoarthritis, and their mean age was 63 (61-66) years.

Discussion

Nishihara et al.¹ examined the change in pelvic flexion angle after THA in a 5-year postoperative period, and reported that the pelvic flexion angle was unchanged from 1 to 5 years after THA in the majority of cases. In the current study, we evaluated the pelvic inclination angle and cup angles after THA up to 10 years, and discovered no change up to 10 years. Also, the percentage of cases whose PIA changed more than 10 degrees did not change up to 10 years. This is the first paper that has examined yearly change in pelvic inclination angle up to 10 years after THA, and it supports the previous results of a 5-year follow-up after THA by Nishihara et al.¹

The limitation of this study was the radiographic measurement method of PIA. In the current study, a simple method based on AP radiographs was used because only AP radiographs of the pelvis were available in most cases. However, an excellent correlation between the PIA calculated by the simplified formula used in this study and the PIA measured in lateral radiographs was confirmed by Kitajima et al.²

Conclusion

The pelvic inclination angle changed significantly in the first 6 months after THA, but no further marked change was observed in the remainder of the 10-year follow-up.

References