Accuracy of acetabular cup placement in navigated THA with modified registration technique in semilateral decubitus position

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Background: The accuracy of cup placement in navigated THA depends on the bony landmark registration intraoperatively. The usual patient position for registration is supine, but supine position has some drawbacks such as it’s more difficult for femoral stem visualization and implantation. The alternate patient position is lateral decubitus, but registration in this position may be unreliable because of the contralateral ASIS can’t be palpated accurately. The other technique is registration in supine position first and then placing the patient in lateral decubitus position for operation. The drawbacks of this technique are time consumption and increased risk of contamination.

We created a semilateral decubitus position which combined the advantage of supine position for registration and lateral decubitus position for better femoral canal visualization. We modified the registration technique by compressing the soft tissue above Pubic Symphysis (PS) to the abdomen and registered at the Antero-Superior-Pubic-Symphysis (ASPS).

Objective: Evaluate the accuracy of cup placement within the “safe zone” and the accuracy of imageless navigation measurement by comparing the intraoperative values of acetabular cup abduction and anteversion to postoperative computed tomography (CT) values.

Method: The prospective study consisted of 30 patients who received short stem navigated THA in semilateral decubitus position from May to October 2012. CT scans were performed in all cases at six weeks postoperatively. The abduction and anteversion angle measured on postoperative CT were compared to the intraoperative measurement with a paired t-test and a correlation test at a 0.05 level of significance. The number of outliers was also recorded for each individual direction and as a whole.

Results: The mean CT abduction was 41.37° (range, 37° to 45°, SD 2.01) and the mean navigated abduction was 40.29° (range, 37.6° to 45.5°, SD 1.99). The mean paired difference was 1.26° (range, -0.8° to 4.6°, SD 1.05), this difference was significant (p = 0.02) but considered to be clinically irrelevant. There was a significant correlation between the CT abduction and navigated abduction (p < 0.001). All cases showed a difference of less than 5° between the two measurements and all cases were within the safe zone of CT measurement. The mean CT anteversion was 13.57° (range, 7° to 18°, SD 3.28) and the mean navigated anteversion was 11.18° (range, 5.9° to 15.5°, SD 2.52). The mean paired difference was 3.02° (range, -2.6° to 8.6°, SD 2.33), this difference was significant (p = 0.001) but considered to be clinically irrelevant. There was a significant correlation between the CT anteversion and navigated anteversion (p = 0.005). Twenty-two cases (22/30, 73%) showed a difference of less than 5° between the two measurements and all cases were within the safe zone of CT measurement. Soft tissue thickness overlying the PS and ASIS were measured in axial CT images and averaged 28.53 mm. (range, 11.7 to 54.6, SD 9.97) and 8.03 mm. (range, 3.2 to 26, SD 4.86) respectively. We found no significant correlation between the difference and the thickness of the soft tissue above the PS (p = 0.09) nor above ASIS (p = 0.09).

Conclusions: The navigated THA with modified registration technique in semilateral decubitus position offered a more precise cup position. All cases were within the safe zone in both abduction and anteversion angles. The modified registration technique demonstrated the intraoperative position of the acetabular cup...
more accurately when compared to the postoperative CT measurement. Abduction measurements were more accurate than the anteversion measurements.