

Accuracy of Handheld Accelerometer-Based Navigation System in Total Hip Arthroplasty

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INTRODUCTION: Accurate acetabular component positioning in total hip arthroplasty (THA) within established safe zones is essential. Component malposition in total hip arthroplasty is a major risk factor for dislocation. One proposed method of addressing component position involves using intraoperative navigation. The purpose of the present study is to evaluate the accuracy of a handheld navigation system.

METHODS: We identified 268 primary THAs performed by a single surgeon through the posterior approach from 2018 to 2022. A handheld navigation device was used in all cases. Mean age and BMI were 58 years and 30.4 kg/m², respectively. There were 155 females (58%), and mean follow up was 1.1 years. Intraoperative measurements, including change in leg length and acetabular component abduction, were recorded. A previously validated artificial intelligence tool was utilized to radiographically measure acetabular component abduction. Leg length change was measured manually on AP radiographs.

RESULTS: The mean difference between acetabular component abduction measured by intraoperative navigation and on postoperative radiographs was 5.0°. There was no significant association between years of surgeon experience with the navigation system and measurement difference. Preoperative diagnosis of avascular necrosis, developmental dysplasia of the hip, and obesity did not have a significant association with degree of discrepancy between intraoperative and postoperative measurements. Mean difference between intraoperative measurement of change in leg length and postoperative measurement was 2.6 mm.

DISCUSSION AND CONCLUSION:

In this study, measurement of acetabular component abduction by intraoperative navigation had good accuracy when compared with measurement on postoperative radiographs. Similarly, change in leg length measured by navigation had good agreement with postoperative measurement. Although no factors could be identified in this study which predicted discrepancy in measurement, it is possible that other factors may help predict inaccuracies in intraoperative measurement.