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Does Intraoperative Fluoroscopy Improve Limb-Length Discrepancy and Acetabular Component Positioning During Direct Anterior Total Hip Arthroplasty?

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ABSTRACT

Background: One potential benefit of the direct anterior approach (DAA) for total hip arthroplasty is the ability to use intraoperative fluoroscopy for acetabular cup positioning and limb-length evaluation. Previous studies comparing the use of fluoroscopy with an anterior approach to a posterior approach have reported conflicting results. To our knowledge, no prior study has compared acetabular cup position and limb-length discrepancy (LLD) using a DAA with and without fluoroscopy.

Methods: We retrospectively reviewed the charts of 298 patients who underwent direct anterior total hip arthroplasty with or without intraoperative fluoroscopy. All procedures were performed by 2 surgeons who use DAA as their primary approach. Preoperative and 6-week postoperative low anteroposterior pelvis and cross-table lateral radiographs were reviewed by 3 independent surgeons. Acetabular cup inclination, anteversion, and LLD were measured and compared.

Results: Thirty-three patients were excluded for inadequate imaging, leaving 125 patients in the fluoroscopy group and 140 patients in the nonfluoroscopy group. Mean inclination, anteversion, and LLD were 39.4° (95% confidence interval [CI], 38.5°-40.2°), 30.2° (95% CI, 29.2°-31.2°), and 1.1 mm (95% CI, 0.1 mm-2.2 mm) for the fluoroscopy group and 39.9° (95% CI, 39.3°-40.5°), 31.1° (95% CI, 30.0°-32.2°), and 0.8 mm (95% CI, −0.1 mm to 1.6 mm) for the nonfluoroscopy group. There was no significant difference in acetabular inclination ($P = .35$), anteversion ($P = .22$), or postoperative LLD ($P = .64$) between groups.

Conclusion: This study found no clinically or statistically significant difference in acetabular inclination, anteversion, or LLD between the fluoroscopy and nonfluoroscopy groups. Both surgeons achieved a similar mean acetabular cup position and an equivalent mean LLD.

Total hip arthroplasty (THA) is an effective treatment to relieve pain and disability due to end-stage hip osteoarthritis [1]. Demands for primary THA are high and continue to rise due to its largely successful track record, recent improvements in recovery pathways, and an aging patient population [2]. The direct anterior approach (DAA) has been popularized over the past several years as an intermuscular surgical exposure that ostensibly results in less soft-tissue damage, accelerated recovery, as well as potentially lower dislocation rates compared to other approaches when done appropriately [3–9].

An additional purported benefit of the DAA is the ability to obtain intraoperative supine fluoroscopic images during implant placement [10]. Advocates of this technique argue that use of intraoperative imaging improves surgeon precision for leg-length determination and acetabular component positioning accuracy, thereby improving wear rates, range of motion, and stability [11,12]. While previous authors have demonstrated the clinical utility of fluoroscopic use with a DAA compared to other approaches, it is currently not known whether use of intraoperative imaging improves implant accuracy compared to a free-hand DAA technique [3]. Indeed, we are unaware of any prior studies that have compared acetabular cup positioning or limb-length discrepancy

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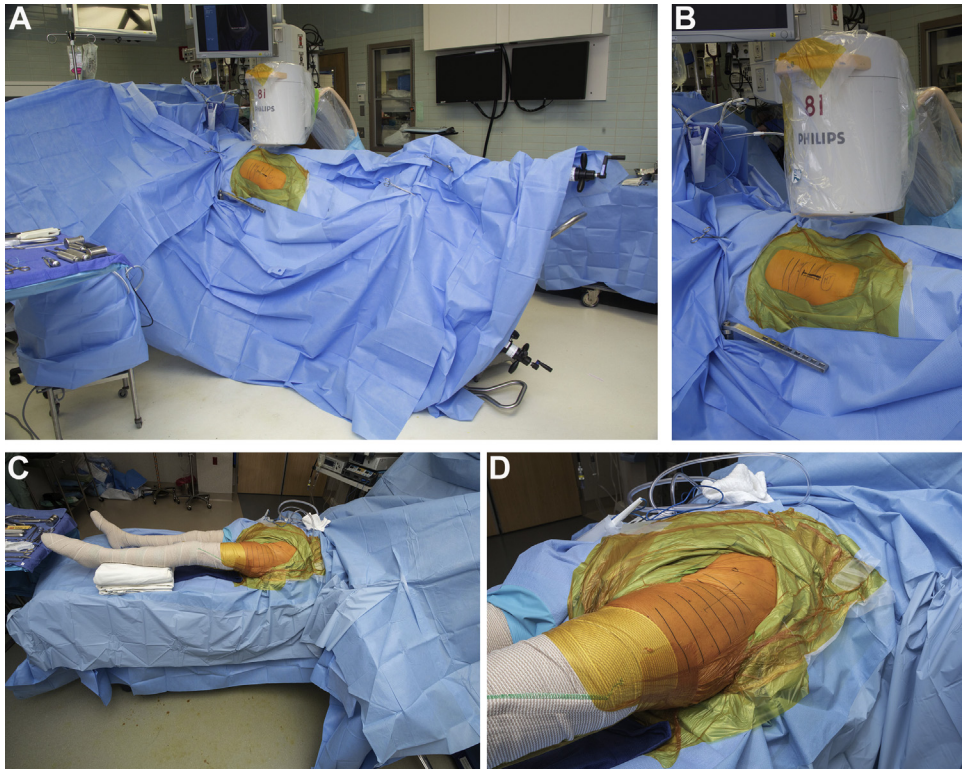

Fig. 1. (A) DAA setup with a specialized table and intraoperative fluoroscopy. (B) Close-up view of the DAA setup with a specialized table and intraoperative fluoroscopy. (C) DAA setup with a standard table with both legs draped into the field to allow for intraoperative limb-length evaluation. (D) Close-up view of the DAA setup with a standard table. DAA, direct anterior approach.

(LLD) with a DAA with or without utilization of intraoperative fluoroscopy (Figs. 1A-1D).

The purpose of this study was to determine whether the use of intraoperative fluoroscopy significantly improved acetabular cup position and/or LLD.

Methods

After approval from our institution's review board, we retrospectively reviewed the medical records of 298 patients from January 1, 2016, to March 1, 2017, with degenerative osteoarthritis who underwent primary DAA THA by 2 high-volume, experienced total joint arthroplasty surgeons who routinely use the DAA as their primary hip approach. Surgeon 1 performed THA using a specialized table, designed to facilitate surgery through a DAA, and allowing for use of intraoperative fluoroscopy, while surgeon 2 performed the DAA procedure without use of intraoperative fluoroscopy, using a more conventional table that allows for evaluation of range of motion and limb lengths as both lower extremities are free draped into the operative field during surgery. Thirty-three patients were excluded due to incomplete clinical data or inadequate radiographs, which left a total of 265 patients available for the study. The cohort included 125 patients and 140 patients who underwent surgery with or without the use of intraoperative fluoroscopy, respectively. Demographic data are provided in Table 1.

Preoperative and postoperative low anteroposterior (AP) pelvis and cross-table lateral radiographs were reviewed by 3 independent orthopedic surgeons, and the mean acetabular inclination and anteversion measurements of each patient were used for statistical analysis. If any measurement was off by more than 5°, the 3 observers reviewed the radiographs together and either came to a

Table 1
Demographic Data of All Patients Included in the Study (N = 265).

Patient Demographics	Fluoroscopy	No Fluoroscopy
Female gender (%)	58 (46.4%)	83 (59.0%)
Mean age, y (95% CI)	63.6 (61.7-65.5)	67.9 (66.3-69.4)
Mean height, cm (95% CI)	172.1 (170.3-174.0)	168.8 (166.8-170.4)
Mean weight, kg (95% CI)	89.8 (86.0-93.6)	76.1 (73.7-78.5)
Mean BMI (95% CI)	29.9 (29.0-30.9)	26.7 (25.9-27.3)

CI, confidence interval; BMI, body mass index.

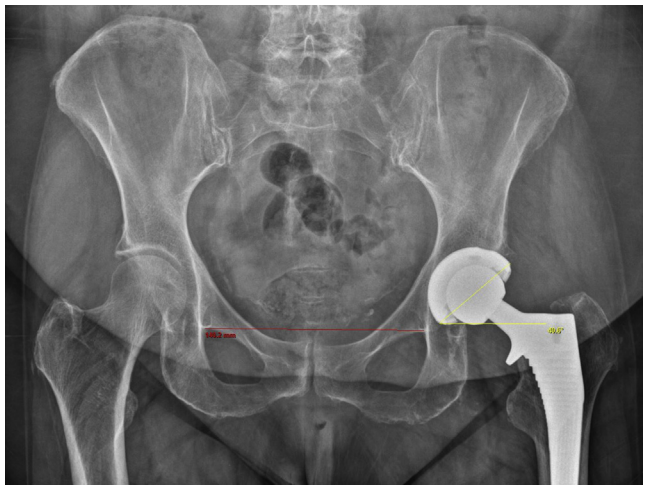

Fig. 2. Low anteroposterior (AP) pelvis with acetabular cup inclination measured using line drawn between bilateral teardrops and the superior and inferior edges of the acetabulum.