Background: Total disc arthroplasty promises to be a viable alternative to fusion for degenerative disc disease of the lumbar spine. Correct placement of the prosthesis is critical for optimal function. Malposition of > 3mm predisposes to asymmetric loading, implant wear, implant loosening, and non-physiological stresses on adjacent vertebral segments. Our objective is to measure the visual accuracy of midline placement of artificial disc using four different anatomic landmarks (pedicle, vertebral body waist, vertebral body endplate, spinous process) under fluoroscopy.

Methods: Artificial discs were implanted into three cadaver specimens at L23, L34 and L45. The implant used is the DePuy Charite III artificial disc. An AP image was obtained by fluoroscopy. The fluoroscopy machine was then rotated in the sagittal plane to 2.5, 5, 7.5, 10, and 15 degrees. We then obtained CT scans of the cadavers. We measured the distances from each of the anatomic landmarks studied to the midline of the implant on both fluoroscopy and CT. The means were then compared to evaluate which landmark had the least variability on fluoroscopy when compared to CT. This process was repeated as the fluoroscopy machine was rotated in the sagittal plane to determine what the maximum allowable error in rotation can be to obtain a discrepancy of < 5mm.

Results: The mean difference in distance on fluoroscopy at 0 degrees when compared to CT from the pedicle, vertebral body waist, vertebral body endplate and spinous process to the center of the implant was 1.31mm (p = 0.0001), 1.72mm (p = 0.0001), 1.99mm (p = 0.0001) and 3.14mm (p = 0.0002) respectively. The difference in the measurements from the medial border of the pedicle to the midline of the implant when comparing fluoroscopy to CT was the smallest (1.31mm) and was statistically significant (p = 0.0001). When the angle of the fluoroscopy machine was greater than 5 degrees, a mean difference of > 3mm when compared to CT was obtained for all anatomic landmarks.

Conclusion: The pedicle is the most consistently identifiable and accurate of the anatomic landmarks studied for placement of total artificial discs in the lumbar spine. Error in rotation of the fluoroscopy machine of > 5 degrees in the sagittal plane can lead to implant malposition.