INTRODUCTION: At the present time there is no universally accepted radiologic assessment method for determining pseudoarthrosis after cervical spine fusion surgery. The use of plain radiographs is used widely in clinical research, although little information is known on the true validity. The purpose of this prospective study was to assess inter- and intra-rater variability for fusion status assessment using CT and X-Rays.

METHODS: Patients who were approximately one-year (9 months to 15 months) post-operative of a cervical fusion were solicited via letter to enroll in the study, regardless of current clinical status, in order to enroll 50 patients. All patients had routine radiographs taken, including AP and lateral views as well as flexion-extension lateral views. For study purpose, a thin-cut helical CT with coronal and sagittal reconstruction was obtained. A total of 118 surgical treated levels in the 50 patients were reviewed by each of four reviewers: two spine surgeons, one radiologist and one spine fellow. Random, blind reviews of X-rays and CTs were separated by at least two-weeks for each reviewer. Fusion on plain x-rays was defined as presence of spanning trabecular bone and <2mm motion on flexion-extension.

RESULTS: Levels were more likely to be assessed as not fused on CT 22% (range of individual reviewers: 13% - 31%) as compared to plain x-rays 11% of levels (range: 2% -- 16%). The within reviewer consistency of percent of levels assessed similarly on both CT and X-rays ranged from 64% to 85% (kappas: 0.19 – 0.47). All reviewers had higher pseudarthrosis rates based on CT assessment as compared to x-rays. The consistency between X-rays and CTs was highest at the C5-C6 level (78%)

Consistency between reviewers assessment of fusion status was higher with CT (average pairwise agreement: 89%; range 82% - 96%; generalized kappa=0.69) as compared to plain radiographs (average pairwise agreement 81%, range 76% - 87%; generalized kappa 0.26).

CONCLUSIONS: Whether CT is better than X-ray at assessing fusion status is not definitively known from this study, however we did observe a higher observation of pseudarthrosis with this diagnostic technique. The “true” fusion
status of these patients is unknown, as no gold standard for fusion status, other than surgical exploration exists. Thus, specificity and sensitivity of the methods is not available.

The higher agreement between x-ray and CT at level C5-C6 may be due to the more parallel endplates allowing for more accurate plain radiograph assessment.

In assessment of cervical spine fusion, the use of fine-cut helical CT scans with coronal and sagittal reconstruction may be more sensitive in detecting the absence of spanning trabecular bone. This may allow better detection of pseudarthrosis in patients with symptoms. The reading of the CTs appears to be more reproducible when compared to static and dynamic x-rays.