

## **Are Biplanar Projection Radiographs Adequate to Confirm Intra-operative Pedicle Screw Placement?**

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**INTRODUCTION:** Two-dimensional Biplanar Radiographs (BPR - AP and lateral fluoroscopy) have been the gold standard in spine fusion surgery for many years, however, three-dimensional (3D) intraoperative imaging systems are now available which may offer improved visualization. BPR for confirmation of intraoperative pedicle screw placement may be inferior to three-dimensional fluoroscopic (3D) imaging. The purpose of this study was to compare intraoperative pedicle screw confirmation using BPR and 3D imaging.

### **METHODS:**

In this retrospective review of prospectively collected data, 100 patients were enrolled undergoing degenerative spinal surgery by a single spine surgeon. Pedicle screw placement was compared using three different imaging modalities – BPR, 3D fluoroscopic image, and postoperative computed tomography (CT). The M-line and Gertzbein-Robbins system (GRS) was used to assess screw position on intraoperative BPR, 3D fluoroscopy, and postoperative CT. M-line was defined as a line connecting the upper and lower spinous processes through the fixed vertebrae within BPR. Patient postoperative CTs were compared to intraoperative 3D fluoroscopy by the GRS method.

### **RESULTS:**

A total of 604 instrumented pedicles in 100 patients were studied. Postoperative CTs were then compared to M-line findings in BPR, to confirm whether false positives or negatives were detected. Five screws (0.8%) in 5 patients (5%) crossed the M-line on BPR imaging. However, when compared to their postoperative CT imaging, breach was not detected and was classified as fully within the pedicle (category A of GRS) indicating a false-positive BPR finding. A BPR in a separate patient (1%) did exhibit one screw (0.2%) with a false-negative BPR compared to 3D imaging due to anatomical rotation.

**DISCUSSION AND CONCLUSION:** A clinically significant number of patients had false-negative and false-positive screw placement readings on BPR. A false-negative reading may give the surgical team an incorrect sense of security that a screw is within the pedicle when it actually has a breach. Conversely, a false-positive reading on BPR may alert the surgical team to expend additional time evaluating screw position when it is actually in a satisfactory position. These findings may make 3D imaging a more desirable post-instrumentation gold standard for confirmation of screw position.