Radiographic PEEK double-lucency finding after anterior cervical discectomy and fusion with local autograft and PEEK spacer: a preliminary study

Technical note

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Anterior cervical discectomy and fusion (ACDF) is considered a standard neurosurgical treatment for cervical degenerative disc disease, but the methods for determining fusion after ACDF that involves the use of a polyetheretherketone (PEEK) cage are not well defined. The authors examine an image finding called “PEEK double lucency” that may be useful in identifying fusion. This finding was studied to determine if it would be helpful in identifying fusion on radiographs obtained in 148 patients who underwent an ACDF in which a PEEK cage was filled with local autograft bone (bone spurs in the present cases). The presence of a PEEK double lucency was discovered during review of the plain radiographs and defined as a complete radiolucent ring around the titanium markers within the PEEK cage. In total, 178 spinal levels were examined. Of the 356 (2 for each of the 178 levels) titanium portions examined, the PEEK double lucency was present in 323 or 91% of the titanium portions of the PEEK cages for the patients with complete fusion. The authors conclude that the radiolucent feature of the PEEK cage, which produces the image finding PEEK double lucency, aids in the determination of fusion. (DOI: 10.3171/2011.11.SPINE1141)

Key Words • anterior cervical discectomy and fusion • polyetheretherketone • radiolucency

Methods

After receiving approval of the institutional review board, independent radiologists reviewed radiographs obtained in 148 patients who underwent ACDF in which a PEEK cage was filled with small bone pieces collected from the excision of bone spurs. The radiologists determined that 209 of the 237 levels were completely fused. The radiographs of the remaining 28 levels in which the radiologist indicated there was partial fusion were reviewed again. During this review of the plain radiographs, PEEK double lucency was observed. The presence of the PEEK double lucency was defined as a complete radiolucent ring around the titanium portions within the cage. Once the image finding was defined, 2 criteria had to be met before any patient’s radiographs could be included in this study. First, both the independent radiologist and 2 neurosurgeons had to determine the levels to be fused. Second, the levels examined had to be completely visible on the plain radiographs. In total, there were 109 patients in whom these criteria were met.
Radiographic PEEK double-lucency finding

The authors observed the PEEK double-lucency finding around the titanium of the PEEK cage on radiographs acquired in patients with complete fusion. In the 109 patients in whom the aforementioned criteria were met, 178 levels were examined. For each level, 2 radiolucent rings could be observed around the 2 titanium portions of the PEEK spacer. These radiolucent rings appear when bone has filled the intervertebral space completely and only the area containing the radiolucent PEEK surrounding the titanium remains. It was also observed that the double-lucency finding was more evident on the reverse radiographs (Fig. 2). Review of the radiographs showed that 323 complete radiolucent rings were observed of the expected 356 (2 for each of the 178 levels). Therefore, of the 356 titanium portions examined, the PEEK double-lucency image finding was present in 91% or 323 of the titanium portions of the PEEK cages for patients with complete fusion. The lack of a comparison group for this examination prevented the Bayesian analysis of the radiographic review.

Discussion

Anterior cervical discectomy and fusion with a PEEK cage is used to treat cervical disc disease. The postoperative evaluation of solid fusion has proven to be an important aspect for predicting a patient’s outcome and evaluating success rates of surgical spinal techniques. However, variation exists in the radiographic criteria for defining fusion. In a prospective clinical study by Bishop and colleagues, fusion was defined in ACDF cases when bony trabeculae were seen crossing the involved interspace. Brown et al. defined fusion in their clinical study as complete bridging of trabeculae between adjacent vertebral bodies and the bone graft. In a prospective study, Niu and associates defined fusion as the absence of a radiolucent line between the cage coupled with no translation or angulation change on lateral cervical flexion-extension radiographs. Finally, a study on the interobserver variation in the radiographic evaluation of postoperative fusion in ACDFs confirmed that interobserver variation exists. Computed tomography scans are the gold standard for review of fusion, and a weakness of the present study is that CT scans were used infrequently. This study and the existing variation in the definition of fusion support the growing need for the development of better methods for radiographically determining fusion.

The authors observed a PEEK double-lucency finding on radiographs of patients with complete fusion. Our theory is that when fusion is incomplete, bone will not
surround the PEEK spacer and radiolucent rings will not be observed. However, there were not enough patients with definite nonfusion to test this hypothesis. This image finding can be observed on both standard and reverse radiographs (Figs. 2 and 3). The PEEK double-lucency finding was more apparent on the reverse radiographs (Fig. 2).

Conclusions

The authors conclude that the radiolucent feature of the PEEK cage, which produces the PEEK double-lucency finding, can aid in the determination of fusion.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the finding specified in this paper.

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