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Clinical Study

Clinical experience using polyetheretherketone (PEEK) intervertebral structural cage for anterior cervical corpectomy and fusion

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ABSTRACT

Anterior cervical corpectomy and fusion (ACCF) is commonly performed for various pathologies involving the cervical spine. Although polyetheretherketone (PEEK) cages have been widely used following anterior cervical discectomy and fusion (ACDF), clinical literature demonstrating its efficacy following ACCF is sparse. A retrospective review of patients enrolled in a prospective database who underwent single/multi-level ACCF was performed. Fifty-nine patients were identified who underwent corpectomy reconstruction with PEEK cages for symptomatic degenerative, neoplastic, infectious, or traumatic pathologies of the cervical spine. Thirty-five patients having at least 6 months follow-up (FU) were included in the final analysis. The mean age of patients was 51 years (range, 18–81 years) with FU ranging from 6 to 33 months (mean, 6.6 months). None of the patients had dysphagia at last FU. There was no implant failure with fusion occurring in all patients. While 57% of patients (20/35) remained stable with no progression of myelopathy, 43% (15/35) improved one (11 patients) or two (four patients) Nurick grades after surgery. The use of PEEK cages packed with autograft or allograft is safe and effective following anterior cervical corpectomy, demonstrating high fusion rates and good clinical results. This synthetic material obviates the morbidity associated with autograft harvest and possible infectious risks of allograft. The wide array of cage dimensions facilitates ease of use in patients of all sizes and appears safe for use in the typical pathologic conditions encountered in the cervical spine.

1. Introduction

Anterior approaches to the cervical spine remain highly successful for patients afflicted with various pathologies resulting in cervical myelopathy.[1] Though the basic approach remains the same since it was first described by Smith and Robinson,[2] there has been a tremendous development of and variability in the use of graft options and instrumentation for treating cervical spine pathologies through the anterior approach. An aging population with advanced degenerative diseases has made patients with multi-level disease a common clinical scenario faced by spine surgeons.[3–6] Patients with multi-level cervical degenerative disc disease present a unique challenge to the spine surgeon who can employ multi-level anterior cervical discectomies and fusion (ACDF) or anterior cervical corpectomies with fusion (ACCF) or a hybrid technique capitalizing on segmental fixation to optimize the fusion rate and overall rigidity of the construct.[5–7] Cervical corpectomy has become very common over the past several years to ensure adequate decompression for degenerative conditions or following cervical spine trauma or for neoplastic reconstruction. Secondary to that, the selection of graft options has become critically important. Though various graft options exist for fusion after ACDF, the choice of implants for reconstruction after a corpectomy is not as extensive. A variety of materials may be used to reconstruct the corpectomy defect including autograft (including, iliac crest, rib or fibula), allograft (including, iliac crest, humerus or fibula) and titanium cages packed with autograft or allograft.[3,4,6,8–13] The use of iliac crest and fibular autograft has fallen out of favor, especially in the USA, secondary to the associated morbidity of harvesting.[14] Fibular allograft remains the most common choice for reconstruction following a cervical corpectomy and has been reported to be associated with very good results.[4,10,11,15] Though allograft has been widely used in cervical spine fusion, the risk of disease transmission is of concern, and it is more likely to collapse and has lower fusion rates after long strut cervical reconstruction.[14] The use of titanium or polyetheretherketone (PEEK) cages is another option for reconstruction of the cervical spine after a corpectomy.[1,3,4,12,16,17]

PEEK is an attractive material as a structural graft due to its inert chemical nature and its comparable modulus of elasticity to bone.[8,18] Although PEEK cages have been used widely following ACDF,[8,18–20] the clinical literature demonstrating its efficacy following cervical corpectomy is sparse. There is a lack of significant

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data reporting the clinical application of PEEK cages following cervical corpectomy in spite of its significant advantages.[4,17,18] We have been using PEEK cages for all our cervical corpectomies since 2006 and the present study was conducted to review our clinical experience in a mixed group of patients who underwent cervical corpectomies for various indications followed by use of PEEK cages for reconstruction of the anterior column.

2. Material and methods

A retrospective review of all patients enrolled in a prospective database who underwent single or multi-level ACCF by the senior surgeon (J.O'T.) was performed. Institutional Review Board approval was obtained. Included patients underwent corpectomy reconstruction with intervertebral structural PEEK cages for symptomatic degenerative, neoplastic, infectious, or traumatic pathologies of the cervical spine from January 2006 to December 2010. The indications for surgery were intractable radiculopathy, myelopathy, or a combination of the two due to nerve root or spinal cord compression by degenerative disease, or presence of infection, trauma, or neoplasm with or without functional or neurologic deficit with good clinico–radiological correlation confirmed by MRI and/or CT scans. The PEEK cages were packed with autograft from the corpectomy or with allograft and demineralized bone matrix in patients with tumor or infection. Nurick myelopathy grade was assessed before surgery and at last follow-up for clinical outcome measurement.[21] Details of surgical technique, intraoperative details, duration of surgery and estimated blood loss were also reviewed. Fig. 1 demonstrates a representative image of one the patients from the study population.

3. Surgery

The patients were placed with the head extended in a supine position. The use of tongs for cervical traction was decided on a patient-by-patient basis. The operative procedure was performed with the method described by Smith and Robinson.[2] A standard left side approach to the cervical spine was performed. A right sided approach was used when necessary or in the presence of any contraindication to a left sided approach. The procedure was performed using high magnification loupes with a microscope when considered necessary. Additional distraction at the operative level was achieved with the use of distraction screws. Following the discectomy at the cephalad and caudad level of the proposed corpectomy, the vertebral body was removed with the combination of a Leksell rongeur and a high speed drill. The use of a rongeur was preferred to maximize the amount of autograft harvest from the ventral body except in patients with infection or neoplasms. The endplate of the vertebral body was prepared by removing the cortical cartilaginous layers. After adequate anterior decompression at the corpectomy site, the size of the defect was measured. The PEEK cage is a hollow frame with retentive teeth on the top and bottom, which improves fixation of the cage to the bone. The hollow PEEK cage was impacted with either autogenous bone graft harvested from the corpectomy or another graft extender such as demineralized bone matrix/calcium hydroxyapatite for reconstruction and fusion. The correct position of the cage was ascertained using an image intensifier in lateral view. The availability of various sizes of PEEK cages made inserting the graft relatively easy. ACDF was carried out in patients where a hybrid decompression was performed with placement of a PEEK cage at the level of discectomy. Anterior cervical plating was subsequently performed in all patients.

4. Follow-up

All patients were maintained in a cervical collar for 6 weeks after surgery followed by standard physical therapy. Follow-up data consisted of clinical and radiographic evaluation at regular intervals. The patient's preoperative Nurick myelopathy grade was compared to that at last follow-up. Presence or absence of dysphagia was subjectively assessed by the senior surgeon (J.O'T.) and classified as none (no episodes of swallowing problems), mild (rare episodes of dysphagia), moderate (occasional swallowing difficulty with specific foods), or severe (frequent difficulty swallowing with the majority of foods). Complications were recorded as implant-related, surgery-related, or general (not directly implant or surgery related). Neutral and flexion/extension (F/E) radiographs were evaluated by both the authors for graft subsidence, implant failure, and status of fusion. Fusion was defined as the absence of radiolucencies, evidence of bridging trabecular bone within the fusion

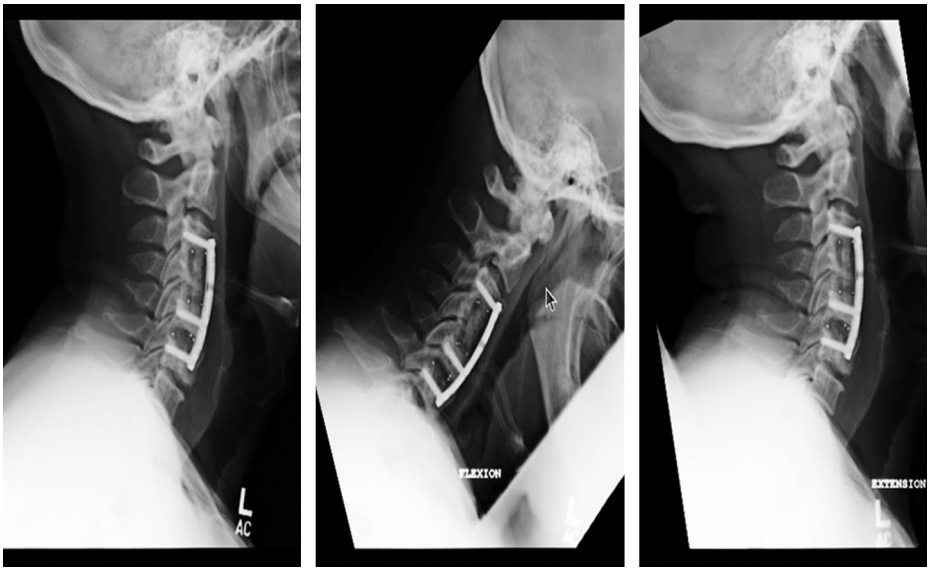

Fig. 1. Postoperative lateral (left) neutral, (middle) flexion, and (right) extension radiographs at 8 months follow-up showing solid fusion in a patient who underwent C4 corpectomy, C5/6 discectomy, reconstruction with polyetheretherketone cages and C3–C6 plating.