

## Intraosseous Screw Fixation of Anterior Cervical Graft Construct After Discectomy

Kao-Wha Chang, Gen-Zen Lin, Yee-Wen Liu, Kai-Lai Suen, and Po-Ling Liang

*Department of Orthopaedic Surgery, 803 Army General Hospital, Taiwan, Republic of China*

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**Summary:** This article describes a new technique of intraosseous screw fixation of the cervical spine, as well as a retrospective review of 27 patients who had anterior cervical interbody fusion after discectomy and fixation with one intraosseous Herbert screw, with a minimum follow-up of 1 year. The study included 19 men and eight women. There were no neurologic complications at final follow-up evaluation. All patients had radiographic evidence of fusion. No screw breakage, back-out, or dislodgement occurred. Optimal intraoperative radiographic evaluation for accurate intraosseous screw placement is recommended. The use of intraosseous screw fixation is a useful addition to the armamentarium of the spine surgeon when fixation of anterior cervical graft after discectomy is required. One hundred percent rate of union and prevention of complications related to the currently used anterior fixation systems are the major advantages of this method.

**Key Words:** Intraosseous screw—Anterior cervical interbody fusion—Discectomy.

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Anterior discectomy and subsequent fusion through a variety of grafting constructs (1,5,11) is a widely and often used method in the treatment of degenerative condition with neural compression. Despite the inherent stability of these graft constructs to sustain axial loads, anterior shear at the interface between the graft and the adjacent vertebrae may result in graft migration. This problem continues to be a source of significant morbidity. Although some investigators feel that it is unnecessary and impractical to use anterior cervical plate and screw fixation for most degenerative conditions (9), it has been used for stabilization of the graft construct for years (3,4). However, the high profile of these fixation devices, back-out of the screws, or screw dislodgement may contribute to soft tissue erosion or dysphagia. Such complications may be difficult to avoid with currently

used anterior metallic fixation systems. Continued objective documentation of the results with these systems is necessary to solve the problem of an optimal fixation system and technique.

The aim of this study was to describe a new technique of intraosseous screw fixation of anterior cervical graft construct and to review the results of 27 consecutive patients treated by the senior author (K-W.C.) using this technique.

### OPERATIVE TECHNIQUE

Exposure of the cervical spine is obtained through a standard anteromedial approach. Once the anterior aspect of the cervical disk has been exposed, discectomy, removal of compressive structures such as posterior and posterolateral osteophytes, and insertion of a tricortical horseshoe-shaped bone graft are performed. Through a stab-wound incision, a 1.5-mm Kirschner wire (K-wire) is introduced through the anterior border of sternomastoid muscle at the level that

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Address correspondence and reprint requests to Dr. Kao-Wha Chang, No. 115-1, Alley 322, Section 1, Chung-Shan Road, Taipei, Taichung Hsein, Taiwan, Republic of China.

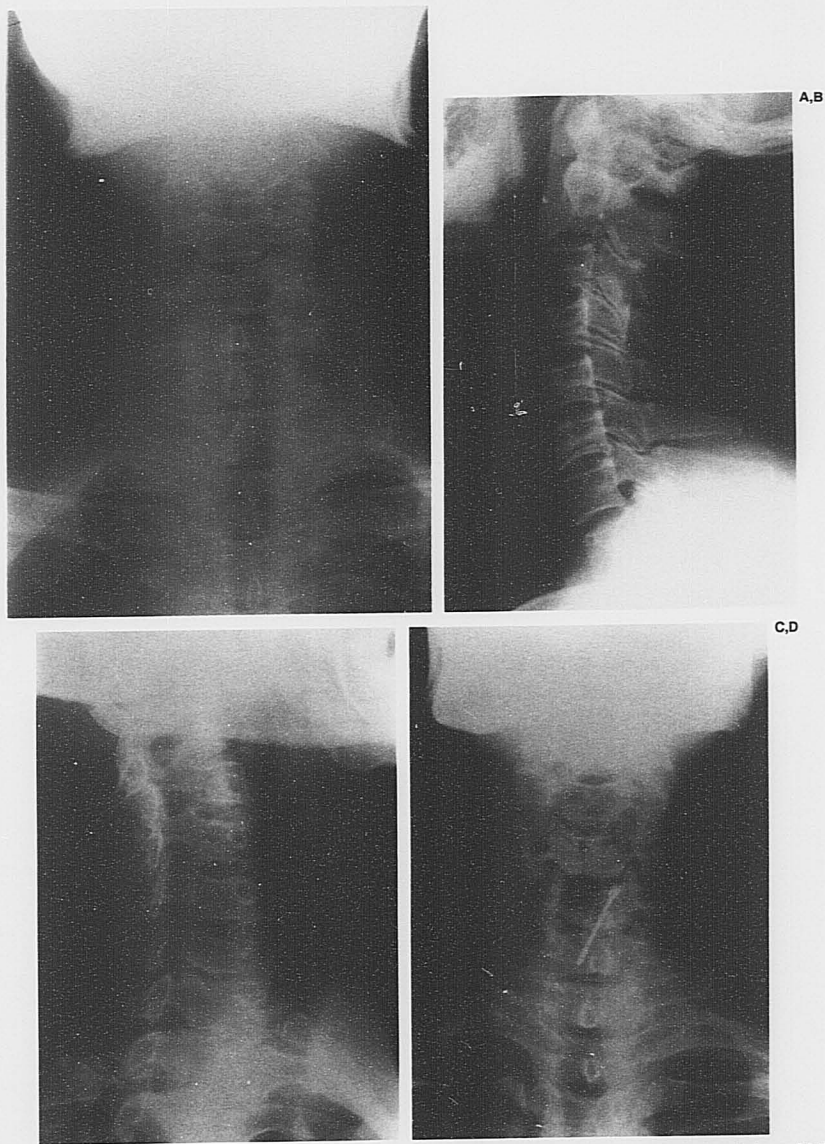


FIG. 1. Anteroposterior (A), lateral (B), and oblique roentgenograms (C) before surgery of a 51-year-old man who had cervical spondylotic neuropathy demonstrating posterior and posterolateral osteophytes at C6-7. Anteroposterior (D) and lateral roentgenograms (E, p. 128) taken 6 months after surgery demonstrating one intraosseous Herbert screw fixation of the graft construct and solid union of the graft construct.



FIG. 1. —Continued.

is one to two levels higher than the level of discectomy, reappearing in the lateral side of the exposed cervical spine. The K-wire should be introduced slowly. During penetration of the K-wire through the soft tissues, the surgeon should squeeze the interposed tissues between his or her fingers to move the neurovascular structures away from the pathway of the K-wire, and thus minimize the risk of neurovascular injury. The K-wire is inserted from the lateral corner of the superior endplate of the vertebra above the discectomy. Under anteroposterior and lateral image intensifier control, the K-wire is then advanced through the tricortical bone graft and into the vertebral body of the vertebra below the discectomy. Adequate intraoperative confirmation of K-wire placement is crucial to optimum placement of the intraosseous Herbert screw. Then the K-wire is removed and replaced by a Herbert screw of appropriate length. No tap is needed. The whole length of the Herbert screw should be intraosseous. The two-threaded portion of the screw shall not be in the graft to prevent jeopardizing the compression effect of the screw (Fig. 1). All the procedures of instrumentation are manipulated by hand, and motorized instruments should be avoided.

A suction drain is always placed and removed in 24

h. Patients are then mobilized in a cervicothoracic brace, which is to be worn for 3 months.

## MATERIALS AND METHODS

Twenty-seven consecutive patients with spondylosis were treated by anterior discectomy, tricortical iliac bone grafting, and one intraosseous Herbert screw fixation at 803 Army General Hospital, Taiwan. All patients have been followed for 12–24 months. The average age was 49 years (range 41–69). The review included 19 men and eight women. Evaluation addressed the subjective relief of pain, radiographic evidence of union, and instrumentation migration or failure. Successful arthrodesis was evaluated in all patients by routine flexion–extension roentgenograms of the cervicle spine at 3, 6, and 12 months after surgery.

## RESULTS

There were no intraoperative complications. All patients had improvement in the level of pain at the time of follow-up. No patient experienced a deterioration in neurologic function as a result of surgery. No wound infection occurred. Five patients developed urinary infection and all resolved by antibiotic. Three patients described persistent ache and discomfort at their graft donor sites. No screw breakage or back-out occurred. All patients exhibited clinical and radiographic union by 6 months. No patient complained of dysphagia at follow-up.

## DISCUSSION

Cervical interbody fusion using tricortical iliac bone graft is commonly used for stabilization after an anterior cervical decompression (1,2,5,7,11–13). The main advantages of anterior interbody fusion are that it allows restoration of the normal anatomic relationships between spinal elements and provides axial stabilization of the spinal segment. When fusion appears solid on radiograph, long-term graft problems are uncommon. However, within the initial 6 weeks after surgery, early graft problems occur with some frequency (15). Difficulties associated with anterior graft migration include nonunion, esophageal impingement, and neurologic deficit. Although complications do occur, the rate of graft dislodgement after single-level discectomy is low and the neurodeficit rate is very low.

Possible solutions to the problem of early graft mi-

gration have included varying graft constructs (7,13) and internal fixation (3,4,6). The tricortical iliac graft has been used most widely (7,11-13). The Smith-Robinson procedure using this graft was shown to be more stable than was a Cloward's dowel graft or a Bailey's strut graft (14). Other techniques further alter the configuration of the bone graft-vertebra interface. The attempts of Simmon's keystone technique (13) and Gore's modification (7) of this technique were to prevent graft dislodgement and improve fusion rate. However, Simmon's technique of angles cut into the end-plates are difficult, and Gore was able to simplify this by making flat horizontal vertebral resections. Gore has reported a higher fusion rate than was observed using the Smith-Robinson technique (7). To augment early graft stabilization, plate and screw fixation has also been used.

Although whether to fix the graft construct with plates and screws in the treatment of spondylitic neuropathy is still debatable, once the decision is made to fix the graft, instrumentation-related complications might occur. The relatively high profile of these devices and back-out or loosening of the screw causing erosion into the esophagus or surrounding soft tissues has been reported (8,10). The new AO titanium locking plate has a low rate of screw back-out.

The present study set out to describe a new technique of intraosseous single-screw fixation of anterior cervical grafts, and some of the advantages are expressed in the results of 27 patients treated by this method. That no graft migration and 100% union rate occurred in this study demonstrates that one intraosseous Herbert screw fixation can provide adequate graft stability for the anterior tricortical graft construct after discectomy and the compressive spondylolysis effect of the double-threaded screw can promote union. That no patient complained of dysphagia and no screw back-out, loosening, or breakage occurred in this study shows that this method can solve the existing problems of graft migrations, implant removal, and morbidity associated with currently available implants. This study demonstrates that one in-

traosseous Herbert double-threaded compression screw fixation is an alternative fixation method for stability of anterior cervical graft after discectomy. However, the possible risk of neurovascular injury does exist, and this technique should be used judiciously.

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