

# Complications of Multilevel Anterior Cervical Fusion

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## ABSTRACT

**Objective:** Although anterior cervical fusion is a standard procedure for most anterior cervical lesions, multilevel anterior cervical fusion with or without instrumentation remains a challenge due to the complexity of decision making and the high rate of complications as reported in the literature. **Patients and Methods:** During the period from June 1994 to June 1999, 49 cases of multilevel segmental anterior cervical fusion were retrospectively reviewed. Levels of fusion were determined mainly according to clinical presentations and related magnetic resonance imaging (MRI) findings. A modified Smith-Robinson surgical procedure and tricortical autogenous bone graft taken from the anterior iliac crest were used in all reviewed cases. Instrumentation was indicated only when there were 3 or more fusion levels, and/or when instability was documented. Complications including a painful donor site, transient dysphagia, instrumentation failure, hematoma formation, and spinal cord injury were analyzed. **Results:** Thirty-six patients (73.5%) received 2 levels of fusion, 11 patients (22.4%) received 3 levels of fusion, and 2 patients (4%) received 4 levels of fusion. Sixteen of 49 (32.6%) patients received plate and screw fixation. All patients achieved solid fusion by at least the 12-month follow-up. Complications included a painful donor site in 18 patients (36.7%), transient dysphasia in 16 patients (32.6%), instrumentation failure in 4 patients (8%), donor site hematoma in 1 patient (2%), and spinal cord injury in 1 patient (2%). **Conclusions:** Although the fusion rate of multilevel segmental anterior cervical fusion can be maximized if an autogenous tri-cortical bone graft is used and the stability is reinforced with instrumentation, the morbidity remained high. Alternative fusion materials such as a cage with or without an autogenous bone graft should be considered to avoid a painful donor site; meticulous surgical technique with intermittent retraction blade relaxation may decrease the incidence of dysphasia. Proper patient selection is important for avoiding unnecessary fusion levels and instrumentation. (*Tzu Chi Med J* 2004; **16**:79-84)

*Key words:* anterior cervical fusion, complication, tri-cortical autogenous bone graft

## INTRODUCTION

Since the pioneer introduction of the anterior cervical approach by Cloward, Robinson, and Smith in the early 1950's [1-3], anterior cervical discectomy and fusion have been standardized neurosurgical procedures dealing with most single-level discogenic and degenerative cervical spinal lesions. The choice of treatment options is more complicated when there is more than

one lesion segment. Complexities encountered in multilevel surgery include correlation between clinical findings and imaging studies [4,5], an anterior versus a posterior surgical approach [6-8], a segmental discectomy versus a corpectomy [9-14], a tricortical autogenous bone graft versus fibula or other heterogeneous grafts [15-20], grafting with or without additional instrumentation [21-25], instrumentation with a bicortical screw versus a monocortical locking-screw [23,26,27], and the fusion rate and morbidity of surgery [28-34]. In this article, we

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review 49 patients who underwent multilevel segmental anterior cervical fusion and focus on their complications.

## PATIENTS AND METHODS

### Patients

Forty-nine cases of multi-level segmental anterior cervical fusion treated during the period from June 1994 to June 1999 were retrospectively reviewed. The level of the operation was decided mainly according to clinical presentations and related radiological findings (6-view cervical spinal plain films and magnetic resonance images). Ancillary electrophysiological studies were performed in all cases.

### Surgical procedures

A right side anterior cervical approach with the Smith-Robinson microsurgical procedure with some extensive modifications was performed in all cases [1-3]. Segmental decompression was well performed using a high-resolution microscope, a high-speed burr, and a specially designed thin-blade punch. A tri-cortical autogenous bone graft taken from the ipsilateral anterior superior iliac crest was used in all reviewed cases. Instrumentation was indicated when there were 3 or more fusion levels, and/or when instability was documented. A soft collar was worn for 3 months in all cases.

### Complication analysis

X-ray and clinical symptoms and signs were followed-up at 2 weeks, 1, 6, and 12 months postoperatively. Solid fixation was defined as no segmental motion observed on dynamic X-ray at at least the 1-year follow-up. A painful donor site was defined as pain sustained for more than 2 weeks, and which required analgesics for relief. Transient dysphagia was defined as dysphagia sustained for more than 2 weeks but less than 1 month.

## RESULTS

There were 31 men and 18 women with a mean age of 50 (range, 26 to 78) years. Major pathogeneses included herniation of the intervertebral disc (HIVD), spondylosis, traumatic instability, and ossification of the posterior longitudinal ligament (OPLL) (Fig. 1). Thirty-six patients (73%) received 2 levels of fusion, 11 patients (22.5%) received 3 levels of fusion, and 2 patients (4%) received 4 levels of fusion (Table 1). Sixteen of 49

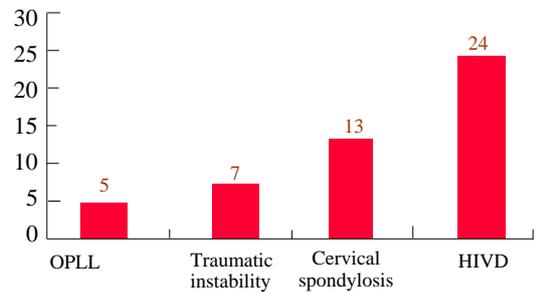


Fig. 1. Pathogenesis in 49 patients with multilevel anterior segmental cervical fusion.

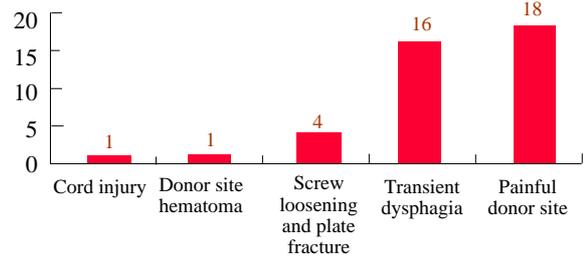


Fig. 2. Complications of 49 patients with multilevel anterior segmental cervical fusion.

Table 1. Levels of Segmental Anterior Cervical Fusion in 49 Patients

Level of fusion	No. of patients
Two levels	36
Three levels	11
Four levels	2

(32.6%) patients received plate and screw fixation due to 3 or more levels of fusion and/or instability. All patients achieved solid fixation by at least 12 months of follow-up (12 to 24 months; mean, 18 months). Complications included a painful donor site in 18 patients (36.7%), transient dysphagia in 16 patients (32.6%), instrumentation failure in 4 patients (8%), donor site hematoma in 1 patient (2%), and spinal cord injury in 1 patient (2%) (Fig. 2).

## DISCUSSION

Anterior cervical discectomy (ACD) is a well-established neurosurgical procedure dealing with myelopathy and radiculopathy [11,35-37]. Smith and Robinson's original discectomy method preserved the end plate and posterior longitudinal ligament (PLL). In recent years, several surgeons modified this surgical

technique for more-extensive decompression and to enhance the rate of fusion [1-3]. In our series, we used a specially designed 1 mm disc punch, a high-speed drill, and a microscope to remove the disc, PLL, and uncinete osteophyte. The posterior border of the vertebral body was tunneled for adequate cord decompression, and a foraminotomy was performed for nerve root decompression.

For multilevel cervical spinal lesions, options of decompression include segmental ACDs, a corpectomy, a laminectomy, and laminoplasty. The major concerns with all these various options are adequate decompression, immediate stability, and final bony fusion. For surgeons familiar with the posterior approach, due to the high incidence of postoperative kyphosis and the overall poor outcome in decompressive laminectomy, most suggest that laminoplasty should be the treatment of choice for patients with multilevel spondylosis, except those patients with a kyphotic deformity [6]. Macdonald et al reported a series of 36 patients who underwent a multilevel anterior cervical corpectomy and fibular allograft fusion for cervical myelopathy. Although significant improvement in pain and myelopathy was gained postoperatively, 35 of 36 patients had to use Halo-vest external fixation for 3 months to enhance the fusion rate. The mortality and major morbidity rate was 22% [9]. In our series, we used a modified Smith-Robinson method for segmental decompression and fixation with autogenous bone graft taken from the anterior iliac crest in all cases. A soft neck collar was applied for 3 months postoperatively. All patients had achieved solid fusion at least by 12 months of follow-up. There was no surgical mortality; the patient complicated with a cord injury had extensive ossification of the posterior longitudinal ligament (OPLL). Though anterior decompression achieves the best result for cervical radiculopathy, technical difficulty, the risk of dura tear, and even cord injury do exist when performing tunneling procedures in OPLL. So, in cases of myelopathy without radiculopathy caused by extensive OPLL, laminoplasty is a simpler and safer procedure for adequate decompression [6,36].

Anterior cervical fusion with plate and screw fixation is a useful technique for the management of instability. In multilevel ACDs, the use of instrumentation enhances the fusion rate [6,21,25]. In this series, instrumentation for fusion was used in 16 patients who received 3 or 4 levels of ACDs or who had significant instability. Although those patients all achieved solid fusion, 4 instrumentation failures occurred with a broken screw and/or plate loosening. Despite instrumentation failure, solid fusion did occur by at least 12 months of follow-up.

The incidence of a painful donor site reported in the literature is around 21.1%-26.1% [33,34]. In this series, 35% of patients experienced pain for more than 2 weeks, which constituted the major morbidity. Though an autogenous iliac bone graft is the optimal fusion substance for multiple-level fusions, the big purchase of bone mass is a limitation. Alternative fusion materials such as fusion with cages may be considered. Cho et al reported that the complication rate of using cages in the treatment of cervical disc disease was less than in patients who underwent fusion with autogenous iliac bone grafts (2.5% Vs 17.5%;  $p = 0.03$ ); the fusion rate was 100% [38].

Transient dysphagia results from prolonged traction on the esophagus during surgery. Bazaz et al reported an incidence of 50.2% of dysphagia at 1 month, with 4.8% remaining at the 12 month follow-up [32]. In our series, although we used a technique of intermittent retraction blade relaxation, transient dysphagia occurred in 32.6% of patients at to 2 weeks of follow-up. But none remained at the 1 month follow-up. Two patients with the late complication of instrumentation dislodgement experienced dysphagia at 6 and 8 months of follow-up, respectively, which improved after surgical removal of the instrumentation.

Although the advent of modern images of 3-dimensional CT scan and high-resolution MRI all have improved surgical outcomes, degenerative changes observed at multiple spinal levels may be erroneously mistaken as surgical problems with no clinical significance. There is no controversy that to achieve good surgical outcomes on multilevel cervical spinal lesions, patient selection based on clinical symptoms and signs is more important than imaging studies [39].

## CONCLUSIONS

Although the fusion rate of multilevel segmental anterior cervical fusion can be maximized if an autogenous tri-cortical bone graft is used and the stability is reinforced with instrumentation, morbidity remains high. Alternative fusion materials such as a cage with or without an autogenous bone graft should be considered, to avoid the painful donor site; a meticulous surgical technique with intermittent retraction blade relaxation may decrease the incidence of dysphasia. Proper patient selection is important to avoid unnecessary fusion levels and instrumentation.

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# 多節前位頸椎融合術之併發症

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## 摘要

**目的：**雖然前位頸椎融合術對於大多數的前頸椎病灶已是種普通術式，多節前位頸椎融合手術的複雜性、高併發症及內固定器使用之時機，令此種術式之進行仍是種挑戰。**病人與方法：**由1994年6月到1999年6月間，共有49位患者接受多節前位頸椎融合術，神經減壓及骨融合的位置由臨床症狀及核磁共振的發現來決定。所有的病患均接受改良後的史密斯-羅賓森術式(modified Smith-Robinson procedure)及自體前腸骨頂取得的三面皮質骨融合。在接受三節或三節以上手術及頸椎不穩定的患者會加上內固定器。手術併發症之分析包括：取骨處疼痛、吞嚥困難、內固定器失敗、取骨處血腫及脊髓損傷。**結果：**共有36位患者(73.5%)接受二節融合、11位患者(22.4%)接受三節融合、2位患者(4%)接受四節融合、16位患者(32.6%)接受內固定器固定，所有的患者經過至少12個月的追蹤後，頸椎均已融合。手術併發症包括：在18位患者取骨處疼痛(36.7%)、16位患者短暫的吞嚥困難(32.6%)、4位患者內固定器失敗(8%)、1位患者取骨處血腫(2%)及1位患者脊髓損傷(2%)。**結論：**合併使用三面皮質骨及內固定器做前位頸椎多節融合術，雖然能得到很高的融合效果，卻有太高之罹病率。慎選病患以避免不必要之骨融合及內固定器之使用，可避免過高之罹病率。使用人工骨關節(cage)，是可以考慮的另類選擇。(慈濟醫學 2004; 16:79-84)

**關鍵語：**多節前位頸椎融合術，併發症，三面皮質骨融合

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