MULTILEVEL CERVICAL CORPECTOMY AND FUSION USING AUTOGENOUS FIBULA STRUT GRAFT WITHOUT INSTRUMENTATION: HEALING PATTERNS OF THE GRAFT IN SMOKERS VS NON-SMOCKERS

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INTRODUCTION: Multilevel cervical corpectomy provides excellent decompression of the spinal cord and nerve roots for numerous pathologic conditions of the cervical spine. Previous reports of fusion rates in cervical corpectomy surgery are sparse and few have included a strict criteria to determine radiographic fusion for autogenous fibula graft without instrumentation. The purpose of this study was to determine radiographic healing patterns of the fibula strut graft and the effects on fusion rates with smoking.

METHODS: A retrospective chart and radiographic review was performed for 45 consecutive patients who underwent multilevel cervical corpectomy with autogenous fibula strut graft without instrumentation utilizing the technique by Bohlman (1). Office charts were reviewed for history of smoking, complications, revisions, and length of follow-up. Plain cervical radiographs were evaluated to determine evidence for union. Non-union was determined to be present by the following criteria: measuring greater than a 2 mm opening gap between the posterior most tip of the spinous processes on flexion-extension views or a lucent line appearing at the graft-vertebral body interface. Strut graft subsidence was analyzed by measuring the change in total vertebral body height of the grafted levels from post-op (within 3 wks but excluding intra-op radiographs) to final follow-up. Statistical analysis utilized the Fisher's exact test and chi-squared analysis.

RESULTS: 45 consecutive patients had undergone multilevel cervical corpectomy (2-4 levels) with autogenous fibula strut graft without instrumentation between Nov 93 and Aug 97. Diagnosis included cervical radiculopathy or myelopathy in 33 patients, central cord syndrome in 6 patients, non-union post discectomy in 4 patients, and post laminectomy kyphosis and infection one each. 41 patients had radiographs available for evaluation (3 of the 4 patients were lost to follow-up and one pt had posterior revision for graft subsidence 3 months post op). There were 26 male and 15 female patients with an average age of 56 yrs and a range of 36 to 79 yrs. The average follow-up for the entire group averaged 14 months (with a range of 3 to 30 mos). There were 14 non-unions for an average of (14/41) 34%. There were 13 smokers and 28
non-smokers. The smoker non-union rate was $(7/13)$ 54% while the non-smoker non-union rate was $(7/28)$ 25%. This was statistically significant with a $p$ value of $< 0.025$. Twenty-three of the 41 patients had follow-up greater than 12 months. For those 23 patients with greater than one year follow-up, the non-union rate was $(7/23)$ 30%. The smoker non-union rate was $(5/8)$ 63% and the non-smoker non-union rate was $(2/15)$ 13% ($p$ value $<0.026$). For those 18 patients with less than one year follow-up the non-union rate was $(7/18)$ 39% and the smoker non-union rate was $(2/5)$ 40% and the nonsmoker non-union rate was $(5/13)$ 38%. Only one of the 14 patients with a non-union was symptomatic enough to require revision posterior fusion. Graft subsidence measurements were available for 14 patients. The average subsidence was 2.4 mm with a range of 0-11 mm. Graft complications occurred in four patients. One patient, who underwent a four level corpectomy, had a fibula graft stress fracture after a solid union was evident. This patient was treated with posterior fusion. The fibula fracture as well as the posterior fusion healed uneventfully. One patient had immediate graft dislodgment post-op with fracture through the distal end-plate which was treated with revision anterior surgery. Another patient had significant graft subsidence post-op treated with revision posterior fusion. No patient suffered any loss of neurologic function post op.

DISCUSSION: Based on rigid radiographic criteria, the overall non-union rate for the 41 patients was 34%; however, the non-union rate was remarkably different when smoking is accounted for. The overall smoker non-union rate was 54% and the non-smoker non-union rate 25%. When the length of follow-up is accounted for, those patients with less than one year follow-up had an overall 39% non-union rate. In this group with less than one year follow-up, the non-union rate did not appear to be different between smoker (40%) and non-smoker (38%). Although the group of patients with greater than one year follow-up showed an overall improved non-union rate to 30%, the difference between smokers and non-smokers in this group were dramatic. Whereas the non-smokers had an improved non-union rate decreasing to 13%, the smokers showed an opposite trend, increasing to 63% (see graph).

In conclusion, smoking appears to have a profound effect on the healing patterns of fibula strut grafts. Non-smokers tend to continue healing up to and probably beyond the one year mark whereas the smokers do not. Finally, despite having 14 patients in this study with a radiographic non-union, only one pt was symptomatic enough to require revision posterior fusion. A study currently underway will determine the clinical outcome of these patients utilizing the SF-36 outcome questionnaire.