

Revision Cervical Spine Surgery: Anterior versus Posterior.

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Introduction

Anterior cervical fusions were first described in the 1950's. Since that time anterior cervical fusion has become increasingly popular in treating a variety of cervical conditions including degenerative or herniated discs, radicular symptoms with or without collapse, cervical stenosis with or without myelopathy, fractures and neoplasms. The literature varies considerably with regards to fusion rates in part because of the variety of methods used for the primary surgery and the number of segments fused.⁸ Pseudarthrosis is clearly a problem following anterior cervical fusions with the rate falling somewhere between 4 and 40%. Phillips et al.¹⁵ recently reported on the natural history of anterior cervical pseudarthrosis and found 67% became symptomatic within 5 years time. Pseudarthrosis, however, is only one mode of failure in cervical fusions. Other modes of failure include collapse with ensuing kyphosis, migration of the graft, and residual nerve root compression. Once failure has occurred the literature once again is controversial with papers that support both revision anterior ^{8,11,13,15} and posterior foraminotomy with fusion ^{12, 14, 16}.

Anatomically it makes sense to try and restore the normal anatomic relationships by restoring anterior height and therefore indirectly restoring the foraminal area. Lu et al.⁶ looked at foraminal area based on disc height in a computer simulated model and found that 1mm of disc collapse resulted in 20-30% decrease in foraminal area. They also found that 2mm and 3mm of collapse would decrease the area by 30-40% and 35-45% respectively. Tanaka et al.⁴ looked at nerve root impingement from a posterior surgical approach. They describe the intervertebral foramina as a funnel with the entrance zone or most medial aspect being the most narrow. They found that herniated discs and uncovertebral osteophytes compressed anteriorly while the superior articular process, ligamentum flavum and periradicular fibrous tissue compressed posteriorly. Sixty percent of nerve root compressions in their study were from the disc or uncovertebral osteophytes.

Clearly the disc height and anterior anatomy is important in nerve root impingement but there is nothing in the literature that looks directly at foraminal area and nerve root impingement when performing revision surgery following failed anterior cervical fusions. The purpose of this study was to determine if restoration of anterior height in revision surgery restored foraminal area and eliminated nerve root impingement better than posterior foraminotomy and fusion with interspinous wiring.

Hypothesis

Neuroforaminal decompression can better be performed by restoration of anterior height when compared with posterior decompression and stabilization.

Research Plan

Cadaveric study where the spine is removed to allow for multiple procedures and imaging. The first phase of the study would involve CT and CT myelogram on intact

spines. This would be the base line imaging studies measuring foraminal area, disc height and nerve root impingement (based on the myelogram). The discs would then be removed from the cervical spines and the vertebral bodies would be collapsed. CT and CT myelogram would once again be performed looking again at the same parameters. Half of the spines would then undergo anterior revision (restoration of disc height) and half would undergo posterior decompression and stabilization. CT and CT myelogram would once again be performed looking again at the same parameters.

Anticipated results

We anticipate that foraminal area and nerve root impingement will be more improved with anterior revision versus the posterior revision surgery.

Significance

The literature is controversial in the area of anterior versus posterior revision surgery when there is radicular symptoms or myelopathy. There are no studies that address this particular issue on an anatomic basis. Instead the literature has a few clinical studies comparing fusion rates.