POST-OPERATIVE CT ASSESSMENT OF INTERBODY FUSION TWO YEARS AFTER THORACOSCOPIC SCOLIOSIS SURGERY

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Introduction

The relationship between radiologic union and clinical outcomes in thoracoscopic scoliosis surgery is not clear, as apparent non-union of a spinal fusion does not always correspond to a poor clinical result. The aim of this study was to evaluate interbody fusion rates using low dose CT scans at minimum 24 months after thoracoscopic scoliosis surgery, and to explore the relationship between fusion scores and; (i) rod diameter, (ii) graft type, (iii) fusion level, (iv) implant failure, and (v) lateral position in the disc space.

Method

Between 2000 and 2006 a cohort of 44 patients had thoracoscopic instrumented scoliosis correction. Discectomies were performed at instrumented levels and the defect was packed with either autograft (n=14), or allograft (n=30). Instrumentation consisted of either 4.5mm (n=24) or 5.5mm (n=20) single titanium anterior rod and vertebral body screws (Medtronic). Fusion quality and implant integrity were evaluated at a minimum 24 months following surgery using a low-dose CT protocol. At each intervertebral disc space, left, right and mid-sagittal CT reconstructions were generated and graded (ImageJ software, NIH, USA) using the Sucato 4-point scale (Sucato, 2004) which is based on calculated percentage of fusion mass across the cleared and grafted intervertebral disc space.

Results

Fusion scores were measured for 259 disc spaces in 44 patients. Rod diameter had a strong effect on fusion score, with a mean score of 2.12±0.74 for the 4.5mm titanium (Ti) rod, decreasing to 1.41+0.55 for 5.5mm Ti rod, and to 1.09+0.36 for 5.5mm Ti-alloy rod. Mean fusion scores for autograft and allograft subgroups were 2.13±0.72 and 2.14±0.74 respectively. Fusion scores were highest in the middle levels of the implant construct, dropping off by 20-30% toward the upper and lower extremities. Fusion scores adjacent to the rod (2.19±0.72) were significantly higher than on the contralateral side of the disc space (1.24±0.85). Levels where rod fracture occurred (n=11) had lower fusion scores than those levels without fracture (1.09±0.67 vs 1.76±0.80). Levels where top screw pullout occurred (n=6) had lower CT fusion scores than those without (1.25±0.60 vs 1.83±0.76).

Discussion

This is the first detailed investigation of CT fusion scores after thoracoscopic scoliosis surgery. Rod diameter (larger), intervertebral level (proximal or distal), lateral position in disc space (further from rod) and rod fracture or top screw pullout all reduce fusion scores, while graft type (autograft or allograft) does not affect scores. However, the assumed link between higher fusion score and better clinical outcome must be treated with caution, because in this study rod fractures did not necessarily occur in patients with lower fusion scores. It is possible that with a stiffer 5.5mm rod, less bony fusion mass is required for a stable construct. We propose that moderate fusion scores on the Sucato scale secure successful clinical outcomes in thoracoscopic scoliosis surgery.

References: Sucato DJ, et al. Recombinant human bone morphogenic protein-2 enhances anterior spinal fusion in a thoracoscopically instrumented animal model. JBJS (Am) April 2004; 86-A (4): 752-62.