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Change in Lung Volume after Thoracoscopic Anterior Spinal Fusion Surgery for Adolescent Idiopathic Scoliosis: A 3-Dimensional Computed Tomography Study

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Introduction. This is a retrospective study of adolescent idiopathic scoliosis (AIS) patients treated with thoracoscopic anterior spinal fusion (TASF). Volumetric reconstructions from low dose CT scans were used to determine the change in lung volume after surgical correction.

Methods. A total of 23 female AIS patients with a low dose CT scan obtained before surgery and at two years after surgery were selected from an ethically approved, historical databank. Three-dimensional lung volume reconstruction was performed (*Amira*, FEI, Oregon). A segmentation method¹ was used to isolate lung tissue. Right and left lung volumes, total lung volume, and right-to-left lung volume ratio were obtained from pre- and post-operative CT scans. Hemithoracic symmetry, a distance measured from the apical rib head articulation to the inner border of thoracic cavity, was quantified from the CT dataset using methods described by Campbell et al². A ratio between length from the concave side and that from convex side is calculated to evaluate the extent of chest deformity. In a normal thorax, this ratio is approximately 1. Patient demographics and spinal deformity information, such as pre- and post-operative Cobb angle, rib hump, levels fused in surgery and patient height were used for analysis.

Results. Both left and total lung volume increased significantly two years after surgery (from mean values of 930.5ml and 2056.8ml preoperatively to 1020.9ml and 2228.5ml postoperatively, $P = 0.01, 0.03$, respectively). Right lung volume underwent a near-significant (from a mean 1126.3ml to 1207.6ml, $P = 0.06$) increase postoperatively. There was no significant change in right-to-left lung volume ratio ($P = 0.36$). Hemithoracic asymmetry was significantly improved (from a mean of 0.58 to 0.73, $P < 0.001$). Mean thoracic Cobb angle was significantly improved postoperatively (51.0° preoperative, 22.6° postoperative, $P < 0.001$) as was mean rib hump (14.7° preoperative, 7.4° postoperative, $P < 0.001$). Statistical regression found significantly positive correlation between lung volume changes, reduction in Cobb angle, increase in height, and improvement in hemithoracic symmetry ratio.

Conclusion. Deformity correction resulted in an improvement in the symmetry of the thoracic architecture in addition to postural balance and trunk appearance. Furthermore, change in lung volume was significantly correlated with changes in Cobb angle, hemithoracic asymmetry, and increased patient height, which are major consequences of corrective surgery.

References

1. Gollogly S, Smith JT, White SK, et al. The volume of lung parenchyma as a function of age: a review of 50 normal CT scans of the chest with three-dimensional volumetric reconstruction of the pulmonary system. *Spine* 2004, 29(18): 2061-6.
2. Campbell RM Jr, Smith MD, Mayes TC, et al. The characteristics of thoracic insufficiency syndrome associated with fused ribs and congenital scoliosis. *Journal of Bone & Joint Surgery Am* 2003, 85-A: 399-408.