Effects of lung volume reduction surgery for emphysema on diaphragm dimensions and configuration

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Part of the functional benefit provided by lung volume reduction surgery (LVRS) may be related to improvement in respiratory muscle function resulting from changes in diaphragm dimension and configuration. To study these changes, we obtained 3D reconstructions of the muscle using spiral computed tomography in 11 patients with severe emphysema before and 3 mo after surgery, and in 11 normal subjects matched for sex, age, height, and weight. Bilateral LVRS was performed by thoracoscopy in eight patients and by sternotomy in three patients. Acquisitions were made in the supine posture at relaxed FRC, midinspiratory capacity, and TLC. On average, LVRS produced a 51 +/- 11% increase in FEV(1) and a 30 +/- 4% decrease in FRC. The total surface area of the diaphragm (A(di)) and of the zone of apposition (A(ap)) at FRC increased by 17 +/- 4% and 43 +/- 8%, respectively, but the surface area of the dome did not change. Compared with the values recorded in the normal subjects, postoperative values of A(di) and A(ap) at FRC were reduced by 11% (p < 0.05) and 24% (p < 0.005), respectively. The curvature of the dome increased at TLC in the left sagittal plane, but was otherwise unaffected by the procedure. We conclude that LVRS substantially increases A(di) and A(ap), but does not significantly improve diaphragm configuration at FRC.