Stabilizing function of the diaphragm: dynamic MRI and synchronized spirometric assessment.

Abstract:
The aim was to describe diaphragmatic behavior during postural limb activities and examine the ventilatory and stabilizing functions of the diaphragm. Thirty healthy subjects were examined in the supine position using a dynamic MRI system assessed simultaneously with specialized spirometric readings. The diaphragmatic excursions (DEs) were measured at three diaphragmatic points in the sagittal plane; the diaphragm positions (DPs) as related to a reference horizontal baseline were determined. Measurements were taken during tidal breathing (TB) and isometric flexion of upper or lower extremities against external resistance together with TB. Mean DE in both upper and lower postural limb activities was greater compared with the TB condition (P < 0.05), with the effect greater for lower limb activities. Inspiratory DPs in the upper and lower extremity activities were lower compared with TB alone (P < 0.01). Expiratory DP was lower only for lower extremity activities (P < 0.01). DP was most affected at the apex of the crescent and crural (posterior) portion of the diaphragm. DEs correlated strongly with tidal volume (Vt) in all conditions. Changes in DEs relative to the initial value were minimal for upper and lower extremities but were related to lower values of Vt (P < 0.03). Significant involvement of the diaphragm in the limb postural activities was found. Resulting DEs and DPs differed from the TB conditions, especially in lower extremity activities. The differences between the percent changes of DEs vs. Vt found for lower extremity activities were confirmed by both ventilatory and postural
diaphragm recruitment in response to postural demands.

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