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Title: Costal diaphragm and parasternal intercostal function during CO2 stimulation

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Body: INTRODUCTION: Classically, with increasing CO2 there is a linear increase in minute ventilation (VI) and diaphragm electromyogram (EMG). Although all respiratory muscles would be expected to increase in parallel with VI, given diverse mechanical advantage of individual muscles, there is no a priori reason that all muscles would have equivalent recruitment. QUESTION: Are two primary muscles of inspiration, Costal Diaphragm (COS) and Parasternal Intercostal (PARA), recruited identically during CO2 stimulated ventilation? METHODS: Sonomicrometry transducers and EMG electrodes were implanted in the left COS and PARA. After recovery, the animals were studied awake, breathing through a mask. Airflow, ETCO2, muscle length and Mavg EMG were recorded during room air and CO2 rebreathing. Output included breath-by-breath breathing pattern, muscle shortening and EMG, averaged at 3 levels of ETCO2.

RESULTS: For N=7 (wgt 31.1 kg) studied 25 days after implant, VI and tidal volume increased significantly with CO2 stimulated breathing. Simultaneously, both SHORT and EMG of COS and PARA exhibited a linear increase. However, changes in action of the two muscles were significantly different, with greater SHORT and EMG of PARA compared to COS per mmHG CO2. SUMMARY: With CO2 stimulation, both shortening and EMG of parasternal increased in lock-step with ventilation. Relative action of costal diaphragm was less than parasternal at equivalent CO2.