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Title: Perpetual length of respiratory muscles during breathing

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Body: Introduction: Where is resting respiratory muscle length at Functional Residual Capacity (FRC) in comparison to the innate length of each muscle? It is unknown whether end expiratory/pre-inspiratory length of muscles at equilibrium i.e. length at FRC, is below, above or identical to inherent muscle length when ambient system tension is removed. Therefore we studied canines during nondepolarizing paralysis to determine the perpetual resting length of respiratory muscles. Methods: With approval by Animal Ethics Board, sonomicrometry and EMG were implanted in the costal (COS) and crural (CRU) diaphragm, transversus abdominis (TA), parasternal (PARA) and external intercostal (EXT). After recovery, the animals were studied awake, recording flow, CO₂, muscle length, and EMG per breath during room air, before and after flaccid paralysis. Results are shown before, during, and after paralysis.

Results: For N= 4 dogs (wt 29.8kg) studied after 50 days, all muscles lengthened significantly with onset of paralysis. During paralysis, lengthening was: COS 1.69%, CRU 1.5%, TA 3.30%, PARA 1.99% and EXT 1.68% respectively. All lengths reverted to the original shorter baseline with resolution of paralysis.

Summary: Perpetual resting length of respiratory muscles at equilibrium, is universally shorter than inherent muscle length without normal system tension. That is, each breath initiated from FRC begins from a “pre-shortened” muscle length compared to inherent muscle length.