Lacertus fibrosus contributes to synchronization of head and forelimb movement in the horse

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BACKGROUND Lacertus fibrosus (LFB) in the horse extends the influence of the biceps brachii muscle from the scapula to the metacarpus via attachments to the antebrachial fascia and the extensor carpi radialis tendon. It lacks direct connection to the head or neck, but LFB may influence head movement via the fascial connections of the shoulder girdle, thorax, and cervical vertebrae. In this way, LFB may contribute to movement synchronicity of the head and forelimb in the horse.

METHODS Seven late-term equine fetal cadavers were placed in right lateral recumbency on a wet stainless steel table with the head in a position approximating normal unrestrained posture. Each foal was photographed using a fixed overhead camera in 3 limb positions: (1) both forelimbs extended ventrally to mimic standing (reference position), (2) left forelimb fully protracted, and (3) left forelimb fully retracted. The left forelimb LFB was then completely severed and, without moving the foal or camera, photographs were repeated in the 3 limb positions. Image processing software was used to independently measure, in triplicate, the angle between the ventral aspects of the mandible and the neck (head angle). Differences in average head angles between the reference position and forelimb protraction or retraction were calculated and compared between intact and severed LFB using a paired student's t-test.

RESULTS In all 7 intact foals, forelimb retraction caused simultaneous head extension, while forelimb protraction caused simultaneous head flexion. Severing of LFB decreased head extension with forelimb retraction by >50% in 6/7 foals ($p<0.05$). Changes in head flexion with forelimb protraction after LFB was severed were inconsistent (0.18% to 29%) and not statistically significant.

CONCLUSIONS This study demonstrates a mechanical connection between forelimb and head that coordinates their movements independent of any innervation. This connection may thus contribute to economy of locomotion in the horse. Although passive, the role of LFB in the synchronization of head and forelimb movement appears to be important, particularly during forelimb retraction, accounting for at least 50% of the head extension measured during forelimb retraction in this study. The path(s) involved remain to be studied but likely involve extension of myofascial tensions from the shoulder girdle to the thorax and cervical vertebrae, resulting in extension of the head when the forelimb is retracted.