Synchronization of head and limb movements in the horse

Helen MS Davies, Carla M Lusi, and Sa'ad M Ismail
Faculty of Agricultural and Veterinary Science, The University of Melbourne, Parkville 3010, VIC, Australia. Tel: Int 61397312342. Email: h.davies@unimelb.edu.au

BACKGROUND Synchronized movement of the head and the limbs is a feature of equine locomotion, presumably mediated in part by the extensive myofascial connections of the equine musculoskeletal system. The equine fetus provides a practical model with which to explore the coordination of movements between body parts in the horse.

METHODS Fetal foal cadavers aged between 3 months' (first trimester) and 11 months' (near-term) gestation were placed in lateral recumbency on a wet stainless steel table. Using an overhead camera, videos were taken of the foals while individual limbs were retracted, protracted, flexed, and extended in locomotory patterns approximating those seen in live horses.

RESULTS Retraction of the forelimb and hindlimb and flexion of the hindlimb were each associated with simultaneous extension of the head; and protraction of the forelimb and hindlimb and extension of the hindlimb were each associated with simultaneous flexion of the head. While present in all fetuses examined, these related movements were more apparent and were relatively greater in the less developed (younger) fetuses.

CONCLUSIONS This study demonstrated mechanical connections between the forelimb and head and the hindlimb and head that coordinated their movements independent of any innervation. The equine forelimb lacks direct skeletal connection to the head, neck, or thorax, so forelimb movement probably influences head movement via the distribution of tension through the local fascial connections of the shoulder girdle. The equine hindlimb is directly connected to the trunk via a relatively large and immobile sacroiliac joint. Movements of the distal hindlimb are probably directed past the mobile coxofemoral joint into the lumbosacral fascia dorsally and laterally via the gluteal fascia and fascia latae, and into the abdominal fascia and linea alba medially and ventrally via the accessory ligament of the head of the femur and strong fascial connections of the pectineus muscle. Our finding that these coordinated movements were more apparent in the younger fetuses suggests that these connections (a) are a foundational component of locomotion in the horse, and (b) increase in complexity with development.