



Original Research

Congenital Malformations of the First Sternal Rib

Sharon May-Davis*



ARTICLE INFO

Article history:

Received 30 December 2015

Received in revised form 23 September 2016

Accepted 26 September 2016

Available online 27 October 2016

*Keywords:*1st sternal rib

Rudimentary rib

Bifid

Thoroughbred

Thoracic inlet

ABSTRACT

During the dissection and skeletal examination of 151 horses, a congenital malformation (CM) of the first sternal rib that influenced the aperture of the Thoracic inlet was noted in six horses. The presentation of this CM was variable between horses in gross anatomic appearance; notably, an absent first sternal rib, bifid tuberculum costae, bifid sternochondral articulation onto the sternum, flared shaft, normal first sternal rib inserting onto the cranial branch of a bifid sternochondral articulating second sternal rib, straight costal shaft, and an articulating rudimentary tuberculum costae with a ligamentous extension replacing the bony shaft and attaching to a rudimentary sternochondral articulation onto the sternum. Of the 151 horses examined, the CM of the first sternal rib was restricted to 6/60 Thoroughbred horses, and only in those that were affected by either the unilateral or bilateral transposition of the caudal ventral tubercle from C6 onto the ventral surface of C7. The normal anatomic presentation of the thoracic inlet was altered, along with associative musculature including neurological pathways. These CMs are likely to produce clinical and functional ramifications of the thoracic inlet, thoracic limb, and thoracic viscera, with the probability of altering postural and locomotive function as noted in four horses demonstrating the CM.

© 2016 Elsevier Inc. All rights reserved.

1. Introduction

In the horse, there are supposedly eight paired sternal ribs that are often referred to as “true” ribs, this is due to their distal attachment onto the sternum via a costal cartilage [1,2]. A typical sternal rib articulates proximally with two thoracic vertebrae; however, this does not apply to the first sternal rib, it articulates cranially with the seventh cervical vertebra (C7) and caudally with the first thoracic vertebra (T1) [2]. In comparative anatomic terms, the first sternal rib is the shortest, it displays less convexity in the shaft, it has a smooth impression on the cranial border where the axillary vessels pass, its ventral extremity is the largest, and the first sternal rib is the only rib that displays a cranial deviation in its distal extremity (Fig. 1) [2,3]. Functionally, the sternal ribs are designed to protect the heart and lungs, although the first sternal rib is cranial to the heart, and therefore, its protective role relates to the

lungs [1,3]. In addition, it provides rigidity and form; anchor points for muscles such as the scalenes and along with its articulation to the corresponding costal cartilage, limited movement during respiration [1–4].

The articulation of the first sternal rib to C7/T1 and to the manubrium of the sternum via the costal cartilage creates the cranial aperture to the thorax known as the thoracic inlet (Fig. 2). This aperture is ovoid in outline and is occupied by the Longus colli muscle, trachea, esophagus, nerves such as the Phrenic, large blood vessels, for example, carotid artery and jugular vein, lymphatic vessels, lymph nodes, and in the young horse, the thymus [1–3]. Furthermore, Bradley [3] notes that the pleural sac indirectly ends blindly on the left first sternal rib and on the right can extend beyond the first sternal rib and come into contact with the scalene muscles. The role of the thoracic inlet is not clearly defined in current literature; however, its shape helps guide important structures to and from their respective organs, provides a cranial restriction that aids in retaining organs within the thoracic cavity and due to the size and shape of the first sternal rib, it provides a

* Corresponding author at: Sharon May-Davis.

E-mail address: maydavis@bigpond.com.

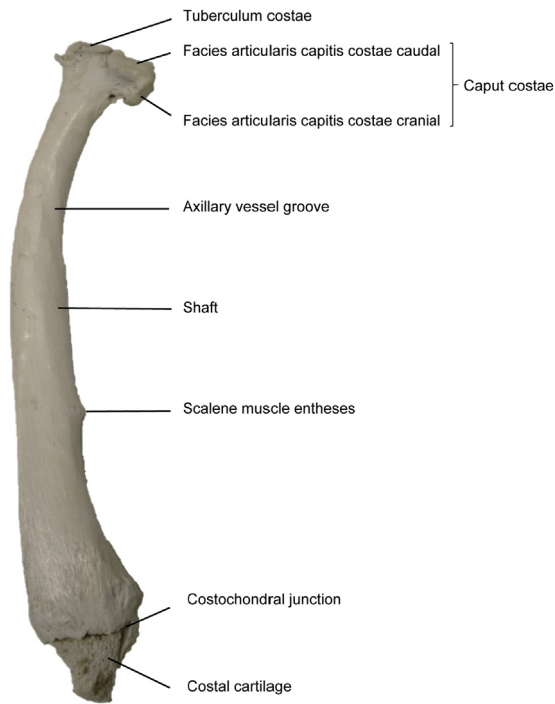


Fig. 1. The lateral view of a normal right first sternal rib in the horse.

protective barrier for those structures. In addition, the thoracic inlet is likely to contribute in respiration by means of providing a resistance against the compressive visceral forces applied to it during expiration, especially in the galloping horse [5].

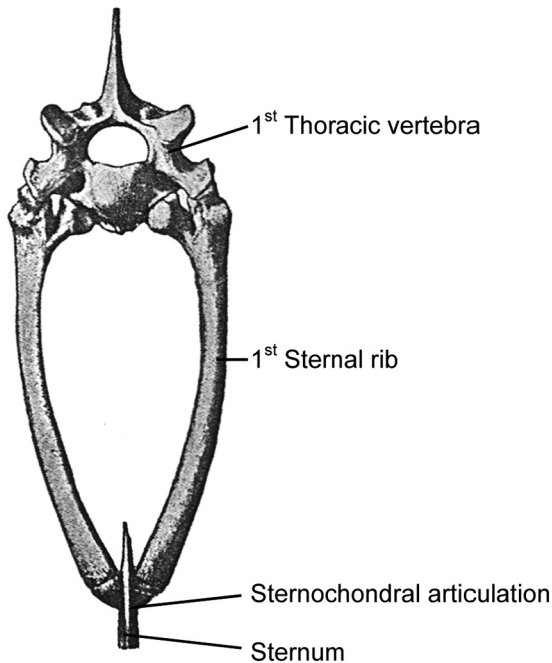


Fig. 2. The cranial view of the Thoracic inlet in the horse (Sisson and Gossman 1975).

Subsequently, the first sternal rib plays an important role in the cranial thorax, and CMs have not been clearly defined in equine anatomy and to date, their existence rarely reported or understood. Even when Bradley [6] reported a case where an aged mare exhibited a bilateral rudimentary first sternal rib with a ligamentous shaft in 1901 (Fig. 3), has there been any significant research found by the current author. However, this cannot be said for other species whereby numerous CMs of the first sternal rib have been reported in dogs and humans since the 1800s [6–8] and in Holstein calves since 1999 [9–11]. Moreover, associative symptoms reported in humans included neurological impingement, visceral displacement, and the relocation of musculature, such as the scalenes [6–8]. In addition, severe CMs of the first sternal rib reported in Holstein calves simultaneously displayed complex vertebral malformation (CVM) that was inclusive of severe CMs of the cervicothoracic junction [9]. In the affected calves, there were multiple axial skeletal CMs including proximal fusion of the first sternal rib to the second sternal rib and nonparallel intercostal spacing [9,10]. CVM is a congenital condition resulting in multiple malformations of the caudal cervical and anterior thoracic vertebrae including the first sternal rib [10]. It predominantly involves the cervicothoracic junction (C5–T2) but can also affect the lumbar vertebrae and appendicular skeleton; furthermore, these malformations have been linked to a lethal recessive gene [9–11].

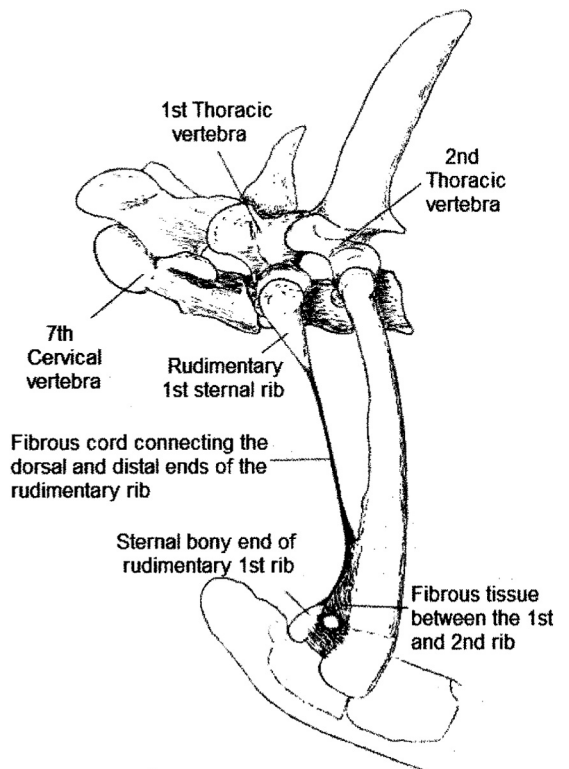


Fig. 3. The lateral view of a right rudimentary first sternal rib with fibrous cord in the horse (Bradley 1901).

Download English Version:

<https://daneshyari.com/en/article/5535699>

Download Persian Version:

<https://daneshyari.com/article/5535699>

[Daneshyari.com](https://daneshyari.com)