Journal of Equine Veterinary Science 34 (2014) 1313–1317

Contents lists available at ScienceDirect

Journal of Equine Veterinary Science

journal homepage: www.j-evs.com

Original Research

The Occurrence of a Congenital Malformation in the Sixth and Seventh Cervical Vertebrae Predominantly Observed in Thoroughbred Horses

Sharon May-Davis BAppSc (Equine), MAppSc *

45 Hall Street, Cessnock, New South Wales 2325, Australia

ARTICLE INFO

Article history:
Received 17 July 2014
Received in revised form 13 September 2014
Accepted 19 September 2014
Available online 28 September 2014

Keywords:
Congenital malformation
Caudal ventral tubercle (CVT)
Sixth cervical vertebra (C6)
Seventh cervical vertebra (C7)
Thoroughbred
Cervicothoracic junction

ABSTRACT

During the dissection and skeletal examination of 123 horses, it was observed that a significant number had a gross skeletal congenital malformation of the sixth and seventh cervical vertebrae. In the sixth cervical vertebra (C6), either a unilateral or bilateral absence of the caudal ventral tubercle (CVT) was noted. In the presence of the C6 malformation, the seventh cervical vertebra (C7) presented either as normal or with a unilateral or bilateral transposition of the CVT from C6 onto the ventral surface of C7 with an arterial foramen. This transposition onto C7 was noted to be present on the corresponding side as the absent CVT on C6. Of the 123 horses examined, the congenital malformation of C6 was noted in 19 of 50 Thoroughbred horses; three of three Thoroughbred derivative horses; one of 15 nondescript bred horses; and none of 55 purpose bred horses of mixed breeds. In total, 23 horses expressed a C6 congenital malformation of which 22 were Thoroughbreds or Thoroughbred derivatives. Of these 22 Thoroughbred and Thoroughbred derivative horses, 11 of 22 expressed either a unilateral or bilateral transposition of the CVT from C6 onto the ventral surface of C7 with an arterial foramen on the corresponding side. This malformation could have functional and clinical ramifications in the postural and locomotive properties of the equine neck and cervicothoracic junction as reported in other species.

1. Introduction

The function of the equine neck in postural and locomotive presentations has been well researched and documented [1–3]. However, these presentations are reliant on normal symmetry within the cervical musculoskeletal system so that function may follow form without being compromised [4–6]. In principle, the equine form is a skeletal framework with specialized anchor points designed for soft tissue attachments that are primarily governed by muscles. Furthermore, these muscles are specifically attached to the skeletal framework to act in agonistic and antagonistic arrangements, so to articulate the skeleton and thus provide function, whether it is postural or locomotive [2].

With this in mind, each bone in the equine neck is purposely designed to provide a specific function, and the caudal cervical vertebrae (CCV) with specialized characteristics form a pronounced concave curve that is in the opposite direction to the cranial cervical vertebrae [7]. This curvature lies within the cervicothoracic junction (C5–T2), and C6, C7, and T1 have shortened vertebral bodies that aid in the directional transition, with C7 being at the most ventral point [3,7]. This requires significant stabilization by the perivertebral muscle longus colli that has three layers: superficial, medial, and deep [8]. All three layers use the caudal ventral tubercle (CVT) on C6 as a point of attachment and, in particular, the superficial thoracic part that inserts with a strong tendon on the CVT of C6 and then travels in a fusiform bellied muscle ventral to C7, originating from the vertebral bodies of T1–T6 [7,8].

* Corresponding author at: Sharon May-Davis, 45 Hall St, Cessnock, New South Wales 2325, Australia.
E-mail address: maydavis@bigpond.com.

0737-0806/$ – see front matter © 2014 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jevs.2014.09.012

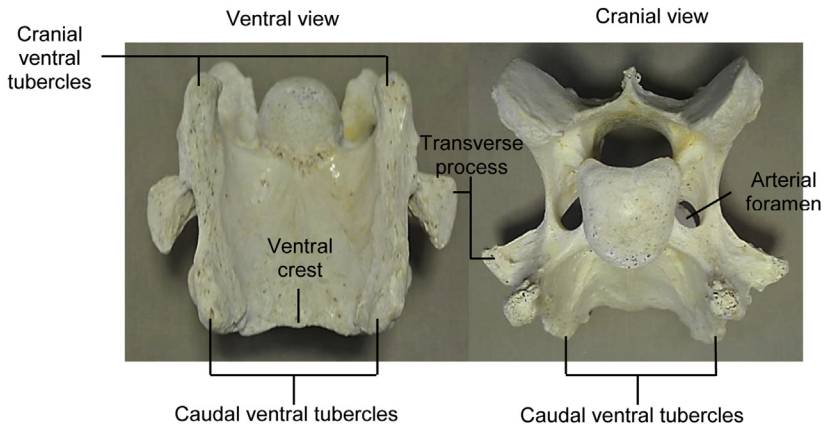

Fig. 1. The ventral and cranial view of a normal C6 in a 19-year-old Australian Stock Horse.

The potential deviation of the attachment of the thoracic part of longus colli because of the absence of the CVT on C6 implies dysfunction and therefore instability in the cervicothoracic junction. Yovich et al [9] reported that any deviation of alignment in the cervicothoracic junction can lead to malarticulation and possible cervical static stenosis (CSS). However, research of the equine CCV has focused largely on arthropathy of the caudal articular processes and measurements of the vertebral canal [10,11]. This is primarily because of the belief that congenital malformations in cervical vertebrae are rare [7,10–13]. Although the absence of the CVT in C6 [7,11] and transposition of the CVT onto the ventral surface of C7 have already been noted in Thoroughbreds [12], the prevalence within the breed has not been reported.

Therefore, the purpose of this study was to investigate the prevalence of congenital malformation in C6 and C7 with particular reference to the absence of the CVT on C6 and its transposition onto the ventral surface of C7 in conjunction with an arterial foramen in Thoroughbreds and other breeds.

2. Materials and Methods

According to Sisson and Grossman [7], C6 is an atypical cervical vertebra that displays a transverse process with three branches; the third branch is known as the CVT [14] as shown in Fig. 1.

In C7, the transverse process has only one branch and no ventral tubercles or arterial foramen [7] as shown in Fig. 2.

Postmortem examinations were collected from 123 horses that either died from natural causes or were euthanized for purposes unrelated to this study. The horses were sourced from Australia, England, North America, and Japan; they were of mixed gender and aged between 0 (stillborn) and 30 years. They were placed in four categories according to breed: Thoroughbreds, Thoroughbred derivatives, purpose bred, and nondescript breeding. Observations of the gross skeletal architecture of C6 and C7 were further divided into normal anatomy; unilateral (left or right) absence of the CVT in C6 (Fig. 3); bilateral absence of the CVT in C6; unilateral (left or right) transposition of the CVT onto the ventral surface of C7 (Fig. 4); bilateral

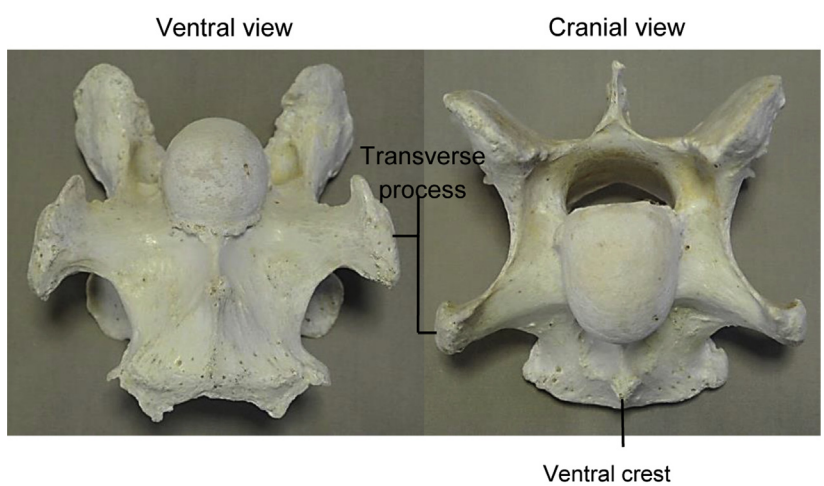

Fig. 2. The ventral and cranial view of a normal C7 in a 19-year-old Australian Stock Horse.