Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Biomedicine

journal homepage:www.elsevier.com/locate/apjtb

Document heading doi:10.1016/S2221-1691(11)60196-2

Congenital sternal foramen in a stillborn Holstein calf

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ARTICLE INFO

Article history:
Received 16 May 2011
Received in revised form 2 June 2011
Accepted 18 June 2011
Available online 28 January 2012

Keywords:
Sternal foramen
Congenital anomalies
Calf
Congenital
Sternum
Human

ABSTRACT

Congenital sternal foramen is an anomaly whose occurrence is rare in human but is especially unusual in animals. This defect was formed when fusion of multiple ossification centers was incomplete. It may be associated with other lesions in body organs especially cardiac anomalies. In the present study, we report a very rare case of congenital sternal foramen in a Holstein calf. The oval defect was like a gunshot wound and located at the lower third of the sternum. Apparently, the rest of skeleton system seems normal. The awareness of the anomaly is important for better diagnosis and treatment of diseases.

1. Introduction

The sternum is a bone with flat shape that is composed of three parts including the manubrium, body and xyphoid cartilage. It is located in the middle of the thorax, between two set of ribs. The sternum body ends at the slender xiphoid process. The broad, triangular manubrium articulates with clavicles and the cartilages of the first pair of ribs[1,2].

Embryologically, the sternum develops from a pair of longitudinal mesenchymal condensations named sternal bars that form in the ventrolateral body wall. The sternal bars fusion starts along the midline. Fusion of the sternal bars will be finished with the formation of the xiphoid. Ossification of the sternal bars is endochondral type. It begins from the cranial to caudal part, producing the definitive bones of the sternum[3]. In calf, the first focal ossification starts from the seventh sternal segment in 75 days old fetus[4]. Any failure in developmental process results in various sternal anomalies such as fissure or foramen[5-7].

2. Case report

The present case of sternal foramen was discovered in a stillborn Holstein calf that was born dead. It was present at the lower third of the sternal body and thoracic viscera were exposed. The oval foramen was easily recognizable. The hairs around the foramen were contaminated with bloody secretions. The size of sternal foramen was 5-6 cm (Figure 1). The calf was born in a dairy farm and we did not hadve the opportunity to examine all the bones of the chest or cardiac anomalies but the other skeletal compounds were apparently normal.

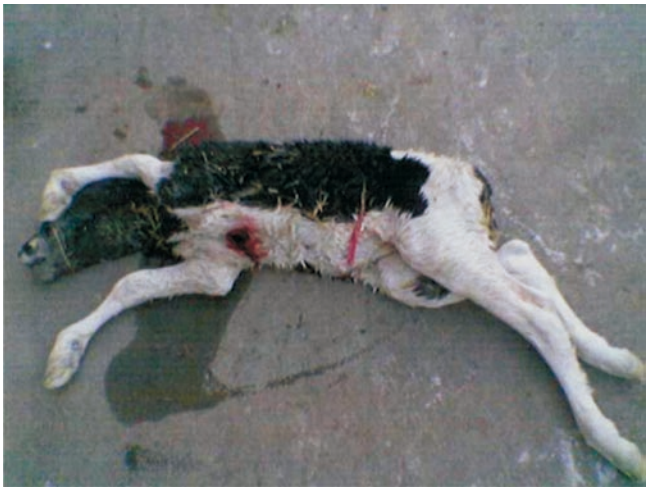

Figure 1. Sternal foramen at the lower third of the sternal body of a stillborn Holstein calf whose thoracic cavity was exposed.

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3. Discussion

Congenital disorders are caused by various factors such as genetic defects, infective agents of the fetus and ingestion of toxic plants by the dam at certain stages of gestation[8,9]. The sternum is one of the skeleton parts with different variations and anomalies in appearances. In human, these malformations and anomalies are frequently detected accidentally by radiology[10,11], multiplanar and 3D reconstructed CT images[12], and MRI[13]. Reported developmental anomalies of sternum included branched xiphoid process, V-shaped bifurcation, sternum bifidum, synchondrosis sternii (incomplete ossification of the sternum), anomalies in the shape of the sternum (wedge-shaped or asymmetrical bone), sternum gallinaceum and sternal foramen. Some of them such as sternum fenestratum and alterations of the xiphoid process do not influence the physiological function of the chest but those change the shape and diameter of the chest which may cause problems in breathing and heart function[14]. Sternal anomalies are not common in human and are very rare in animals. Sternal foramen is usually asymptomatic and could be detected by CT incidentally[15]. If during development of sternum, incomplete fusion of multiple ossification centers occurs, it results in a round defect at the sternum that named sternal foramen. This study described the presence of a single foramen which affected the sternum of the Holstein calf. The defect was observed at the lower third site of the sternum. Unfortunately, because of field conditions, we could not necropsy the calf and check the internal organs but no other abnormalities were observed in body shape. In animals, this anomaly is extremely rare and previous reported cases had accompanied with different anomalies in other organs. Hiraga and Abe reported different anomalies including shortening of the length, widening of the manubrium, hypoplasia of the xyphoid cartilage, the paired appearance of sternebrae in the sternum of Holestein-Friesian calves affected with cervical ectopia cordis by X-ray[16]. Cooper *et al* found sternal foramina in 6.7% of a large contemporary autopsy population that were usually solitary and located in the body of the sternum. They also detected a foramen in the manubrium[5]. Similar results were found by Moore *et al*. They detected 135 (6.6%) sternal foramina on plastron radiographs from 2 016 radiographs in an autopsy population[7]. Yekeler *et al* evaluated the frequency of sternal variations and anomalies in 1 000 patients examined by MDCT. In their investigation, all sternal foramens 45 (4.5%) were found in the inferior part of the sternal body with size between 2 to 16 mm (mean, 6.5 mm). In one case, sternal cleft was also observed adjacent to the foramen. They stated the sternal foramen is a frequent minor anomaly and generally associated with sternal sclerotic bands[12].

Awareness of a sternal foramen is important because the sternal marrow aspiration can cause heart damage[6]. Fatal cardiac tamponade resulting from a congenital sternal foramen located in the inferior part of the sternum[17,18] and low thickness of sternal body[19] was seen during the sternal puncture. Therefore, having knowledge about the presence of sternal variations and anomalies is useful to prevent these fatal complications during bone marrow aspiration. It is important that practitioners should be aware of congenital abnormalities for better diagnosis and treatment of diseases.

Conflict of interest statement

We declare that we have no conflict of interest.

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