Post Mortem Study Of Congenital Anomalies Of The Sternum Bone

Dr.Dipak H.Vora*, Dr.Jainik P. Shah, , Dr.H.M.Mangal***,Dr.H.T.Khubchandani **** ,**
Dr. K. N. Pipaliya***, Dr. V. J. Aghera*****, Dr. D. M. Dabhi*****
*Tutor, M.D, **Asst.Prof. P.D.U.Medical college, Rajkot, *** Prof.&Head, Forensic Medicine Dept., P.D.U.M.C., Rajkot, **** Asst.Prof., B.J.Medical college, Ahmedabad, ***** Resident Doctor, P.D.U.Medical college, Rajkot

Abstracts: **Introduction:** The sternum is one of the skeleton parts with frequent variation in appearances on images or autopsy series. **Method:**Present study was carried out during the year 2010 and 2011 at Department of Forensic Medicine, P. D. U. Government Medical College, Rajkot. The study was carried out to find out congenital anomalies of sternum bone recovered from the cadavers during post mortem examination. **Result:** Total 114 sternum bones were studied out of which 24 were having congenital anomalies either in the body of sternum or in xiphoid process. No any abnormality is found in manubrium. Sternal foramen is found in 10 cases and it is the most common form of congenital anomaly of sternum. Other anomalies are xiphoid foramen in 7 cases, fissured 4th segment in 5 cases and bifid xiphoid is found in 2 cases. Misinterpretation of autopsy findings has been a major concern to forensic pathologists. This article documents the occurrence of relatively rare congenital anomalies which may be misleading and may result in serious erroneous conclusions, particularly when evaluating skeletonised human remains. **Conclusion:** Presence of these anomalies and their antemortem records in the form of previous x rays make important data for the identification of skeletonised remains. [Vora D NJIRM 2014; 5(1) : 37-39]

Key Words: Sternum Bone, Sternal Foramen, Post-Mortem Examination, Congenital Anomaly.

Author for correspondence: Dr.D.H.Vora, Tutor, M.D.,B.J.Medical college, Ahmedabad,Gujarat,India Email:mahavirreturns@gmail.com

Introduction: A Human skeletons have many variations that may occasionally necessitate distinction from pathologic changes. The sternum is one of the skeleton parts with frequent variation in appearances on images or autopsy series. In living subjects, sternal variations are frequently detected incidentally on cross-sectional images. Knowledge of radiologic appearances of sternal variations and anomalies is useful so as to not confuse those with pathologic conditions. Awareness of a sternal foramen is important in acupuncture practice and sternal marrow aspiration because of the danger of heart damage.[1] The largest series evaluating sternal variations and anomalies were based on macroscopic[2] and radiographic[3] appearances of the sternum in autopsy populations. The frequencies of sternal anomalies in living subjects have been described based on their radiograph[4,5]. Various kinds of sternal variations and anomalies, such as suprasternal bones and tubercles, manubriosternal and sternoxiphoidal fusions, sternal clefts and foramina, and sternal sclerotic bands were documented in the literature. In the fetus the sternum originally consists of two cartilaginous bars, one on either side of the midline, which become connected to the cartilages of the upper nine ribs on each side. During the eighth week of gestation these bars migrate, converge toward the midline, and fuse with each other, beginning cephalically. By the ninth week the union of the plates is established in the midline and fusion is almost completed to form the manubrium and body of the sternum. The xyphoid process is formed by a caudal extension of the sternal plate.

The ossification of the sternum begins from six centers: one in the manubrium, four in the body, and one in the xyphoid process. These ossification centers appear between the articular depressions for the costal cartilages and divide the sternal plate into six transverse pieces. Ossification center appears in the manubrium at 5th month of intrauterine life and in the four segments of the body of sternum above downwards at 5th, 7th , 7th , and 10th months of intrauterine life. In the xiphoid process ossification centre appears at 3 years of age.[6]

Incomplete fusion of the sternal bars in this area accompanied by eccentric centers of ossification accounts for the relatively rare occurrence of a perforate sternum (sternal foramen), or of a vertical fissure which intersects this part of the bone and which is referred to as fissura sterni. Ossification of the sixth part in the xiphoid process; does not begin until the 5th to 18th year of life and

partial cartilaginization may persist well into adult life. Thus, malformations of the xyphoid process due to abnormal fusion and irregular ossification are much more common. Abnormalities of the manubrium and upper portion of the body of the sternum where fusion and ossification occur early in fetal development are much more rare.[7] The position of these defects, in the center of the lower portion of the body of the sterum between the articular surfaces of the costal cartilages, and their characteristic gross appearance are consistent with sternal foramina.

Developmental defects of the sternum are usually not readily detected in vivo or in the intact body during postmortem examination, unless they are associated with severe malformations of the rib cage. Perforations or fissures are obscured on routine chest X-rays by the radio-dense structures of the mediastinum and by the superimposed thoracic vertebral column.

Abnormalities can be demonstrated at autopsy by holding the removed breastplate between the prosector and a strong light source. If a defect is detected by transillumination, it can be documented by further dissection and by X-raying the breastplate alone.

The differentiation between traumatic and congenital defects of the sternum does not present a difficult problem in bodies that are not decomposed. Associated abnormalities, either old or recent, in the surrounding soft tissues and adjacent structures and organs will indicate a lesion caused by injury.

Finally, a close examination of even severely macerated specimens should confirm the presence of a sternal foramen. The defect will be located in the midline through the lower half of the body of the sternum. The measurements of the defect will be the same on both the outer and inner surfaces of the bone. No beveling will be present on either surface. Careful examination of the edges with a hand lens will reveal it to be smooth and covered by cortical bone.

In specimens which have been exposed to insects, fauna, or marine animals, characteristic erosion, teeth, or claw marks may be present around the foramen, but these should not be mistaken for recent antemortem, traumatic injury.

Material and Methods: Present study was carried out during the year 2010 and 2011 at Department of Forensic Medicine, P. D. U. Government Medical College, Rajkot. The study was carried out to find out congenital anomalies of sternum bone recovered from the cadavers during post mortem examination. Total 114 sternum bones were studied both grossly and by doing x ray examination. Necessary consent was taken from next to kin and investigating officer in each case. After removal from the cadavers the sternal bones were subjected to x ray examination. Then maceration of sternum was done for gross examination.

Observations:

Table-1: Sex wise distribution of cases

Male	**84**
Female	**30**
Total	**114**

From the above table it is evident that in medico-legal autopsies male cases are more in number than female cases.

Table-2:- Age and Sex wise distribution of cases

Age group	Male	Female
11-15	02	02
16-20	06	05
21-25	25	10
26-30	08	04
31-35	09	03
36-40	11	04
41-45	09	-
46-50	06	-
51-55	02	01
56-60	01	-
61-65	03	-
66-70	-	-
71-75	01	-
76-80	01	01
Total	**84**	**30**

From the above table it is evident that most of the cases are belong to the age group 20 to 40 years. In this age group person is more active and at the same time more prone to death of medico-legal importance.

Table-3:- Distribution of cases according to anomaly in body of the sternum

Developmental Defect in body of sternum bone		MALE (Total)	FEMALE (Total)
Strernal foramen	In 2nd segment	0	1(0.95%)
	In 3rd segment	7(6.7%)	0
	Between 3rd & 4th segment	2(1.9%)	0
Bifid 4th segment (Fissured segment)		4(3.9%)	1(0.95%)
Total		13(12.5%)	2(1.9%)

Table-4:- Distribution of cases according to anomaly in xiphoid process.

Developmental Defect in xiphoid process	MALE (Total)	FEMALE (Total)
Foramen in xiphoid	7(6.8%)	0
Bifid xiphoid	2(1.9%)	0
Total	9(8.7%)	0

DISCUSSION: It is evident from this study that the most common form of congenital anomaly of sternum bone is a sternal foramen. Incidence of the sternal foramen in this study is about 10%. 9 cases were of male and 1 was a female. In 7 cases sternal foramen was found in the 3rd segment of the body while in 2 cases it was at junction between 3rd and 4th segments and in 1 case it was in the 2nd segment.

So it is clear that location of the sternal foramen is mostly in the lower half of the body of the sternum bone, mainly in the 3rd segment. These findings are consistence with the findings of the other authors studied the congenital anomalies of the sternum bone.

4th segment of the sternum was fond fissured (due to the lapsed union) in 4 male subjects and 1 female subject. As some times 3rd and 4th segments of the body of sternum are developed from two lateral ossification centers, midline fissure is found due to lapsed union in these segments.

In total 9 cases xiphoid process was found abnormal. All 9 cases were of male. Out of these 7 cases were showing foramen in the xiphoid process while 2 cases were showing bifid xiphoid process. No female was having any anomaly of the xiphoid process.So it is quite clear from the present study that congenital anomalies of the sternum bone is more common in males than females. Sternal foramen remains the commonest congenital anomaly of the sternum bone followed by foramen in the xiphoid process.

Conclusions:-The sternal foramen is a relatively rare congenital anomaly but when encountered by the pathologist in a case that has medicolegal implications, the failure to recognize it as a developmental abnormality can be a serious pitfall and hazard. The misinterpretation of this bony defect by the nature of its location can result in ascribing a wrong cause and manner of death. It can also cause unnecessary expenditure of time and effort in the investigation of a suspected homicide or suicide. Congenital anomaly in the sternum bone can also be used to identify the skeletonised remains if antemortem records in the form of x rays are available for the comparision.

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