

# Age of Fusion of Body of Sternum with Manubrium Sterni in both the Genders: A Comparison

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## Abstract

**Objectives:** This article documents comparison of age of fusion of body of sternum with manubrium sterni in both the genders. Determination of age from human skeletal remains an integral part of forensic and medico-legal investigation. The study of changes in skeleton with respect to age, serves as a reliable and time-honored method in medico-legal work.

**Methods:** Sterna will be removed from the cadavers by sectioning the costal cartilages just besides the costo-chondral junction. The sterna thus collected will be marked, numbered, and then put in a water bath containing solution of sodium hypo-chloride for a week for maceration. The elements of each sternum-manubrium, body and xiphoid process will be examined for their fusion. The manubrio-sternal and the xiphisternal articulations will be carefully examined for degree of fusion: complete, partial, non-fusion.

**Results:** Out of total hundred sternum studied, seventy were males and thirty were females. Mean age of fusion of manubrium sterni with mesosternum in males is 61.20 years and in female is 61.47 years.

**Conclusion:** Majority of sternum samples retrieved from dead bodies of individuals brought for postmortem belonged to 51-60 years' age group in males and 30-40 years' age group in females. Males (70%) outnumbered the females (30%) in this study. Fusion of xiphisternum starts earlier as compared to fusion of manubrium sterni with mesosternum. Fusion of manubrium sterni with mesosternum starts at 51 years and completely fuses at >60 years.

**Keywords:** Xiphisternum • Sternum • Xiphoid process • Mesosternum • Complete fusion

## Introduction

The estimation of age is an integral part of the biological profile employed by forensic anthropologists in order to assist in achieving an identification of an unknown deceased individual. The biological profile consists of sex, age, ancestry, and stature estimations, which can be compared to missing persons reports [1].

Aging in the forensic context is necessary both for the dead and the living. For the dead it is principally to aid identification in creating a biological profile which can then be compared to missing persons. For the living the aim is to solve judicial or civil problems concerning age of minors as regards questions of adoption, imputability, pedopornography and for adults, civil issues on pensionable age and other similar matters for individuals lacking valid identification documents. It should always be borne in mind that, whatever the case is, all a forensic anthropologist or odontologist can do is give the best estimate of biological age regardless of how far it may be from actual chronological age, provided these limits are made clear to judicial authorities [2]. Human identification in postmortem scenarios is fundamental and achieving it is one of the most challenging task [3].

In medicolegal practice, most of the time forensic medicine specialists

have to mainly depend upon the bones for establishing the identity. They are often required to determine sex, age and stature of a person from dismembered body parts and bones [4].

The determination of age at death particularly is an important part of physical and forensic anthropology. The exact chronological age of individual at death has assumed importance recently due to dynamic approach now introduced into anthropometric analyses [5]. Over the course of the past decades several age estimation methods were established to serve the needs of practitioners using known age and sex databases or during medicolegal autopsies [6]. These age estimation methods include secondary sexual characteristics, macroscopic examination of dental development and eruption, epiphyseal union of long bones, degeneration of pelvic articular surfaces, sternal rib ends, and cranial sutures, as well as microscopic examination of bone in histological analysis [7].

## Case Presentaion

The present study was carried using sternal bones removed during autopsy on a total of 100 cases above the age of 30 years at the Department of Forensic Medicine, Lady Hardinge Medical College, New Delhi. After removal of tissue and maceration, the sternum was examined for degree of fusion.

## Results

### Comparison between age and grades of fusion of mesosternum with manubrium sterni in males

Out of total 70 male sternum samples, non-fusion (Grade 0) between mesosternum and manubrium sterni is seen in 42 (60%) cases with mean value of 43.26 and standard deviation of 6.332 with a standard error of  $\pm 0.977$ . Partial fusion (Grade 1) is seen in 10 (14.2%) samples with a mean value of 51.90, standard deviation of 1.287 and standard error of  $\pm 0.407$ . Complete fusion (Grade 2) is seen in 18 (25.7%) sternum samples with a

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**Table 1.** Comparison between age and grades of fusion of mesosternum with manubrium sterni in male.

Grade	Number	Mean	SD	SEE	p-value
Non-fusion (Grade 0)	42	43.26	6.332	0.977	0.0001
Partial fusion (Grade 1)	10	51.9	1.287	0.407	
Complete fusion (Grade 2)	18	60.11	4.664	1.099	
<b>Total</b>	70	61.2	11.705	1.399	

**Table 2.** Comparison between age and grades of fusion of mesosternum with manubrium sterni in females.

Grade	Number	Mean	SD	SEE	p-value
Non-fusion (Grade 0)	16	38.81	7.867	1.967	0.0001
Partial fusion (Grade 1)	11	60.73	8.661	2.611	
Complete fusion (Grade 2)	3	51.67	0.577	0.333	
<b>Total</b>	30	61.47	16.158	2.95	

**Table 3.** Fusion of mesosternum with manubrium sterni in both males and females.

Age Group (Years)	State of Fusion	Sobhan K. Das	Gaur VB (2011)	Present Study (2018)
41-50	Complete	69.44%	28.59%	0
	Partial	Nil	-	0
	Separate	Nil	71.40%	22
51-60	Complete	79.41%	-	0
	Partial	Nil	-	13
	Separate	Nil	-	14
>60	Complete	86.38%	-	29
	Partial	Nil	-	0
	Separate	Nil	-	0

mean value of 60.11, standard deviation of 4.664 and standard error of  $\pm 1.099$ , On comparison between age and grades of fusion of mesosternum with manubrium sterni in male, the mean value of total males is 61.20, standard deviation is 11.705 and standard error is  $\pm 1.399$  with p value 0.0001 (Table 1).

### Comparison between age and grades of fusion of mesosternum with manubrium sterni in females

Out of total 30 female sternum samples non-fusion (Grade 0) between mesosternum and manubrium sterni is seen in 16 (53.3%) cases with mean value of it is 38.81 and standard deviation 7.867 with a standard error of  $\pm 1.967$ . Partial fusion (Grade 1) is seen in 11 (36.6%) cases with a mean value of 60.13, standard deviation of 8.661 and standard error of  $\pm 2.611$ . The mean value on comparison of age and grades of fusion of mesosternum with manubrium sterni in total females is 61.47, standard deviation is 16.158 and standard error is  $\pm 2.950$  with p value 0.0001 (Table 2).

### Comparison of fusion status of mesosternum with manubrium sterni in male and female

In the present study, in males, mean age of onset of fusion of mesosternum with manubrium sterni is  $53.50 \pm 1.500$  and complete fusion occurred in  $67.11 \text{ years} \pm 0.0001$ . In females, mean age of onset of fusion is  $55.00 \text{ years} \pm 0.0001$  and complete fusion occurs with mean value of  $68.00 \text{ years} \pm 0.0001$ . There is statistically insignificant difference in the mean age of onset and fusion of mesosternum with manubrium sterni between males and females (Table 3).

## Discussion

The present study is in agreement with study by Wadhawan, et al., who reported negligible difference in age of onset and complete fusion of mesosternum with body of sternum that is onset of fusion in males was  $35.1250 \pm 0.6409$  years and for complete fusion was  $58 \pm 12.4811$  years. In females, mean age for onset of fusion was  $35.8333 \pm 1.4720$  years and for complete fusion was a  $53.10 \pm 7.2758$  year. There was negligible difference in age of onset of fusion in males.

However, Chandrakanth HV 2012 reported differences in ages of fusion of manubrio-mesosternal joint being proportionately commoner in males than females [8].

## Conclusion

Majority of sternum samples retrieved from dead bodies of individuals brought for postmortem belonged to 51-60 years' age group in males and 30-40 years' age group in females.

Males (70%) outnumbered the females (30%) in this study. Fusion of xiphisternum starts earlier as compared to fusion of manubrium sterni with mesosternum. Fusion of manubrium sterni with mesosternum starts at 51 years and completely fuses at >60 years.

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