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Age of Fusion of Body of Sternum with Xiphisternum 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 xiphisternum 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 sterniwith xiphisternum in males is 41.20 years and in female is 41.47 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.

Keywords: Xiphisternum • Sternum • Xiphoid process • Mesoternum • 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 [7,8].

Materials and Methods

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 and xiphoid process was examined for degree of fusion.

Results

Comparison between age and grade of fusion of mesosternum with xiphisternum in males

Out of total 70 male sternum samples, Non- fusion (Grade 0) between mesosternum and xiphisternum is seen in 5 (7.14%) cases, mean value of it is 32.80 and standard deviation is 0.837 with a standard error of ± 0.374. Partial fusion (Grade 1) is seen in 6 (8.57%) samples with a mean value of 30.11, standard deviation of 1.549 and standard error of ± 0.632. Complete fusion (Grade 2) is seen in 59 (84.2%) samples with a mean value of 40.20, standard deviation of 10.174 and standard error of ± 1. 325, on comparison, the mean

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value is 41.20, standard deviation is 11.705 and standard error ± 1.399 with p value 0.0001 (Table 1).

Comparison between age and grades of fusion of mesosternum with xiphisternum in females

Out of total 30 female sternum samples, Non- fusion (Grade 0) between mesosternum and Xiphisternum seen in 5 (16.6%) cases with mean value of 32.80 and standard deviation is 1.643 with a standard error of ± 0.735. Partial fusion (Grade 1) is seen in 6 (20%) cases with a mean value of 30.17, standard deviation of 0.408 and standard error of ± 0.167. Complete fusion (Grade 2) is seen in 19 (63.3%) cases with a mean value of 40.53, standard deviation of 11.306 and standard error of ± 2. 594. The mean value of total female is 41.47, standard deviation is 16.158 and standard error is ± 2.950 with p value 0.0001 (Table 2).

Discussion

In the present study, in males mean age of onset of fusion of mesosternum with xiphisternum is 38.0 years ± 0.0001 and mean age of complete fusion is 50.83 years ± 1.641 whereas in females mean age of onset of fusion of mesosternum with xiphisternum is 38.0 years ± 0.0001 and mean age of complete fusion is 58.58 years ± 2. 831. There is no statistically significant difference in age of fusion of mesosternum with xiphisternum in males and females in the present study.

Comparison of fusion status of mesosternum with xiphisternum in male and female

Similar to present study no differences in ages of fusion of manubriosternal and xiphisternal joints to body of sternum the findings were reported by Chandresh I. Tailor who reported almost equal percent 35% fused type body with xiphoid process in both sexes 63 and Dharmesh Patel who reported 42 years and 44 years as fusion ages for males and females respectively (Table 3).

The present study is in agreement with study by Tayal 2013 who stated that the fusion of cases showing partial and absence of fusion were randomly scattered in both the sexes. Thus, it can be assumed that the fusion is independent of sex.

Though Chandrakanth HV, Garg A. and Gautam reported variations in fusion of ages in both sexes and Chandrakanth HV stated that fusion of mesosterno-xiphisternal junctions was proportionately commoner in males than females.

In the present study, it is evident that the fusion of mesosternum with manubrium sterni and xiphisternum is totally independent of sex of the subject and no relation between the sex and the pattern of fusion of mesosternum with manubrium sterni and xiphisternum could be established in the present study.

Table 1. Comparison between age and grade of fusion of mesosternum with xiphisternum in males.

Grade	Number	Mean	SD	SEE	p-value
Non-fusion (Grade 0)	5	32.80	0.837	0.374	0.0001
Partial fusion (Grade 1)	6	30.11	1.549	0.632	
Complete fusion (Grade 2)	59	40.20	10.174	1.325	
Total	70	41.20	11.705	1.399	

Table 2. Comparison between age and grades of fusion of mesosternum with xiphisternum in females.

Grade	Number	Mean	SD	SEE	p-value
Non-fusion (Grade 0)	5	32.80	1.643	0.735	0.0001
Partial fusion (Grade 1)	6	30.17	0.408	0.167	
Complete fusion (Grade 2)	19	40.53	11.306	2.594	
Total	30	41.47	16.158	2.950	

Table 3. Fusion of mesosternum with xiphisternum in both males and females.

Age Group (Years)	State of Fusion	Sobhan K. Das (2005)	Gaur VB (2011)	Sethi Prabh Dayal 2016	Present study (2018)
11-20	Complete	Nil	-	-	-
	Partial	Nil	-	-	-
	Separate	Nil	-	-	-
21-30	Complete	0% (25-30 yrs.)	-	0%	-
	Partial	Nil	-	-	-
	Separate	Nil	-	100%	-
31-40	Complete	16.2%	26.3% (35-40 yrs.)	62.5%	0
	Partial	Nil	-	-	12
	Separate	Nil	83.3% (35-40 yrs.)	37.5%	10
41-50	Complete	31.94%	34.12%	90%	22
	Partial	Nil	-	-	0
	Separate	Nil	54.32%	10%	0
51-60	Complete	50%	84.45%	85.7%	27
	Partial	Nil	-	-	0
	Separate	Nil	65.87%	14.2%	0
>60	Complete	72.73%	87.25%	94.1%	29
	Partial	Nil	-	-	0
	Separate	Nil	47.32%	5.8%	0

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.

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