

Comparison in age of fusion between mesosternum with manubrium sterni and xiphisternum in both the genders based on occupation, climate, and geographical/statewise distribution.

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Abstract:

Objectives: There is paucity of data on age determination from sternum in middle and elderly age groups. In all such cases, while estimating age in middle and elderly age group the forensic experts are facing lot of problem because there are few bones which ossify during this age group and the age calculated gives a bigger range and this study is done with the aim to find out age estimation within short range above thirty years age bracket. This article documents comparison in age of fusion between mesosternum with manubrium sterni and xiphisternum in both the genders based on occupation, climate, and geographical/statewise distribution. **Methods:** Sterna were removed from the cadavers by sectioning the costal cartilages just besides the costo-chondral junction. **Results:** Out of total hundred sternum studied, seventy were males and thirty were females. Out of the total one hundred sternum samples retrieved from dead bodies maximum number was 17 (17%) that were businessmen amongst males and maximum of females were 16 (16%) that were housewives. In present study, out of the total one hundred sternum samples retrieved from dead bodies maximum number of cases that is 48 (48%) belonged to individuals who were from temperate climate, in 30-40 years age group. In present study, out of the total one hundred sternum samples retrieved from dead bodies maximum number that is 28 (28%) belonged to individuals from Delhi, in age group between 30-40 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. A good number of samples were retrieved from individuals who were businessman (17%) amongst males and housewife (16%) amongst females. Majority of sternum samples were of individuals from temperate climate and Delhi region

Key words: sternum, xiphisternum, manubrium sterni, mesosternum.

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 There is paucity of data on age determination from sternum in middle and elderly age groups. In all such cases, while estimating age in middle and elderly age group the forensic experts are facing lot of problem because there are few bones which ossify during this age group and the age calculated gives a bigger range and this study is done with the aim to find out age estimation within short range above thirty years age bracket. The present study is therefore an attempt to assess the age of an individual from the least studied and reliable skeletal remain, the sternum, which is one of the superficial bones, and is spared even

in a highly decomposed body. Moreover, it is a bone, which can be easily procured from cadavers, without the slightest damage during routine autopsy procedure. So, considering these factors, study of the sternum is selected as an identifying unit of age. As fusion activities of bones depend upon built, food habits and heredity etc. These parameters with any relation of fusion of sternum with occupation, climate, and geographical/state wise distribution were studied.

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. Sterna were removed from the cadavers by sectioning the costal cartilages just besides the costo-chondral junction. The elements of each sternum - manubrium, body and xiphoid process were examined for their fusion. Comparison in age of fusion between mesosternum with manubrium sterni and xiphisternum in both the genders based on occupation, climate, and geographical/state wise distribution was done.

Observations and results:

Distribution of sternum samples on the basis of occupation:

Out of the total one hundred sternum samples retrieved from dead bodies 14 (14%) belonged to males were unemployed, 13 (13%) to manual laborer, 3 (3%) to farmers, 12 (12%) to shopkeepers, 11 (11%) to teacher, and 17 (17%) to businessmen. Out of the thirty sternum samples retrieved from females 3 (3%) were from those who were unemployed, 16 (16%) to housewives, 1 (1%) to manual laborer, 2 (2%) to farmers, 1 (1%) to shopkeeper, and 2 (2%) to teacher, and 5 (5%) to businesswomen. On statistical analysis fisher's test value is 16.03 and p- value is 0.007. This distribution of sternum samples on the basis of occupation of individuals is shown in Table no. 1 and 2 and Fig. No. 1.

Table 1: distribution of sternum samples on the basis of occupation		
Occupation	Male	Female
Unemployed	14 (14%)	3 (3%)
Housewife	-	16 (16%)
Manual Laborer	13 (13%)	1 (1%)
Farmer	3 (3%)	2 (2%)
Shopkeeper	12 (12%)	1 (1%)
Teacher	11 (11%)	2 (2%)
Businessman	17 (17%)	5 (5%)

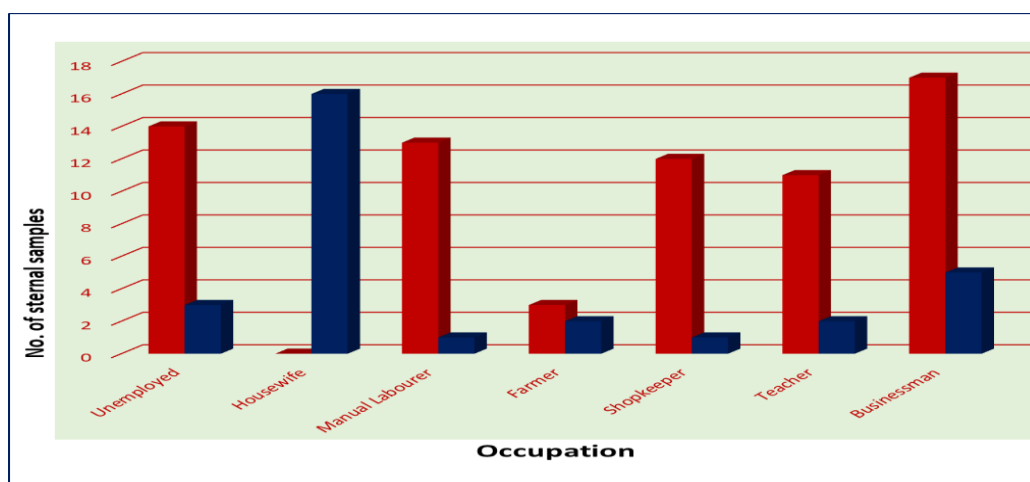


Fig. No. 1: distribution of sternum samples on the basis of occupation

Table no. 2: Statistical analysis done for occupations			
Variable	Sex		p-value
	Male	Female	
Occupation			
Unemployed	14	3	Fisher's test value= 16.03 p-value= 0.007
Housewife	12	16	
Manual Labourer	13	1	
Farmer	3	2	
Shopkeeper	1	1	
Teacher	10	2	
Businessman	17	5	

Distribution of sternum samples on the basis of climate:

In present study, out of the total one hundred sternum samples retrieved from dead bodies 48 (48%) belonged to individuals who were from temperate climate, 6(6%) from subtropical and one sample (1%) from tropical climate in 30-40 years age group and 12 (12%) belonged to those from temperate climate, 2 cases (2%) from subtropical climate in 41-50 years age group; 10 (10%) belonged to individuals from temperate climate, one (1%) sample from individual from subtropical climate, in age group between 51-60 years, and remaining 17 (17%) were of individual from temperate climate and one (1%) and 2 (2%) of those from subtropical and tropical climate respectively. On statistical analysis fisher's test value is 14.03 and p- value is 0.005. This distribution is shown in Table no. 3,4 and Fig. No. 2.

Table no. 3- distribution of total cases on the basis of climate				
Variables	Age Groups (Years)			
	30-40	41-50	51-60	>60
Climate				
Temperate	48 (48%)	12 (12%)	10 (10%)	17 (17%)
Subtropical	6 (6%)	2 (2%)	1 (1%)	1 (1%)
Tropical	1 (1%)	0	0	2 (2%)

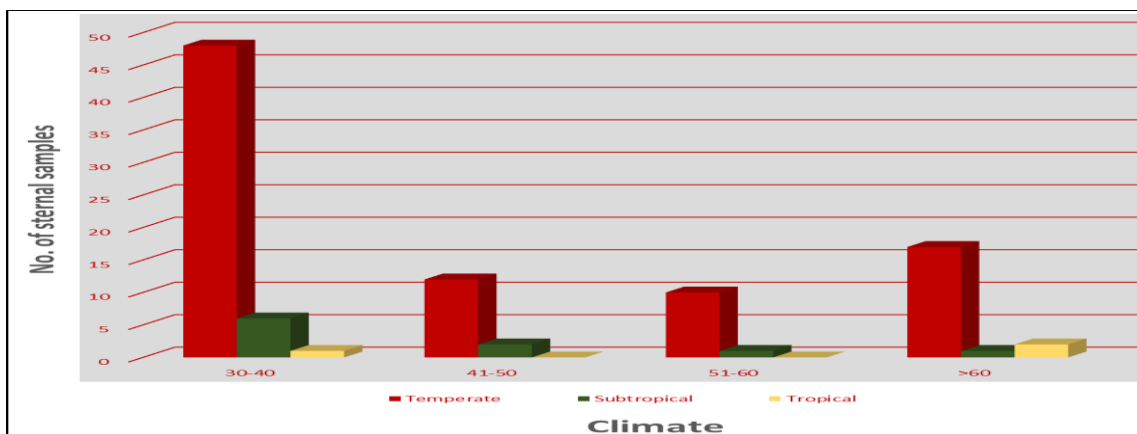


Fig. No. 2: distribution of sternum samples on the basis of climate

		Table no. 2: Statistical analysis done for climate
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Variable	Age groups (years)				p-value
Climate	30-40	41-50	51-60	>60	
Temperate	48%	12%	10%	17%	Fisher's test value= 14.03 p-value= 0.005
Subtropical	6%	2%	1%	1%	
Tropical	1%	0	0	2%	

Distribution of sternum samples on the basis of geographical/ statewise distribution:

Out of the total one hundred sternum samples retrieved from dead bodies 28 (28%) belonged to individuals from Delhi, one (1%) from Rajasthan, 10 (10%) were those from Haryana, 7 (7%) cases from Uttar Pradesh, 2(2%) from Bihar, 2 (2%) from Maharashtra and one sample (1%) belonged to individual from Sri- Lanka in age group between 30-40 years. 6 samples (6%) of individuals from Delhi, 5(5%) from those belonging to Haryana, 2(2%) from Uttar-Pradesh, 9 (9%) sternum samples were of those belonging to Delhi, 8 (8%) samples from those belonging to Haryana, 3(3%) are from Uttar- Pradesh, one sample (1%) each from Bihar and Maharashtra, and one sample (1%) from Sri-Lanka. On statistical analysis fisher's test value is 16.03 and p- value is 0.006. Distribution of sternum samples on the basis of climate is shown in Table 5,6 and Fig. No. 3.

Table 5: Distribution of Sternum Samples On The Basis Of Geographical/ Statewise Location

Variables	Age Groups (Years)			
Geographical Distribution (State)	30-40	41-50	51-60	>60
Delhi	28 (28%)	6 (6%)	6 (6%)	9 (9%)
Rajasthan	1 (1%)	0	0	0
Haryana	10 (10%)	5 (5%)	3 (5%)	8 (8%)
Uttar-Pradesh	7 (7%)	2 (2%)	0	3 (3%)
Bihar	2 (2%)	0	0	1 (1%)
West- Bengal	0	1 (1%)	2 (2%)	0
Maharashtra	2 (2%)	1 (1%)	0	1 (1%)
Sri- Lanka	1 (1%)	0	0	1 (1%)

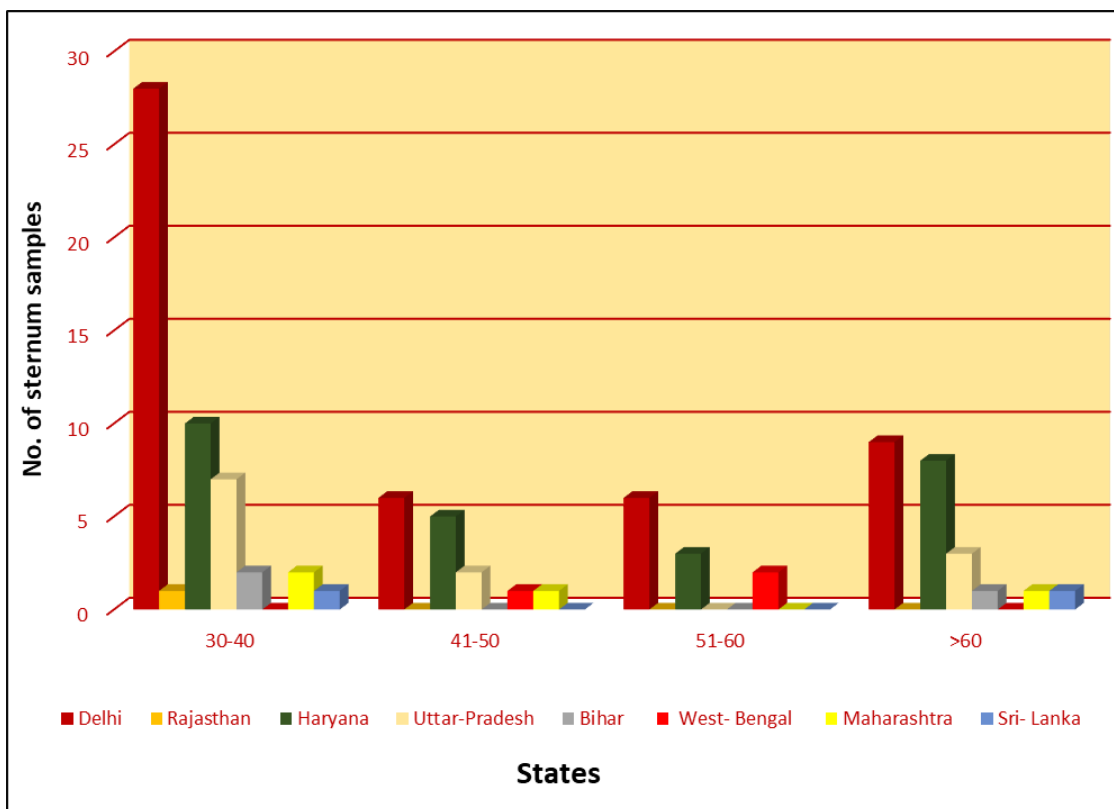


Figure no. 3: distribution of sternum samples on the basis of geographical (state wise) distribution

Variables	Age Groups (Years)				p-value
Geographical Distribution (State)	30-40	41-50	51-60	>60	
Delhi	28 (28%)	6 (6%)	6 (6%)	9 (9%)	Fisher's test value= 16.03 p-value= 0.006
Rajasthan	1 (1%)	0	0	0	
Haryana	10 (10%)	5 (5%)	3 (5%)	8 (8%)	
Uttar-Pradesh	7 (7%)	2 (2%)	0	3 (3%)	
Bihar	2 (2%)	0	0	1 (1%)	
West- Bengal	0	1 (1%)	2 (2%)	0	

Maharashtra	2 (2%)	1 (1%)	0	1 (1%)	
Sri- Lanka	1 (1%)	0	0	1 (1%)	

Discussion:

'Age determination is ultimately an art, not a precise science'-Maples (1989: 323)⁴:

The present study is conducted in the Department of Forensic Medicine, Lady Hardinge Medical College, New Delhi on a total of 100 cases (70 males; 30 females) age more than 30 years that were brought for medicolegal autopsy after verification of age from necessary government documents. Sterna were removed from the cadavers, kept for maceration for a week and then cleaned and dried at room temperature. The manubrio-sternal and the xiphisternal articulations were carefully examined for degree of fusion: complete fusion, partial fusion and non-fusion and graded accordingly to determine the age.

Out of a total of one hundred samples of sternum retrieved from dead bodies, 11 male (15.7%) and 11 female (36.6%) sterni belonged to 30-40 years age bracket and 21(30%) males and 1 (3.3%) female sterni to 41-50 years whereas 20 (28.5%) male and 7 (23.3%) female sternum samples were in 51-60 age groups and 18 (25.7%) male and 11 (36.6%) female sterni belonged to >60 years age group. On statistical analysis fisher's test value is 12.99 and p- value is 0.004 that is statistically significant. In this study maximum number (28.5%) of male sternum samples belonged to 51-60 years age group whereas females topped the number (36.6%) in 30-40 years and more than 60 years age bracket.

The present study is in agreement with the study by Bruce where maximum number of sternum belonged to males (21.5%) in the 51-60 years age bracket and female sterni (18.4%) in more than 60 years age⁵. The distribution of age in the study of Chandresh I. Tailor is quite different from our study where he studied 116 cases that were more than 10 years of age and more than one third (34.2%) of male were in 21 to 30-year age bracket that was highest among the male group⁶. In the same way, female was highest (27.8%) among 21 to 30 years group. These were cases that were included as they were more than 30 years of age and met all the inclusion criteria. In another study by Chandrakanth HV 2012. A total of 118 sterna (67 males and 51 females) 27 and the male samples were aged between 25 and 74 years whereas the females between 20 and 80 years in study by Sobhan K. Das 14.28% in 30-35 years age amongst male and 13.4% in 36-45 years amongst females.⁷ Sethi PD included 500 cases 371 in his study of which 74.2% were male, and 25.6% were females and one was eunuch i.e. 0.2 %⁸. Comparative analysis of age and sexwise distribution is shown in Table 7.

Variable	Age groups (Years)			
	30-40	41-50	51-60	>60
Male	11 (15.7%)	21 (30%)	20 (28.5%)	18 (25.7%)
Female	11 (36.6%)	1 (3.3%)	7 (23.3%)	11 (36.6%)

Distribution of cases on the basis of Occupation (Table No. 8):

Out of the total one hundred sternum samples retrieved from dead bodies maximum number was 17 (17%) that were businessmen amongst males and maximum of females were 16 (16%) that were housewives. On statistical analysis fisher's test value is 16.03 and p- value is 0.007. None of the studies assessed on sternal fusion and age has studied occupation as one of the socio-demographic profile of the person except Chandresh I. Tailor stated that near about half of the male (47.4%) had service at different places where as more than two third of the female (70%) were house wife⁹.

Table 8: Comparative analysis of occupation

Variable	Chandresh I. Tailor		Present study	
	M	F	M	F
Unemployed	-	-	14	03
Housewife	-	70	-	16
Labourer/Worker	42.1	0	13	3.5
Service/Teacher	47.4	7.5	11	2
Student	5.3	20	-	-
Farmer	-	-	03	02
Businessman/ Shopkeeper	5.3	0	17	6

Distribution of cases on the basis of Climatic variation:

In present study, out of the total

one hundred sternum samples retrieved from dead bodies maximum number of cases that is 48 (48%) belonged to individuals who were from temperate climate, in 30-40 years age group. On statistical analysis fisher's test value is 14.03 and p-value is 0.005, is statistically significant. The maximum numbers of cases for the study are from Delhi NCR region that is in the temperate zone. None of the studies assessed had studied climatic attributes of cases while determining age from sternum.

Distribution of cases on the basis of Geographic/ statewise variation:

In present study, out of the total one hundred sternum samples retrieved from dead bodies maximum number that is 28 (28%) belonged to individuals from Delhi, in age group between 30-40 years. On statistical analysis fisher's test value is 16.03 and p-value is 0.006. None of the studies assessed so far on age and sternum studied demographic profile of the individuals except a study by Jaghendra Singh (2013) who studied variations in sternum and had studied demographic profile of individual and found 39.9% cases were from Punjab¹⁰. Since the present study is conducted in Delhi region that's why maximum number of cases belonged to this region. None of the studies assessed had studied of geographic/ statewise variation while determining age from sternum.

Conclusions:

The present study is an attempt to assess the age of an individual from the least studied and reliable skeletal remains, the sternum, which is one of the superficial bones, and is spared even in a highly decomposed body and can be easily procured from cadavers, without the slightest damage during routine autopsy procedure. This study was conducted in the department of Forensic Medicine and Toxicology, Lady Hardinge Medical College, New Delhi on a total of 100 cases brought to the mortuary for post-mortem examination. 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. A good number of samples were retrieved from individuals who were businessman (17%) amongst males and housewife (16%) amongst females. Majority of sternum samples were of individuals from temperate climate and Delhi region.

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