Stature estimation using interacromial length in South and North Indian population

Abstract

Objective: In medicolegal autopsies, establishing personal identity of the dead is often necessary and assessment of the stature from extremities plays a vital part in identifying the dead in forensic examinations. The aim of the present study was to derive a regression equation for estimating stature using the interacromial length. **Materials and Methods**: 200 normal human subjects belonging to south and north indian population from kasturba medical college, Manipal were used for the study. Their age ranges from 16-23 yrs. The stature and interacromial distances were measured with a measuring tape. The statistical analysis was carried out and a regression equation for estimating the stature from the interacromial length was derived for both males and females. **Results**: The mean interacromial distance in males and females was $36.98 \pm$ standard deviation (SD) cm and $32.5 \pm$ SD cm, respectively, and the mean height in males and females was $176 \pm$ SD cm and $160.5 \pm$ SD cm, respectively. Regression equation formulae were derived from the present study to estimate stature from the interacromial distance in South and North Indian population. **Conclusion**: In forensic investigation, difficulties are experienced in the stature and gender assessment of bodies injured in mass destruction. The present study may be useful for forensic experts in identifying the stature from fragmentary remnants of the thorax whenever the same are recovered.

Key words: Interacromial distance, stature, regression formulae

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INTRODUCTION

Stature provides a perception into the numerous features of a population including nutrition, health, and genetics. Stature is considered to be one of the many methods used for individual identification and one of the "big fours" of forensic anthropology. The stature of an individual is a vital characteristic and its assessment is considered to be a vital assessment in the identification of anonymous human remnants.[1] When an entire dead body is found, stature assessment is comparatively an easy job; however, in situations where only some remains of the body are available, the assessment of stature of the individual is challenging.[2]

With the growing incidence of mass disasters, homicides, air plane crashes, train and road accidents, etc., there is always need for studies that help in identifying the deceased from fragmentary and mutilated human remnants. In such a situation, interacromial distance may provide a good estimate about the height of a person.[1]

Interacromial length is the distance between two bony landmarks, namely, the acromial processes of the scapula on both sides. Acromion is the most lateral point on the lateral border of the acromial process when the person stands in the normal anatomical position with his arms hanging by the sides.[3] Many criteria are available that can

be used depending on the part of the body recovered. To add to these criteria, the present study was designed with the objective of deriving a regression equation for estimating stature from the interacromial length. Very scarce studies have been carried out on stature assessment by using interacromial length. Thus, it is vital to have different formulae for the assessment of stature from the lengths of various body parts.[4] The aim of the present study was to establish the relationship between the statures of different persons and their interacromial lengths and to develop regression equation formulae from these two variables in both males and females.

MATERIALS AND METHODS

In this study, 200 (75 males and 125 females)sample size was calculated by the statistician students studying in Kasturba Medical College (KMC), Manipal, Karnataka, India in the age group of 16-23 years were chosen for the study. Ethical clearance has been taken from the institutional ethical committe.

After taking the written informed consent of the participants, the stature of each individual was measured in centimetres with the subject standing against a vertical background surface in the normal erect position, with the shoulders, buttocks, and heels lightly touching the wall as in the anatomical position a measuring tape. Inter-acromial length is the distance between two bony landmarks, i.e. acromial process of scapula on each side. Acromion is the most lateral point on the lateral margin of the acromial process when the subject stands in normal position with his arms hanging by the sides. The interacromial length was measured in centimetres by a measuring tape with the person standing in the same erect position. Keeping one end of measuring tape on right acromion,and the other till the left acromion [Figure 1]. After taking the measurements, statistical analysis was carried out using Spss 16 software and regression equation formulae were derived. Pearson corelation test was done to fine any corelation between stature and interacromial distance. Independent sample *T* test was done to compare male and female data by dividing them into 2 groups.

Table 1: The minimum, maximum, and average values of stature and interacromial length in both males and females

Characters	Males	Females
Minimum interacromial distance (cm)	32	26
Maximum interacromial distance (cm)	44	41
Average interacromial distance±standard deviation (cm)	36.98±2.32	32.5±2.28
Minimum height (cm)	152	149
Maximum height (cm)	192	175
Average height±standard deviation (cm)	176±7.5	160.5±6.1

RESULTS

The result showed a sex-wise distribution of the maximum, minimum, and mean statures and interacromial lengths as shown in Table 1. In our study there was significant corelation between stature and interacromial distance in females as *P* value was 0.000 by pearson corealtion but not in males as *P* value was 0.709. This may be due to less number of males in the study as compared to females. And there was significant difference in males and females stature and interacromial distance as *P* value was 0.000 and 0.000 in both by independent sample *T* test. Regression equation formulae in our study to find the stature from interacromial distance are as follows:
For males and females together -
$y = 178.9-0.13x$
For females -
$y = 122.9 + 1.15x$
Where
y = stature
x = interacromial distance.

DISCUSSION

Population discrepancies in anthropometric measurements do happen and are attributed to hereditary, dietary habit, and environmental influences. This specifies that precise formulae or regression equations used in the prediction of stature are only applicable to the population from which the data were collected. Vishal *et al*. (2010) carried out a study on the people of the northern region in Karnataka and got the regression equation of finding the stature from interacromial length as $y = 167.50 + 0.20x$ in males and $y = 103.62 + 1.6x$ in females.[2]

The study carried out by Momonchand and Devi (1999) found the regression equations as $y = 1.7x + 84$ in females and $y = 2x + 69$ in males.[5] Mishra M et al found the regression formula for estimating the stature from
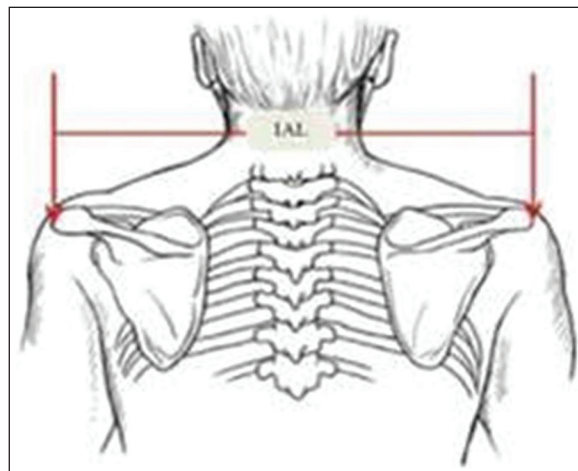

Figure 1: Interacromial distance measurement

interacromial distance as-
Male: HT = 142.39 + 0.811 × a-a
Female: HT = 121.74+ 1.10 × a-a
Where a-a is interacronmial distance.

They also found that the correlation of height with inter acromion distance was extremely significant (p = 0.0008 for males and p = 0.0004 for females).[6]

Anam E et al found the regression formulae as follows-
Females: Stature = 129.03+ 1.00 x
Males: Stature = 126.10 + 1.34 x
Combined: Stature = 99.06 + 2.09 x
Where x is interacromial distance.

They also found that when combined data was used, positive correlation between stature and inter-acromial length was found which was statistically significant. On the other hand, they found that there was insignificant correlation between stature and inter-acromial length in either of the sexes.[7]

Patel SH *et al* found the regression formulae as:
Males and Females combined: y = 102.27 + 1.54x
Males only: y = 140.01 + 0.71x
Females only: y = 137.31 + 0.50x
Where x is the interacromial distance.[8]

Meanwhile, the present study got it as y = 181.33- 0.14x for males and y = 122.9 + 1.15x for females. This is because the present study was carried out on students who came from all over India. And as such, the present formula is more accurate and can be applied to the whole general population of Indian people.

Stature is an important parameter in determining the partial characteristics of anonymous bodies and mutilated fragments. Means to establish stature are plentiful and their significance lies in the ease of measurement, applicability, and accuracy in prediction.[9] In forensic analysis, problems are being experienced in the stature and gender assessment of bodies mutilated in mass devastation. In order to eradicate these problems, new means are being developed.

In the present study, it was found that there was an important correlation of height with the interacromial length of an individual females and that stature could be assessed with the interacromial length when only the upper part of the trunk was available.

CONCLUSION

The present study was devoted to the derivation of formulae for assessing stature from the fragmentary remnants of the thorax whenever the same are recovered.

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Conflicts of interest
There was no conflicts of interest between the authors.

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