Estimation of total length of radius from its fragments

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Abstract:

Establishment of identity of deceased person assumes great medico legal importance. One of the factors in establishing the identity of a person is his stature. The estimation of stature from long bones has attracted the attention of many anatomists. The present study is aimed to ascertain the total length of radius from its fragments which can be employed in available stature formulae to estimate total length of an individual. In this study we have divided the radius in seven segments i.e. a-b, b-c, c-d, d-e, e-f, f-g, g-h on the basis of morphological characters of radius from top of head to the tip of styloid process. In our study, the coefficient of variation is less for the segment d-e to calculate the total length of radius. The segment d-e is one of the largest segments of all the segments and hence it can be concluded that this segment is statistically better segment for the result.

Keywords: Radius, Lateral bone of forearm, Fragments segment.

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Introduction:

Anatomists and Forensic experts have been consulted frequently regarding identification of skeletal remains found under suspicious circumstances and are asked to pronounce an opinion, which may form important evidence in the court of law. One of the factors in establishing the identity of a person is his stature. The estimation of the skeletal samples of the burials is often fragmentary and is found in mixed lots. For this reason, there is a need for developing a technique for stature estimation on skeletal parts. What can be done with fragmentary bones? First we can estimate their total length and secondly to employ them in statural formulae and thus to estimate the total length of an individual (1).

With this in mind, the present study was conducted to ascertain the total length of radius from its fragments which can be employed in estimation of stature using available statural formulae.

Material and Methods:

A cross sectional study consisted of random collection of 140 radius bones. After taking, consent from Institute Ethical Committee (IEC), the dry, fully ossified radius bones from the skeletal sets were collected from grossly normal and complete adult cadaver from the dissection hall of the Anatomy Department of N.K.P. Salve Institute of Medical Sciences, Govt. Medical College and Indira Gandhi Medical College, Nagpur.

In order to compare all measurements, the radius was measured using osteometric scale (Fig. 1). The radius was divided by Krogman **(1)** into 4 segments i.e. a-b; b-c; c-d; d-e as shown in fig. 2 (A), but in our study for the purpose of making it more meticulous and to accommodate the maximum numbers of fragments as it is the case many a times, we divided the bone in seven segments i.e. a-b; b-c; c-d; d-e; e-f; f-g; g-h as shown in fig. 2 (B). To compare all measurements, the radius bone was divided into seven segments by taking the following landmarks on the basis of morphological characters of radius from the top of the head to the of styloid process.

Figure 1: Measurement of the length of radius by Osteometeric Scale

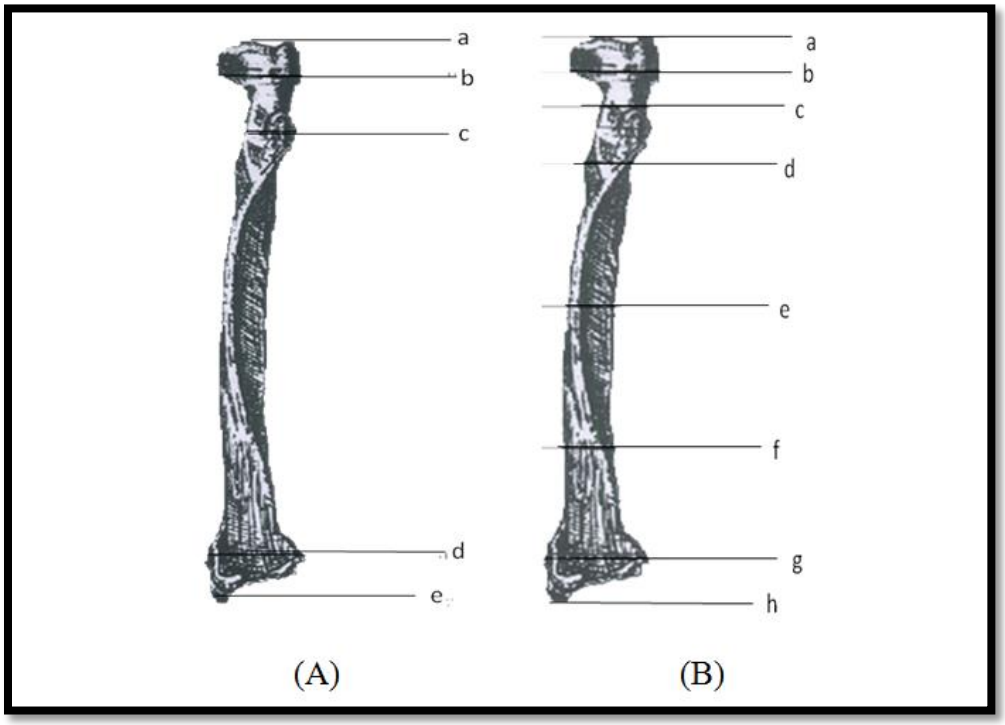

Fig. 2: Radius and its fragments (A) Division of Radius in to Four segments (B) Division of Radius in to Seven segments (a) Most proximal point of the head, (b) Distal margin of the head, (c) Upper end of radical tuberosity, (d) Lower end of radical tuberosity, (e) Midpoint of insertion of pronater teres, (f) Bifurcation of interoseus border, (g) Upper end of Ulnar notch of radius, (h) Tib of styloid process

In this way with the help of above landmarks, the whole length of radius is divided into 7 segments or fragments as ab, bc, cd, de, ef, fg and gh. Most of the landmarks selected could be easily taken and the lengths of the segments were measured. This enables us to take the advantage of numbers of segments and makes a study with broad perspective.

After calculating the mean length of all various segments from 140 Radius bones, the standard deviation, co-efficient of variation and the proportions of the length of all various fragments to the total length of radius is calculated. The 2 SEP value is determined and further to assess the validity of our work we have done statistical evaluation by 95% confidence interval of the proportion of fragments.

Results:

In the present work, the radius bone is divided into seven segments with the help of easily demarkable landmarks, so that the reconstruction of the total length of the radius bone can be carried out even by the smaller available fragment of the bone radius (Table1). After calculating the mean length of all various segments from 140 Radius bones, the standard deviation, co-efficient of variation and the proportions of the length of all various fragments to the total length of radius is calculated. The 2 SEP value is determined and further to assess the validity of our work we have done statistical evaluation by 95% confidence interval of the proportion of fragments (Table 2).

Table 1: Percentage of respective segments of radius to its full length

Sr. No.	Segment	Mean Length (mm)	Proportion
1	a-h	244.34	100%
2	a-b	8.79	3.60%
3	b-c	13.76	5.63%
4	c-d	21.69	8.88%
5	d-e	69.72	28.53%
6	e-f	70.41	28.81%
7	f-g	40.76	16.68%
8	g-h	19.22	7.87%

Table 2: Various findings of different Segment of Radius

Sr. No.	Segment	Mean	Standard deviation	Co-eff. of variation.	Range in mm.
1	a-h	244.34	17.89	7.321765	201-294
2	a-b	8.79	1.471	16.73493	5-13
3	b-c	13.75	2.9	21.09091	7-25
4	c-d	21.68	3.3	15.2214	15-30
5	**d-e**	**69.72**	**10.25**	**14.70166**	**45-95**
6	e-f	70.4	14.66	20.82386	30-110
7	f-g	40.75	9.3	22.82209	23-63
8	g-h	19.22	3.42	17.79396	8-30

Discussion:

The available literature in the field of re-construction of the total length of bones from fragments is very limited. Muller (2) was first who worked on mean proportion of various parts of some long bones i.e. radii, humerus and tibiae, and later on Krogman (1) proved the Muller (2) data to be very useful in stature re-construction from fragmentary long bones in the hands of competent osteologist.

Krogman (1) has also shown the use of immature or fragmentary long bones in statured re-construction. If we compare our study with him, all the segment d-e of their study, which corresponds exactly to the g-h segment in our study, comprises respectively 7.46±1.10% and 7.87 %, which is very close and quite comparable with our study.

The estimation of stature from the segmental length of long bones has also been reported by Steele and Mckern (3). They studied male and female bone separately and have reported separate regression equations to estimate the length of humerus from its segments. Similarly a method of assessment of length of radius and femur from its fragments in Indian subjects has been reported by Mysorkar et. al. (4) by studying only two segments of each bone. They studied the segmental measurements of right and left

radii and analyzed separately and have also suggested the single regression equations for both sexes.

Shroff and Fakhruddin (5) studied the humerus belonging to skeleton of known age, sex and stature by measuring the total length and stature and segmental length dividing humerus into four segments between two salient bony points. They compared the length of each segment with the total length. The percentage and length of each segment was compared to the total length and calculated the regression equations to estimate the total length of humerus from its fragments. Thus, the fragments of long bones can be used to estimate their total length and then it can be employed in available stature formulae to estimate total length of an individual as required in medicolegal practice in many circumstances.

Conclusion:

In this work, we have endeavored to ascertain the total length of the radius from various segments. We have divided the bone into seven segments taking some obvious points as landmarks for measurements. In our study, the segment d-e; it is seen that the coefficient of variation is less for this segment to calculate the total length of radius. This is one of the largest segments of all the segments; and hence it can be concluded that this segment is statistically better segment for the results. We have designed the osteometeric scale for this purpose, which will find very useful for the workers willing to do further work on radius. We are concluding by hoping that our study will help and guide the interested worker in this field in future.

This will help in studying the number of fragments of varying length; as is the case in many samples sent for forensic studies.

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