Morphological method – a new approach for sex assessment from ulna

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Abstract   Identification of sex from bones may be needed either by the law enforcement agency in same medico legal cases, or by anthropologists to establish the identity of the person. Present study is an attempt to assess sex of ulna morphologically.Materials and Methods used as 193 adult human ulnae, 133 male and 60 female from the Bone Bank of Govt. Medical College Aurangabad, were used for the present study. As a morphological parameter i.e. presence or absence of groove in the trochlear notch is observed in all the ulnae. Groove (G): This is a groove which divides the sigmoid notch (Trochlear notch) of ulna into two parts, it may or may not be present. Data is then tabulated for the presence or absence of groove in both sexes. This data is analyzed statistically. On the basis of presence or absence of groove 89% male and 60% of female ulnae can be sorted.
Keywords: Morphological Method, Skeletal Collection, Ulna, Trochlear notch, Groove.

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INTRODUCTION

Anatomists are often asked for expert opinion regarding age, sex and species of bones from skeletal remains found under suspicious conditions. It is not difficult to determine the sex of the adult deceased bone when a complete skeleton is available. However it is difficult to determine the sex of the deceased if the single bone or few bones are available. Determination of sex from available bones has got tremendous significance in medico legal cases. In medico legal work entire body is not always available to the medical expert for identification. On occasions the body is mutilated by animals, criminals or fragmented in mass disaster following air or train accident or from war injuries. Identification of bones may be needed either by the law enforcement agency in same medico legal cases, or by anthropologists to establish the identity of the person. The earliest available literature indicates that Torak A. von (1886) was first to bring on record the sex differences in long bones. Various studies have been done earlier by different workers, Pearson[1] (1915), Fischer[2] (1936), Washburn[3] (1948) and krogman[4] (1949) to name a few, for identifying the sex of a deceased person. Various methods to assess the human skeleton quantitatively and qualitatively are

1. Traditional non-metrical method (Morphological).
2. Metrical methods.
   a. Pearson's univariate analysis.
   b. Demarkating point.
   c. Use of various indices on the basis of significant measurement.
   d. Fischer's[2] multivariate analysis (1936)

Traditional method is non-metrical and morphological. Morphological features of the bones depend upon nutrition, occupation, race and geography of the region, so traditional method is not reliable in the study of bones. Various studies have indicated that sexual dimorphism

can be found in skull[5], pelvis[6], sternum[7] and other bones of the body. Ulna is latin word meaning elbow. The Ulna is a medial bone of the forearm. Morphologically groove in the trochlear notch can also be used for determination of sex from ulna.

MATERIALS AND METHODS

193 Adult human ulnae of known sex available in the Bone Bank of the Department of Anatomy, Government Medical College, Aurangabad are used for the present study. Out of 193 ulnae, 60 are of females and 133 of males. All the ulnae are dry, free of damage or deformity and are fully ossified. The personal records of all the ulnae for age, sex and race are available with the Bone Bank. Aim of present study is to achieve the highest possible accuracy in establishing sex from ulna and to study the usefulness of groove in the trochlear notch as a morphological parameter for determination of sex from ulna. As a morphological parameter i.e. presence or absence of groove in the trochlear notch is observed in all the ulnae. Groove (G): This is a groove which divides the sigmoid notch (Trochlear notch) of ulna into two parts, it may or may not be present. Data is then tabulated for the presence or absence of groove in both sexes. This data is analyzed statistically by applying chi square test. The tabulation is done in the following manner.

Table 1: Shows presence or absence of groove dividing trochlear notch

Sex /Groove	Present	Absent	Total
Male	a	b	g
Female	c	d	h
Total	**e**	**f**	**k**

And the formula is,

$$\text{Chi Sqaure } \chi^2 = \frac{\left[(ad - bc) - \frac{1}{2}K\right]^2 K}{efgh}$$

Subsequently chi square value, odds ratio and probability is calculated.

OBSERVATION

All known sex, One hundred and ninety three ulnae available in Bone Bank of the Department of Anatomy, Government Medical College, Aurangabad, are studied. Morphological parameter as a part of study i.e. presence or absence of groove in the trochlear notch is observed in all the ulnae. Groove which divides the sigmoid notch (trochlear notch) of ulna into two parts, it may or may not be present. Data is then tabulated for the presence or absence of groove in both sexes. This data is analyzed statistically by applying 'chi square' test.

Table 2: Shows presence or absence of groove dividing trochlear notch

Sex / Groove	Present	Absent	Total
Male	119	14	133
Female	24	36	60
Total	**143**	**50**	**193**

χ^2=50.18, P<0.0001

The surface of the sigmoid notch is divided by a groove into two parts, in 119 ulnae out of 133 male ulnae and undivided in 36 ulnae out of 60 female ulnae. This shows that 89% of male and 40% of female show the groove. On the basis of presence or absence of groove 89% male and 60% of female ulnae can be sorted. On sorting ulnae, on the basis of presence or absence of groove, it is observed that out of 193 bones studied 143 shows presence of groove where as 50 not shows any groove. When these bones is sorted on the basis of sex, it is found that 119 out of 143 grooved bones is males and 24 females giving the percentage distribution as 83% and 17% respectively. Similar analysis of bones without groove showed that 36 out of 50 is females and 14 males giving percentages as 72% and 28% respectively.

Table 3: Sex sorting of ulnae on the basis of presence or absence of groove in trochlear notch

	Total no of male ulane	Male ulnae with groove	Total no of female ulnae	Female ulnae without groove	Total bones with groove	Male ulnae with groove	Total bones without groove	Female ulnae without groove
No of bones	133	119	60	36	143	119	50	36

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| Percentage identified | 89% (M) | 60% (F) | 83.21 % (M) | 72% (F) |

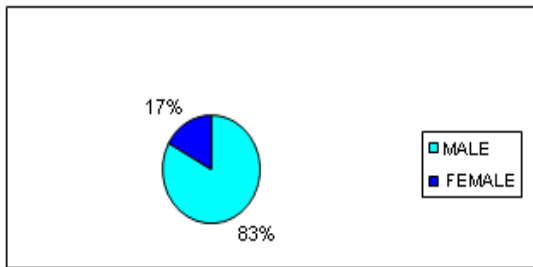**Figure 1:** Trochlear notch A. Presence of Groove and B. Absence of Groove

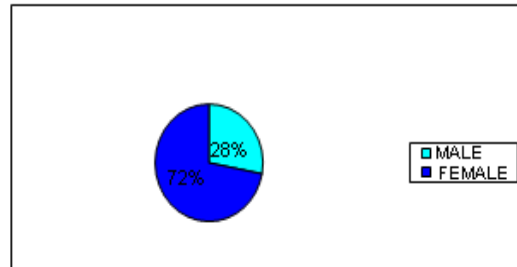**Figure 1:** Distribution of Male and Female Ulnae with Groove

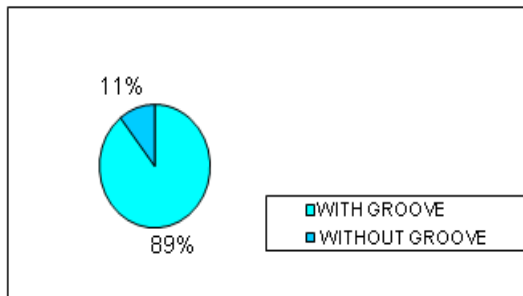**Figure 2:** Distribution of Male and Female Ulnae without Groove

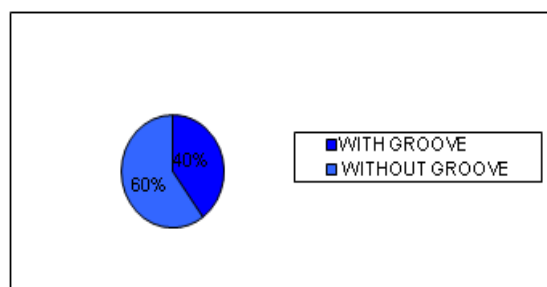**Figure 3:** Distribution of Male Ulnae with Groove and Without Groove

Figure 4: Distribution of Female Ulnae with Groove and Without Groove

DISCUSSION

Morphological parameters are not much emphasised with the advent of reliable metrical parameters and sophisticated statistical techniques applied for the determination of sex from bones. However there are a few interesting observations about groove dividing the trochlear notch of ulna by Martin and Maia Neto. The study of presence or absence of groove dividing trochlear notch of the present data has been compared with that of earlier workers.

Table 4: Showing comparison of frequencies of groove in different sexes of the present study with Martin

GROOVE		Martin (1957)	Present study (2005)
Present		75.5%	74%
Absent		24.5%	26%
Accuracy in sex	M	95%	89%
	F	85%	60%

Where, M is male and F is female.

Present study is compared with the study of Godycki cites Martin (1957) that the surface of the sigmoid notch (Trochlear notch) is divided by a groove into two parts in 66.2% of ulnae and not divided in 25.5%, A divided notch, says Godycki is male, an undivided notch is female. It is claimed that this holds true for 95% of male ulnae, 85% of female ulnae. In present study sigmoid notch is divided by a groove into two parts in 119 ulnae out of 133 male ulnae and undivided in 36 ulnae out of 60 female ulnae. A divided notch is male, this holds true for 89% of male ulnae and undivided notch is female, this holds true for 60% of female ulnae.

Table 5: Showing comparison of frequencies of groove in different sexes of the present study with Maia Neto

Groove	Maia Neto[8] (1959) (Total sample 611)			Present study (2005) (Total sample 193)		
	Total No of Ulnae	No of Bones	% Frequency	Total No of Ulnae	No of Bones	% Frequency
Present	407	M	286	71%	143	M	119	83%
		F	121	29%		F	24	17%
Absent	204	M	52	25%	50	M	14	28%
		F	152	75%		F	36	72%

Where, M is male and F is female.

Maia Neto[8] (1959) noted that of 407 ulnae with the groove (theoretically male), 286 (71%) were male, 121 (29%) were female. And of 204 ulnae without the groove (theoretically female), 52 (25%) were male, 152 (75%) were female. In the present study out of 143 ulnae with the groove (theoretically male), 119 (83%) is male, 24(17%) is female and of 50 ulnae without the groove (theoretically female), 14 (28%) is male, 36 (72%) is female.

SUMMARY AND CONCLUSION

The assessment of sex of ulna is done by morphological method. 193 adult human ulnae are studied, 133 of them being male and 60 female. Depending upon presence or absence of groove dividing trochlear notch, Mortin identified 95% male and 85% female ulnae but in present study it is 89% and 60% in male and female respectively. But if compared, accuracy found higher in male and lower in females with Maia Neto.

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