INCIDENCE OF CLAVICULAR RHOMBOID FOSSA (*IMPRESSION FOR COSTOCLAVICULAR LIGAMENT*) IN THE BRAZILIAN POPULATION: FORENSIC APPLICATION

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ABSTRACT

In the last years, anthropology has been widely explored mainly when related to bones due to its morphologic characteristics, such as the rhomboid fossa of the clavicle. This study examined the incidence of the rhomboid fossa in paired clavicles of Brazilian subjects obtained from 209 adult bodies of known age and sex (107 males and 102 females) on which postmortem examinations had been performed by the senior author. The data were submitted to qualitative statistical analysis according to Fisher. There was a statistical difference ($p= 5.98 \times 10^{-23}$) between sexes related to the frequency of the rhomboid fossa. The fossa was absent in 97,1% of the female clavicles and the incidence of bilateral fossa was present in 2,9% of females. The incidence of bilateral fossa was 29% for male clavicles. The sexual or side differences in the incidence of the fossa could be found in this study, and qualitative analysis can corroborate sex determination of unidentified bodies in forensic medicine.

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Keywords: forensic science, sex determination, rhomboid fossa, clavicle

INTRODUCTION

In the identification of humans, especially in the determination of the sex of whole skeletons, or isolated parts, the process of identification becomes progressively complex. The inexperienced observer can confuse particular anatomic characteristics such as the rhomboid fossa (*impression for the costoclavicular ligament*) with pathologic conditions varying from a simple fibrous displasia (benign) to a chronic osteomyelitis (malignant) as stated by the American College of Radiology (1992).

The costoclavicular ligament (*ligamentum costoclaviculare*) or rhomboid, on its insertion in the lower portion of a clavicle, can produce impressions, tuberosities, depressions, and even a fossa, known anthropologically and anatomically as the rhomboid fossa.[10]

Previous studies have evaluated the relationship between the presence of clavicular rhomboid fossa, and sex in skeletons of various populations worldwide, and found significant results related to incidence of the rhomboid fossa, being higher in males than females.[9,2]

Jit & Kaur (1986) did not find statistically significant differences between sex in relation to incidence of the rhomboid fossa in Indian individuals, where 59% of males and 54% of females showed this anatomic characteristic.[6]

A successful study conducted by Rogers et al (2000) examined the presence of the rhomboid fossa in relation to sex and to age of individuals in determining the sex of unidentified skeletons, since the rhomboid fossa was commonly associated with males more than females (36% for males left clavicles, 31% for male right clavicles, 3% for female left clavicles and 8% for female right clavicles) for 113 female and 231 male clavicles.[10]

Due to the scarcity of studies dedicated to this theme in the Brazilian population, the anthropologists in Brazil needs to refer to foreign research findings which do not always correspond to the national reality. Therefore, the aim of the present study was to determine the presence of the clavicular

rhomboid fossa in the Brazilian population as a qualitative method for the determination of the sex in unidentified skeletons.

MATERIALS AND METHODS

The study included 209 pairs of clavicles from Brazilians (107 males and 102 females), all adult individuals and previously identified. They varied in age between 19 and 85 years and were from the ossuary of the Municipal Cemetery of São Gonçalo, Cuiabá – MT. All the bone pieces belonged to unclaimed bodies, whose families did not request the bones within the administrative time determined by the institution, and which had as final destination internment in a common grave or cremation.

The presence (Fig. 1) or absence (Fig. 2) of a rhomboid fossa in the clavicle was determined corresponding to the right and left of the human body. Recordings were taken for each clavicle, and the results were submitted to analysis of intra-examiner reliability, where all the observations were carried out by a single examiner on three different occasions, with an interval of two weeks between each observation, so that the observations could not be memorized.

Statistical analysis of the data.

The data collected were submitted to calculation of intraclass correlation coefficient (ICC), to descriptive statistics and to Fisher's exact test, utilizing Microsoft Excel and the program Bioestat 5.0.

This work was first submitted and approved by the Committee of Ethics in Research of the Piracicaba Dental School, State University of Campinas - UNICAMP.

Fig 1: *Clavicle with rhomboid fossa (Red Circle)*

Fig. 2: *Clavicle without rhomboid fossa*

Table 1*. Distribution of frequencies (absolute and relative) of rhomboid fossae according to sex.*

Clavicle	Males		Females	
	N	%	N	%
With rhomboid fossa bilateral	31	29,0	3	2,9
With rhomboid fossa only on right	20	18,7	0	0.0
With rhomboid fossa only on left	17	15,9	0	0.0
Without rhomboid fossa	39	36,4	99	97,1

p= 5.98 x 10-23 (Fisher's exact test)

RESULTS

The results obtained by the intraclass correlation coefficient (ICC) showed a correlation of r = 0.96, indicating a nearly perfect match among the three series of observations carried out on the clavicles.

Table 1 shows a highly significant difference ($p= 5.98 \times 10^{-23}$) between sex related to the frequency of rhomboid fossae.

The table showed that 97.1% of the clavicles of female individuals did not have a rhomboid fossa and only 2.9% had a rhomboid fossa and bilaterally. However, 63.6% of males had a rhomboid fossa, 29% had bilateral fossae, 15.9% only on the left side and 18.7% only on the right side.

DISCUSSION

In the analysis of a body in which the sex is to be determined, observers should support their findings with the greatest number of existing tests, so that their conclusions become uncontested.

For the determination of the sexual dimorphism of a body, basically two types of data can be obtained, quantitative,[3,4] determined by measurements, such as weight, perimeter, length and others, and qualitative,[6,7] which examine the shape, presence/absence of a particular bone character by macroscopic means and which are often allowed to be documented in reports.

The results of this study demonstrate that the rhomboid fossa has a markedly greater incidence in males, occurring in 63.6% of male clavicles and only in 2.9% of female

clavicles. Earlier studies found that the presence of a rhomboid fossa is more common in the left clavicle of men and in the right clavicle of women, and that the presence of this anatomic structure reflects a probability of 81.7% in the right clavicle and 92.2% in the left for males.[10] However, other authors have reported different values between sides and genders in relation to the incidence of a rhomboid fossa in different populations.[9,6]

Only 2.9% of the female clavicles examined showed a rhomboid fossa in this study, appearing on both sides (right and left), where there were no cases of an occurrence of a rhomboid fossa in only one of the clavicles on the same individual. However, in the present study, male individuals (107) showed a rhomboid fossa in 63.6% of the cases, where 29% were bilateral, 18.7% only on the right clavicle and 15.9% on the left. Cho & Kang (1998) reported an incidence of 58.70% in men and 54.14% in women.

One of the possible explanations for the results obtained in this study relies in the fact that female bones are generally more delicate and less voluminous with the extremities delicate, and that male skeletons are more robust, mainly due to musculoskeletal activity.[8]

Besides contributing to other information gathered that serve as the basis for the effective determination of sex, the findings of the present study can help in cases in the determination of sex when the body is in parts or reduced to bone fragments. In such situations, the simple presence of a rhomboid fossa would indicate with a relative degree of certainty for judicial authority, if the fragment comes from the body of male or female.[9] In addition to such an affirmation, molecular biology assays can be a handy ratification tool (e.g., amelogenin), verifying the result of physical anthropology.

The factors responsible for the morphologic alterations are still not completely elucidated, where comparative studies demonstrate that the differences in the shape and size of some human bones are determined basically by environmental factors and genetic influence, besides the pattern and rate of growth and development and the type of bone remodeling.[11,5]

CONCLUSIONS

The presence of a rhomboid fossa can be used as a qualitative criterion for the differentiation of sex in bodies of Brazilian individuals, because 97.1% of clavicles of the individuals of females did not posses a rhomboid fossa.

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