International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Sex Determination by Using Mandibular Ramus Posterior Flexure – A Prospective Study

S. Shivaprakash[1], A.G.Vijaykumar[2*]

[1]Assistant professor, Dept of Anatomy, Travancore Medical College, Kollam, Kerala, India.
[2]Assistant professor, Dept of Forensic Medicine, Adhichunchanagiri Institute of Medical Sciences, B G Nagar, Karnataka, India.

[*]Correspondence Email: vijay.fmt@rediffmail.com

Received: 10/11//2013 *Revised: 09/12/2013* *Accepted: 20/12/2013*

ABSTRACT

Introduction- The four main features of biological identity are sex, age, stature and ethnic background. The identification of human skeletal remains is considered an initial step in forensic investigations and is crucial for further analysis.
Objective - Determination of sex by using mandibular ramus posterior flexure.
Materials and methods - The study was conducted on 104 adult mandibles, which were obtained from the mandibles available in the department of anatomy, Kasturba Medical College, Mangalore and from the students of 1st year MBBS.
Results - Using Mandibular ramus posterior flexure, out of 104 mandibles, we could determined the morphological sex in 79 mandibles with 76% accuracy rate and sex was misclassified in 25 mandibles. In the present study, overall predictive of accuracy of (76%) was attained in diagnosing the sex by observing the mandibular ramus posterior flexure. Out of 55 male mandibles, sex was accurately determined in 44 cases with accuracy rate of 80% and out of 49 female mandibles, sex was accurately determined in 35 cases with accuracy rate of 71%.
Conclusion - Consequently, the identification of sexual dimorphism still relies almost exclusively upon as many dimorphic skeletal morphological features as possible. Therefore, the mandibular ramus flexure must be considered for anthropological and forensic purposes as one additional feature among the many parameters used in sex assessment of any skeletal series.

Key words: mandible, sex, mandibular ramus posterior flexure.

INTRODUCTION

The four main features of biological identity are sex, age, stature and ethnic background. The identification of human skeletal remains is considered an initial step in forensic investigations and is crucial for further analysis. The reliability of sex determination depends on the completeness

of the remains and the degree of sexual dimorphism inherent in the population. When the entire adult skeleton is available for analysis, sex can be determined up to 100% accuracy, but in cases of mass disasters where usually fragmented bones are found, sex determination with 100% accuracy is not possible and it depends largely on the available parts of skeleton. [1] As evident from the earlier studies, skull is the most dimorphic and easily sexed portion of skeleton after pelvis, providing accuracy up to 92%. But in cases where intact skull is not found, mandible may play a vital role in sex determination as it is the most dimorphic, largest, and strongest bone of skull. [1]

Three basic criteria should guide the choice of skeletal elements that may be useful indicators of sex: 1) their morphology should clearly reflect anatomic and/or physiologic sex differences, 2) they should be able to withstand the rigors of skeletonization and fossilization, and 3) ideally the trait should be recognizable through time and across paleospecies. [2] Mandible identification is important in medico-legal and anthropological work. Sex can be more accurately determined after the attainment of puberty. The differences are well marked in bony pelvis and skull. Mandible next to the pelvis in human remains will help us in identification of age, sex and race. [3]

Presence of a dense layer of compact bone makes it very durable and hence remains well preserved than many other bones. The relative development (size, strength, and angulation) of the muscles of mastication is known to influence the expression of mandibular dimorphism as masticatory forces exerted are different for males and females.

Hence, this paper aims to evaluate the usefulness of mandibular ramus posterior flexure in sex discrimination and propose the use of same in forensic.

Objectives: Determination of sex by using mandibular ramus posterior flexure.

MATERIALS AND METHODOLOGY

The study was conducted on 104 adult mandibles, which were obtained from the mandibles available in the department of anatomy, Kasturba Medical College, Mangalore and from the students of 1st year MBBS.

The randomly numbered bone was subjectively sexed, independently, using morphological features, given in the standard text books of Anatomy, Anthropometry, and Forensic science. Later Mandibles were reclassified as males and females by observing Mandibular ramus posterior flexure as suggested by Loth and Henneberg (1996).

According to Loth and Henneberg, adult human males exhibit an angulation of the posterior border of the mandibular ramus at the level of the occlusal surface, where as females display generally a straight posterior border of the ramus. When a flexure is present on female mandibles, the feature is never at the level as in males: the flexure is near by the condylar process or close, above the gonial angle. A score of +1 is assigned if the flexure is visible at the occlusal level and '-1' in other cases. If the triat is badly expressed a score of 0 is assigned. For each mandible the scores for the left and right ramus are added and mandibles with score of 0 to +2 are identified as males, and mandibles with scores of -1 or -2 are identified as females.

RESULTS

Table 1: Predictive accuracy of mandibular ramus flexure as a singular morphologic indicator of sex among males and females.

SI NO	MORPHOLOGICAL SEX	RT MRPF SCORE	LT MRPF SCORE	TOTAL SCORE	SEX BY MRPF	
1	M	1	1	2	M	
2	F	-1	0	-1	F	
3	M	-1	1	1	M	
4	M	1	0	1	M	
5	M	-1	0	-1	F	**WRONG**
6	M	1	-1	0	M	
7	F	0	-1	-1	F	
8	M	-1	-1	-2	F	**WRONG**
9	F	-1	0	-1	F	
10	F	-1	0	-1	F	
11	M	0	1	1	M	
12	F	-1	-1	-2	F	
13	F	-1	0	-1	F	
14	M	1	-1	0	M	
15	F	-1	0	-1	F	
16	M	1	0	1	M	
17	M	1	1	2	M	
18	F	1	0	1	M	**WRONG**
19	F	0	0	0	M	**WRONG**
20	M	0	-1	-1	F	**WRONG**
21	F	-1	-1	-2	F	
22	M	1	1	2	M	
23	F	-1	0	-1	F	
24	F	1	0	1	M	**WRONG**
25	F	1	1	2	F	
26	M	1	-1	0	M	
27	F	-1	-1	-2	F	
28	F	-1	0	-1	F	
29	F	-1	0	-1	F	
30	M	0	1	1	M	
31	F	0	1	1	M	**WRONG**
32	F	-1	0	-1	F	
33	F	0	0	0	M	**WRONG**
34	M	0	1	1	M	
35	M	1	1	2	M	
36	M	0	1	1	M	
37	M	1	1	2	M	
38	F	-1	-1	-2	F	
39	M	0	1	1	M	
40	M	0	-1	-1	F	**WRONG**
41	M	1	0	1	M	
42	M	1	0	1	M	
43	F	-1	-1	-2	F	
44	F	-1	-1	-2	F	
45	M	-1	0	-1	F	**WRONG**
46	F	-1	1	0	M	**WRONG**
47	M	1	0	1	M	
48	M	1	1	2	M	
49	F	-1	1	0	M	**WRONG**
50	F	0	0	0	M	**WRONG**
51	M	0	1	1	M	
52	F	-1	0	-1	F	
53	F	-1	-1	-2	F	
54	M	0	0	0	M	
55	M	-1	1	0	M	
56	F	1	-1	0	M	**WRONG**
57	M	1	1	2	M	
58	M	0	1	1	M	
59	M	-1	0	-1	F	**WRONG**
60	M	1	1	2	M	
61	F	-1	-1	-2	F	
62	M	1	0	1	M	
63	M	-1	-1	-2	F	**WRONG**
64	F	-1	-1	-2	F	
65	M	1	0	1	M	
66	F	-1	0	-1	F	
67	M	1	0	1	M	
68	F	-1	0	-1	F	
69	M	0	-1	-1	F	**WRONG**
70	M	1	1	2	M	
71	F	-1	0	-1	F	
72	F	-1	-1	-2	F	
73	M	-1	1	0	M	
74	M	0	0	0	M	
75	M	1	1	2	M	

Table. 1. ***Contd.*** Predictive accuracy of mandibular ramus flexure as a singular morphologic indicator of sex among males and females.

76	F	0	-1	-1	F	
77	F	1	0	1	M	**WRONG**
78	M	1	-1	0	M	
79	F	-1	-1	-2	F	
80	M	0	-1	-1	F	**WRONG**
81	F	1	-1	0	M	**WRONG**
82	M	1	0	1	M	
83	F	-1	0	-1	F	
84	F	0	0	0	M	**WRONG**
85	M	1	1	2	M	
86	M	-1	0	-1	F	**WRONG**
87	F	-1	-1	-2	F	
88	F	-1	0	-1	F	
89	F	1	-1	0	M	**WRONG**
90	F	1	1	2	M	**WRONG**
91	M	1	1	2	M	
92	F	-1	-1	-2	F	
93	M	1	0	1	M	
94	M	1	1	2	M	
95	M	0	-1	-1	F	**WRONG**
96	M	1	0	1	M	
97	M	1	1	2	M	
98	F	-1	-1	-2	F	
99	M	0	0	0	M	
100	F	-1	-1	-2	F	
101	M	0	1	1	M	
102	M	1	1	2	M	
103	F	0	-1	-1	F	
104	F	-1	-1	-2	F	
		OVERALL				
		MALE		**FEMALE**		
	Total Score	**Number**	**Percentage**	**Number**	**Percentage**	
	-2	**2**	**3.6**	**16**	**32.6**	
	-1	**9**	**16.4**	**18**	**36.7**	
	0	**9**	**16.4**	**9**	**18.4**	
	+1	**20**	**36.4**	**4**	**8.2**	
	+2	**15**	**27.2**	**2**	**4.1**	
	TOTAL	**55**	**100**	**49**	**100**	

Using mandibular ramus posterior flexure, out of 104 mandibles, we could determined the morphological sex in 79 mandibles with 76% accuracy rate and sex was misclassified in 25 mandibles.

DISCUSSION

In the present study, overall predictive of accuracy of (76%) was attained in diagnosing the sex by observing the mandibular ramus posterior flexure. Out of 55 male mandibles, sex was accurately determined in 44 cases with accuracy rate of 80% and out of 49 female mandibles, sex was accurately determined in 35 cases with accuracy rate of 71%.

In 1996, Loth & Henneberg have claimed an astonishing 94.2 % accuracy for sexing the mandibles of a combined African and American sample (including whites, blacks and native Americans) using a single character. Their study suggested that the degree of flexure of the posterior border of the ramus at the level of the occlusal plane of the teeth is as reliable for sex determination as the pelvis. [2]

In 1998, Muller tested procedures for determining sex from a single mandibular character and found that gonial flaring provides a more accurate indicator of sex (76%) than either chin shape or ramus flexure. [4]

In 1998, Donnelly et al. undertook a blind test of mandibular ramus flexure as a predictor of sex, and reported that the association between sex and ramus flexure was weak and that the trait could not be consistently identified. [5]

In 2001, Loth & Henneberg indicated that it was possible to determine the sex with a high degree of accuracy (81%) in mandibles of children by observing the shape of the mandibular body. [6]

In 2008, Ivan Claudio SG et al determined the sex of sub adult Brazilian mandibles by observing the shape mandibular body. They performed a blind test on two sets of sample collection using parameters described by Loth & Henneberg. The results showed between 57.5 and 60.5% of accuracy, being the most sensitive test for determining male (70%) than for females (38-46%). The results presented are lower than those reported by Loth & Henneberg and justify the need to assess the diagnostic methods of sex in sub adults in specific populations. [7]

In a study done by Nancy AFK, Hazem MM and Tamer MAW, a moderate overall predictive of accuracy of (83%) was attained in diagnosing the sex by observing the posterior edge of the mandibular ramus in adult Egyptians orthopantomographs. [8]

CONCLUSION

Consequently, the identification of sexual dimorphism still relies almost exclusively upon as many dimorphic skeletal morphological features as possible. Therefore, the mandibular ramus flexure must be considered for anthropological and forensic purposes as one additional feature among the many parameters used in sex assessment of any skeletal series.

Source of financial or other assistance - Nil
Competing Interests - The authors declare that they have no competing interests. Both authors have read and approved the final manuscript.
Consent - was taken from the institutional ethics committee.

REFERENCES

1. Indira AP, Markande A, David MP. Mandibular ramus: An indicator for sex determination - A digital radiographic study. J Forensic Dent Sci 2012: 4:58-62.
2. Loth SR and Henneberg M. Mandibular ramus flexure: a new morphologic indicator of sexual dimorphism in the human skeleton. American journal of physical anthropology 1996: 99; 473-485.
3. Kumar MP, Lokanadham S. Sex determination & morphometric parameters of human mandible. Int J Res Med Sci 2013: 1:93-6.
4. Muller EK. A test of the accuracy of techniques used to determine sex in the mandible. Am J Phys Anthropol 1998: 26:168–9.
5. Donnelly SM, Hens SM, Rogers NL, Schneider KL. Technical note: a blind test of mandibular ramus flexure as a morphologic indicator of sexual dimorphism in the human skeleton. Am J Phy Anthropol 1998: 107:363-6.
6. Loth SR, Henneberg M. Sexually dimorphic mandibular morphology in the first few years of life. Am J Phy Anthropol 2001: 115:179-86.
7. Ivan Claudio SG. Blind test of mandibular morphology with sex indicator in subadult mandibles. Int J Morphol 2008:26(4):845-8.
8. Tamer M. 2012, Predictive Accuracy of Mandibular Ramus Flexure as a Morphologic Indicator of Sex among Adult Egyptians, Munich, GRIN Publishing GmbH, http://www.grin.com /en/e-book/202465/predictive-accuracy-of-mandibular-ramus-flexure-as-a-morphologic-indicator.

How to cite this article: Shivaprakash S, Vijaykumar AG. Sex determination by using mandibular ramus posterior flexure - a prospective study. Int J Health Sci Res. 2014;4(1):155-159.

****