Section: Forensic Medicine and Toxicology

Research Article

ESTIMATION OF AGE FROM MORPHOLOGICAL CHANGES SEEN IN PUBIC SYMPHYSIS OF FEMALE HIP BONE OF SOUTH-EAST INDIA

Madanraj M[1], Valliappan S[2], Shaik Abdul Sameer M[3], Alagammai AL[4]

[1]Assisstant Professor, Department of Forensic Medicine and Toxicology, Govt. Medical College, Pudukkottai, India.
[2]Assisstant Professor, Department of Forensic Medicine and Toxicology, Govt. Medical College, Pudukkottai, India.
[3]Assisstant Surgeon, Government Hospital, Kodavasal, Tamil Nadu, India.
[2]Assisstant Professor, Department of Pathology, Govt. Medical College, Pudukkottai, India.

Received : 28/09/2022
Received in revised form : 12/11/2022
Accepted : 30/11/2022

Keywords:
Pubic bone, Female, Age estimation, Pubic symphysis, Mckern and Stewart.

Corresponding Author:
Dr. Valliappan S,
Email: dr.valliappan17@gmail.com.

DOI: 10.47009/jamp.2022.4.5.182

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2022; 4 (5); 873-876

Abstract

Background: Identification plays a pivotal role in forensic crime investigation and to administer justice at times. Hip bone, most important long bone of our body, helps us to estimate the age of the individual & further leads to establishment of the identity. The present study was carried out to examine if Mckerm and Stewart method (1957) could be used to estimate the age with pubic symphysis of females of Pudukkottai District, South eastern part of India. The study material of the pubic bones was collected from 90 deceased females of known ages, who were brought for post mortem examination at Departmnet of Forensic Medicine and Toxicology, Government Medical College and hospital, Pudukkottai after obtained proper informed consent from legal heirs of the deceased. The study observed that the component based method of age estimation of Mckerm and Stewart cannot be applied in its native form to estimate the age of South Eastren Indian Population. The study revealed that the changes noted in analysis of age were more defined to young population and were gradually obscured as the age advances. It is also found that the changes categorizing the bone in a particular age group starts at a later stage in our study and when compared to the previous studies. Hence it is of inference that pubic symphysis examination helps us to estimate age in female individuals more precious with bigger sample and with more categorizing of the characteristics of the hip bone with future studies.

INTRODUCTION

Anthropological findings are often helpful in establishing a presumptive identification that may lead to a positive identification. Morphological changes in the innominate bones and their relationship in general to skeletal age have long been recognised.[1] Interestingly, the pubic symphysis, with relative lack of mobility and its slightly protracted period of development makes this region ideal for age identification. The right and left hip-bones (ossa innominata) meet in the midline in front to form the pubic symphysis.[2] They do not actually articulate and separated throughout life by the symphyseal cartilage. The estimation of chronological age from the maturational status of unknown skeletal remains is important.[3]

Todd (1921), Brooks (1955) and McKern and Stewart (1957) are all methods in existence are less reliable for females than males in age estimation.[4] For example: Todd (1921) method underestimates the age of nulliparous females and overestimates the age of parous group. The Mckern and Stewart method is recommended for males, as the samples used are from dead American males of mostly younger age during the korean war. Their method underestimates the age of older individuals and lack statistical rigor.[5]

TEN PHASES IN POSTNATAL AGE-CHANGES IN THE PUBIC SYMPHYSIS*

Phase	Symphyseal Surface	Ossific Nodules	Ventral Margin	Dorsal Margin	Extremities
First 18–19	Rugged horiz. grooves, furrows and ridges	None	None	None	No definition
Second 20–21	Grooves filling dorsally and behind	May appear on sym. surf.	Ventral bevel begins	Begins	No definition
Third 22–24	Ridges and furrows progressively going	Present almost constantly	Beveling more pronounced	More definite dorsal plateau begins	No definition
Fourth 25–26	Rapidly going	Present	Beveling greatly increased	Complete dorsal plateau present	Lower commencing definition
Fifth 27–30	Little change	May be present	Sporadic attempt at ventral rampart	Completely defined	Lower clearer: upper extremity forming
Sixth 30–35	Granular appearance retained	May be present	Ventral rampart complete	Defined	Increasing def. upper and lower
Seventh 35–39	Texture finer; change due to diminishing activity	May be present	Complete	Defined	Carry on
Eighth 39–44	Smooth and inactive; no "rim"	May be present	No lipping	No lipping	Oval outline complete, extremities clearly outlined
Ninth 44–50	Rim present	May be present	Irregularly lipped	Uniformly lipped	Carry on
Tenth 50+	Erosion and erratic ossification	← Broken down →			

* From Krogman, '49, Table 3.

The parturition affects pubic symphysis more than auricular surface when determining age at death.[6] Gilbert and Mckern (1973) noted female of the same

ISSN (O): 2687-5365; ISSN (P): 2753-6556

age may appear to be ten years younger based on the ventral rampart and ten years olders based on the dorsal plateau, as females are subjected to trauma from child birth.[7] Lots of remarkable research has been carried out in other parts of the world to check the reliability of employing pubic symphysis in age determination. However, there are very few studies conducted in this region regarding the same. The proposed research aims to study the anatomical changes of the symphyseal surface of the pubic bone to know the different changes, in a known age group, in the female population belonging to Pudukkottai District of Tamil Nadu. The findings of this study would assist in consolidating existing age determination methods employed in the Pudukkottai district and aid in the medicolegal work carried out. So we are presenting a comparative study to assess the reliability of the Mckern and Stewart method to study the age related morphological changes in the pubic symphyseal region of female bones.[8,9]

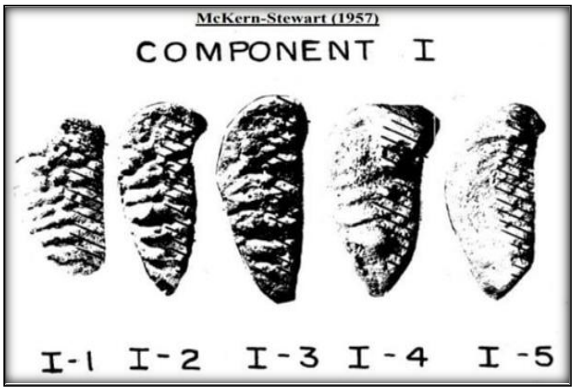

Figure 1: Components of Pubic bone changes

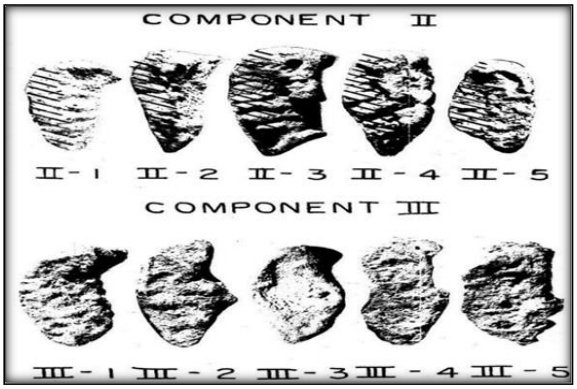

Figure 2: Components of Pubic bone changes

MATERIALS AND METHODS

The present prospective cross sectional research was conducted on 90 cases received for medico-legal postmortem examination over a period of 18 months at Department Forensic Medicine and Toxicology, Government Medical College and Hospital, Pudukkottai of South Eastern District of Tamil Nadu.

The pubic bones forming pubic symphysis are collected from deceased females of known age (between 15-45 years) and natives of Pudukkottai district, who were brought for autopsy examination. A written informed consent was obtained from the legal heirs of the body at the time of autopsy for the removal of the pubic symphysis. The bone specimen was obtained by extending the "T' shaped incision and cutting the superior and inferior pubic rami using electric saw after the soft tissue in the suprapubic region was cleared. The retrieved bone sample was properly tagged with age and date of collection and was buried in the ground at a depth of about 2 feet for a period of 6-8 weeks. The bones were dug out and cleaned. The symphyseal surface was studied for age related morphological changes with a hand lens as described by Mckern and Stewart method.

Inclusion Criteria

1. All medico legal cases of female gender of known age ranging from 15 to 45 years, who were brought for autopsy examination.

Exclusion Criteria

1. Unknown unclaimed bodies
2. All medico legal Male cases
3. Cases with fracture of lower limb, pelvic degenerative disease or fracture of pelvis, suspected bone pathology or congenital anomalies.
4. Refusal by the legal heirs to give written consent for sample retrieval.

After collecting the data, it was entered in WPS office sheets. Statistical analysis was done in SPSS 23. Continuous data were expressed in terms of Mean±Standard deviation and. Categorical variable were expressed in terms of numbers(percentages). P value of <0.05 is considered as significant

The objectives of the study are as follows

There are very few studies conducted in this region to check the reliability of employing pubic symphysis in age determination regarding the same. Our hypothesis is that the changes in pubic symphysis with respect to the female pelvis, the trauma of pregnancy, has repeatedly surfaced as a potential contributor to its apparently higher variability. Hence the proposed research aims to study the anatomical changes of the symphyseal surface of the pubic bone to know the different morphological changes.

RESULTS

The present study was conducted on 90 pubic bones of females between the age group of 15 to 45 years of females which were brought for autopsy over a period of 18 months. The symphyseal surface of both right and left pubic bones was analysed in each case using component based analysis devised by Mckern and stewart and age was deduced.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 1: Age range and mode for individual components in McKern and Stewart method

Stage	Age range(in years)	Mode
Component I		
0	17-18	17.0
1	18-21	18.0
2	18-21	19.0
3	18-24	20.0
4	19-29	23.0
5	23+	31.0
Component II		
0	17-22	19.0
1	19-23	20.0
2	19-24	22.0
3	21-28	23.0
4	22-33	26.0
5	24+	32.0
Component III		
0	17-24	19.0
1	21-28	23.0
2	24-32	27.0
3	24-39	28.0
4	29+	35.0
5	38+	.....

Table 2: Number of cases, age range, mean and standard deviation for the total scores obtained in the present study

Total Score	Number of cases	Age range	Mean	Standard Deviation
0	0	-	-	-
1-2	0	-	-	-
3	6	18-20	19	1.123
4-5	6	21-22	21.67	1.233
6-7	3	24	24	-
8-9	6	23-25	24	2.414
10	6	25-27	26	2.414
11-13	36	25-34	29.89	4.518
14	9	31-37	34.75	3.122
15	18	38-49	43.37	3.654
Total	90			

Table 3: The number of cases, age range, mean age and standard deviation for the total scores calculated in the present and McKern and Stewart study

Total Score	Present study		McKern and Stewart Study			
	Number Of cases	Mean	Standard Deviation	Number of cases	Mean	Standard Deviation
0	0	-	-	7	17.3	0.49
1-2	0	-	-	76	19.0	0.79
3	6	-	1.123	43	19.8	0.83
4-5	6	21.67	1.233	51	20.8	1.13
6-7	3	24	-	26	22.4	0.99
8-9	6	24	2.414	36	24.1	1.93
10	6	26	2.414	19	26.1	1.87
11-13	36	29.89	4.518	56	29.2	3.33
14	9	34.75	3.122	31	35.8	3.89
15	18	43.37	3.654	4	41.0	6.22
Total	90			349		

DISCUSSION

The accurate estimation of age at death represents an important component in the field of Forensic Anthropology. Various parts of the human skeletal remains have been studied individually and in combination to percolate into a scientifically sound practice of age determination with a wider scope of application. This process is not only tedious but also daunting as there are a multitude of factors which result in the variations seen in the human remains.

The present study attempts to analyze the age changes observed on the symphyseal surface of Female pubic bones which were collected during post mortem examination from the natives of Pudukkottai District of South Eastern part of India. This study was based on the findings of McKern and Stewart (1957) and the results obtained from the present study were compared to the reference study and other similar researches. The total number of cases for each of the total scores obtained is compared with that of the reference study and depicted in Table no.3. The age range chosen for the study was 18-45 years, none of the pubic bones in the present study belonged to the scores 0 and 1-2 in contrast to the reference study. It is observed that although the study sample was

ISSN (O): 2687-5365; ISSN (P): 2753-6556

selected to include individuals belonging to the age group of 18 to 45 years, the youngest individual in the study is 18 years old in contrast to the sample study where higher number of people are found in the less than 21 years age group. The changes in the symphyseal surface for the total scores on the extremes appear much earlier and later in the study conducted by Singh BK when compared to the current study.

The changes in the symphyseal surface of pubic bones were well defined in the earlier scores which served us with a better clarity at interpretation of age in comparison with the age changes in the later stage, the accuracy of interpreting the age changes diminished with the onset of degenerative changes.

CONCLUSION

The age changes displayed in the pubic symphysis of the bones of the natives of Pudukkottai District were delayed in comparison to the samples in the reference study. Thus, the findings of the Mckem &Steward study cannot be used in its original form in this population.

The observation made during the comparison of the findings of other Indian studies with the present research highlights the fact there are differences in the age groups of the bones showing the same total scores highlighting regional variation in the same country.

The use of technology like CT has to be considered for better estimation of Changes in the Symphyseal Surface with age. The standard thus obtained age mechanized and objective in comparison with the bias that could arise due to observer variation in the traditional naked eye examination technique followed.

Declaration by Authors
Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: No conflict of interest.

REFERENCES

1. Reddy KSN, Murty OP. Identification. In: The Essentials of Forensic Medicine and Toxicology. Hyderabad: The Health Sciences Publishers, 2014, p. 57-65.
2. Vij K. Identification. In: Textbook of Forensic Medicine and Toxicology Principles and Practice. New Delhi: Reed Elsevier India Private Limited, 2014. p. 34-5.
3. Dudzrik B, Langley NR. Estimating age from the pubic symphysis: A new component-based system. For Sci Int. 2015; 257:98-105.
4. Meindl RS, Lovejoy CO, Mensforth RP. Walker RA. A Revised Method of Age Determination Using the Os Pubis, With a Review and Tests of Accuracy of Other Current Methods of Pubic Symphyseal Aging. Am J Phys Anthropol. 1985:68:29-45.
5. Dudzik B. Langley NR. Estimating age from the pubic symphysis. A new component-based system. Forensic Sci Int. 2015; 257:98-105
6. Becker I, Woodley SJ. Stringer MD. The Adult Human Pubic Symphysis: A Systematic Review, J Anat. 2010,217:475-87.
7. Krogman WM, Iscan MY. Skeletal age: Post cranium. In: The Human Skeleton is Forensic Medicine Springfield Charles C Thomas; 1986 p. 148-54.
8. Mckern TW, Stewart TW, Skeletal age changes is young Americas males. Analyzed from the standpoint of age identification Environmental Protection Research Division and US Army, Technical Report No. EP-45, 1957.
9. Krogman WM, Iscan MY. Skeletal age: Post cranium. Io: The Human Skeleton in Forensic Medicine. Springfield: Charles C Thomas, 1986 p. 154-64.
10. Sharma G. Gargi J, Kasey G. Singh D. Rai H. Sandhu Determination of Age from Pubic Symphysis: An Autopsy Study. Med Sci Law, 2008;48(2): 163-9.
11. Kumar A. Tyagi AK, Banerjee KK. Estimation of Age from Pubic Symphysis Metamorphosis in East Delhi Population. J Indian Acad Forensic Med. 2009;31(1):22-4,
12. Pal GP, Tamankar BP Preliminary Study of Age Changes in Gujrati (Indian) Pubic Bones. Indian J Med Res. 1983:78:694-701
13. Singh BK. Estimation of Age by Pubic Bone an Autopsy Based Comparative Study. J Kar Med Leg Soc. 2013;22(1)21-6.
14. Mahajan BK. Variability and its Measures. In Methods in Biostatistics, 7th ed. Haryana: Jaypee Brothers Medical Publishers (P) Ltd: 2010 p.60-6
15. Sakaue K. Application of the Suchey-Brooks system of pubic age estimation to recent Japanese skeletal material. Anthropological Science 2006:114: 59-64
16. Klepinger, L. L. Katz, D. Micozzi. M. S Carroll. L. Evaluation of Cast Methods for Estimating Age from the Os Pubis. Journal of Forensic Sciences. 1992, 37(3):763-770
17. Djuric M. Djonic D, Nikolic S, Popovic D. Marinkovic J. Evaluation of the Suchey-Brooks Method for Aging Skeletons in the Balkans. J Forensic Sci. 2007; 52(1) 21-3.
18. Biwasaka H, Sato K. Aoki Y, Kato H, Maero Y. Tanjin Tet al. Three Dimensional Surface Analyses of Pubic Symphyseal Faces of Contemporary Japanese Reconstructed with 3D Digitized Scanner. Legal Med 2013:15(5) 264-8
19. Sarajlić N. Gradaščević A. Morphological characteristics of public symphysis for age estimation of exhumed persons. Bosn J Basic Med So 2012 12 (1) 51-54.

ISSN (O): 2687-5365; ISSN (P): 2753-6556