ESTIMATION OF AGE BY PUBIC BONE AN AUTOPSY BASED COMPARATIVE STUDY

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Abstract

Determination of age after 25 years becomes is a difficult task as the eruption of all teeth would have been completed as well as the fusion of secondary centers of ossification of the bones. The age changes on the bones are helpful in estimating the age within a reasonable range. Amongst all bony changes, changes in morphological surface of symphysis pubis are most reliable between 20 to 40 years of the age. Bony changes depend on many factors like race, nutrition, geographical location etc. So a comparative study of age estimation by the pubic bone removed during autopsy with the studies conducted by other workers was carried out by using Mckern- Stewart criteria for scoring.

Keywords: Age estimation, Pubic bone, Anthropology. Autopsy.

Introduction

Question of identification arises in day to day medico-legal practice, both in civil cases such as marriage, disputed sex, missing persons, insurance claims, person and inheritance claims etc. as well as in criminal cases like persons accused of assault, rape, murder, absconding prisoners etc. The methods used for fixing the identification in living and dead are almost same except certain criteria's. But in dead the availability of ante mortem records help in comparing the findings on the body , which in turn depend on the degree of preservation of the remains i.e. whether intact, decomposed, burned, fragmented, semi skeletonized or skeletonized.

Bones resists putrefaction and destruction by animals for a longer period. Skeletal remains contain an abundance of information, which can help in reliable determination of important criterias of identification like age, sex, race, stature of the individual etc.

Ossification centers and dentition are used for estimation of age up to 25 years. After 25 years, skeletal age can be assessed up to within + 5 years by the state of cranial sutures and of the bony surfaces of symphysis pubis. Sutures tend to obliterate after mid-twenties onwards to alleged age but the process begins from within and shows wide individual variations. Amongst all bony changes, changes in morphological surface of symphysis pubis are most reliable between 20 to 40 years of the age[1].

It has been observed by various workers that developmental and regressive changes of the bones are influenced by various factors such as diet, hereditary, nutrition, social, racial, environmental and geographical location etc. Most of these factors are different in different parts of the world and also in different parts of a country especially a large country like India. So it is not possible to have a universal standard that can be devised for estimation of age from bones.

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It is very much true with pubic bone. Observation made by the workers in other countries may not be the same as observations made in Indian population. Delhi being a capital of India and a true cosmopolitan city its population includes all important ethnic groups of the country settled in this place representing a mini India. Anatomical changes of symphyseal surface of the pubic bone was studied in the Delhi population so as to know the different changes in a known age group so as devise a standarad for Indian population .

Our current study was carried out by using Mckern- Stewart criteria for scoring and is compared with other works done in India.

Materials and methods

The study was conducted on 50 cases autopsied at the Department of Forensic medicine, Maulana Azad Medical College, New Delhi.

Study design: Descriptive cross-sectional study**.**

Materials

Human pubic bone (body, part of superior ramus and part of inferior ramus of pubis) belonging to different known age groups and sexes were used for the study .These specimens were collected from the bodies autopsied at the Department of Forensic Medicine at Maulana Azad Medical College mortuary New Delhi. Due consent was obtained from the concerned persons and ethical clearance was obtained from the Ethical committee of the college before starting for the study.

Inclusion criteria

The cases of known age brought for medico legal postmortem examination. Age was confirmed by documentary evidences. Persons above the age of 12 years, even though the literature states that changes in symphyseal surface of pubic bone starts at 17 years of age, we included 12 years of the age for baseline morphology of symphyseal surface of pubic bone and to detect any changes before 17 years in our study population .

Exclusion criteria

1. Unknown, unclaimed bodies whose age is uncertain.
2. Cases showing fracture of limb, pelvic degenerative disease or fracture of pelvis.

Method of removal of pubic symphysis at autopsy

The soft tissue on the supra pubic region was displaced and cleared in order to have workable space. Soft tissue overlying pubic symphysis was retracted as far as possible. Electric bone cutting saw was used for cutting the bone. Two lateral cuts were made on the superior pubic rami about 2 inches from midlines, inferior pubic rami was cut in similar manner. Then soft tissue was separated and the specimen was extracted from the body. The specimens were further dissected to remove any soft tissue without damaging underlying bone by blunt dissection.

Processing

The specimens were processed by chemical method. After proper tagging with patient's details, the specimens were placed in

bath of antiformin (150 grams of sodium bicarbonate and 100 grams of bleaching powder with 1 litre of water mixed with 1 liter of 15% solution of sodium hydroxide) solution sufficient to cover the specimens. For fresh tissue 1 part of antiformin to 8 to10 parts of water was used. The solution was heated just short of boiling and was maintained at this temperature. The specimens were examined from time to time to see how quickly it is being denuded. In most of the specimens additional method like burying in sand was needed to clean the soft tissue. When the specimens were totally free of soft tissue then the symphyseal surface was studied for morphological changes using a hand lens. Age was precisely recorded from police records (inquest papers). The age was further verified from municipal corporation records, i.e. birth certificate, election card etc.

The Study materials were scored on the pattern as described by Mckern – Stewart.

Statistical evaluation

Mean age in years was used for statistical evaluation.

Observations and results'

The present study comprises a total of 53 specimens between the age group of 12-75 years, who were the residents of Delhi. None of them had ever suffered from any disease or deformity that can affect the bone growth during their life. Initially scoring for all 3 components was done and later all 3 scores were added to get final scoring between 0-15 for comparison.

Discussion

Todd (1920) has made a substantial contribution in evaluating the role of pubic symphysis as an age indicator[2]. He called the symphyseal surface of pubis as a modified diaphyso-epiphyseal plane and expected it to show a metamorphosis as an ageing feature. He evolved a system of assessing age from 10 stages of pubic metamorphosis.

In 1957, Mckern and Stewart worked on 450 pairs of pubic symphysis for estimation of age in males covering the age range (17-50 years) [3]. This study was based on Todd's scoring method but they selected three components, i.e. dorsal plateau, ventral rampart and symphyseal rim. Five development stages were described for each component. Mckern and Stewart noted that their system was more reliable for the age period between 17 and 30 years. This method was easier and more accurate than the Todd's method because the scoring eliminated a subjective bias in interpretation of bone metamorphosis.

Glibert at al. in 1973 conducted studies on female pubic symphysis based on the formula of Mckern and Stewart. This work was devoted to the development of a standard for aging female pubic symphysis for the age range 17-55 years.120 samples were collected from female individuals of known ages and parity. Besides, 60 more bones from Stewart collection were also studied. The age of samples ranged between 17 and 55 years. He established 3 components namely the dorsal demi-face, the ventral rampart and the symphyseal rim. Each component was further divided into six (0-5) stages of metamorphic change [4.] It was observed that morphological development of females is different from that of males. Females are subject to trauma during child-birth. This may cause an individual female os pubis to appear older than it actually is. The dorsal surface of female

symphysis was seen to undergo flattening at faster rate as compared to males. It was further noted that in females, the ventral (demiface) is beveled away from dorsal demiface whereas an imaginary line separated the two demi-faces in males. They concluded that female of the same age may appear to be ten years younger based upon the ventral rampart and ten years older based upon the dorsal plateau.

Gllibert in 1973 carried out the comparison of age estimates of female pelvis obtained by the new female standard with those obtained by the male standard[5]. 15 females pelvis were aged by both the male standard and a newly developed female standard. It was found that the male standard significantly under aged females 40 years or older in the test sample, although it worked out very well for pubic between 17-40 years of age. The female standard, however, yielded results within useful limits in all age groups.

In 1979, J.M.Suchey carried out work to assess the reliability of the Gllibert Mckern method for aging the female os pubis[6]. He designed a study in which 23 forensic anthropologist were asked to estimate the age of 11 female pubis of known age. There was a great deal of variability in the responses of these 23 participants. Three, four and five different responses (out of a 6 scale system) were given for each component of each pubic bone. Only 51% of the assessment showed age ranges which included the known age of specimens. It was concluded that it is difficult for an observer to select the exact stage of development which is present in any of the three components using the Gllibert- Mckern method. Analysis of the errors showed that one of the main problems of the Gllibert-Mckern system was the difficulty in judging whether the ventral rampart was building up or breaking down. Same difficulty was experienced while assessing component III (the symphyseal rim).

Pal GP and Tamankar BP[7] published in 1983 a preliminary study of age changes in pubic bones in Gujarati population. They found that changes in pubic symphysis appear early in Gujarati population but completed late as compared to Mckern-Stewart study.

Sinha A and Gupta V [8] findings were in contrast to Hanihara, Brooks and Pal who found that Todd's criteria tended to underage the specimens.

A study by Gaurav Sharma demonstrated that various stages of symphyeal rim changes were seen at a later age in Indians as compared with American pubic bones examined by Mckern and Stewart[9]. This study confirms pubic symphysis as useful age indicator especially for adult male. There were no differences in the urban and rural populations to the metamorphic changes in the symphyseal surface of pubic bone

When the present study was compared with the Pal and Tomarkar`s study, it shows that till score 4 to 5 changes appear early in Pal and Tomarkar study, then up to 6 to 15 changes appear late in Pal and Tomarkar` study. It shows that morphological changes in O.S. pubis appears early in the Pal and Tomarkar`s study (Gujrati population), while maturation of the O.S. pubis occurs late as compare to our study (Delhi population).

When the present study was compared with the Sinha and Gupta's study, it shows in score 6 to

7, 10 and 14 changes appear early in their study, while in remaining scores the changes appear late . It shows that morphological changes in O.S. pubis appears early in Sinha and Gupta's study, while maturation of the O.S. pubis occurs more or less at the same age in our study (Delhi population).

Conclusion

The morphological changes of the symphyseal surface starts late in our study when compared to Pal-Tamankar`s study in Gujarati population. These differences may be due to racial, nutritional, environmental or regional variations. Morphological changes of the symphyseal surface completed early in our study as compared to Pal-Tamankar`s study. In the present study it was observed that the onset of morphological changes start late and complete early when compared with Sinha and Gupta's study conducted on Delhi population. So by this study it concluded that for age estimation from symphyseal surface of pubic bone, factors like geographic location, race, nutrition etc. should be kept in mind and preferably a recent data for local population if available should be used.

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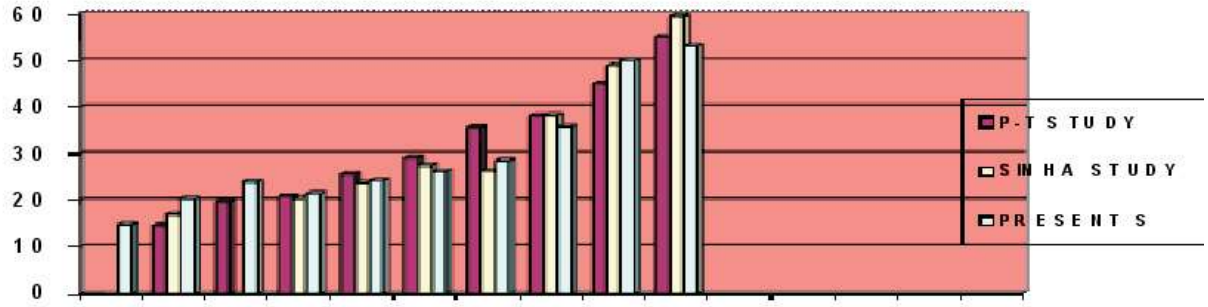
Following are the results



[Mean age for 0 to 15 scores in years for Pal Tamankar, Sinha and present study]

Component I	Score	Component II	Score	Component III	Score
Dorsal margin Absent	0	Ventral Beveling Absent	0	Symphyseal rim Absent	0
Middle third	1	At superior extremity	1	Partial dorsal rim	1
Entire border	2	Extend inferiorly	2	Complete dorsal rim	2
Dorsal plateau Middle third	3	Ventral rampart Begins	3	Breakdown of rim begins	3
Present Most of demiface	4	Extensive	4	Breakdown of rim begins	4
Complete	5	Complete	5	Rarefaction of symphyseal face	5

Table-1 (Mckern-Stewart components with their respective scoring)

Score	0	1-2	3	4-5	6-7	8-9	10-13	14	15
P-T STUDY	14.6	19.66	20.87	25.6	29.14	35.66	38.12	45	55
SINHA STUDY	17	---	20.33	23.8	27.5	26.33	38.15	48.88	59.4
PRESENT STUDY	14.8	20.33	24	21.5	24.25	26.25	28.5	35.82	50

Table-2 (Mean age for 0 to 15 scores in years for Pal Tamankar, Sinha and present study)