



## AGE ESTIMATION OF A 55-YEAR-OLD MALE BY MDCT (MULTIDETECTOR COMPUTED TOMOGRAPHY)

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**ABSTRACT** **Background:** Deciding on an individual's biological and structural maturity is crucial, and bone age plays a significant role in this evaluation. It is necessary for various clinical practices, including paediatrics, endocrinology, and radiology in forensic medicine. Age is the duration a person has lived after birth, decided by physical and cognitive development, legal rights, and responsibilities. Deciding a subject's maturity is crucial in figuring out criminal and civil proceedings, especially when minors are involved as either perpetrators or victims. Age estimation is helpful to solve purposes, including identification, legal proceedings, and sports. CT scan is nowadays readily available at most hospitals. It is a non-invasive procedure, and it can be used for life as well as in a dead person for age estimation. In old age, the skull, suture sternum, and pubis symphysis are the hallmarks of age estimation. In live patients, we can evaluate these bones physically. In such cases, radiology is the modality of choice, and a CT scan is the preferable choice. **Conclusion:** Age estimation in live cases is often necessary for job applications, identification, sports, and retirement planning. Multidetector CT is the preferred method for this process due to its efficiency and widespread availability in most hospitals and districts. Unlike X-ray examinations, CT scans offer a more comprehensive view of skull sutures, sternum joints, and pubis symphyseal surfaces, which are crucial for correct age estimation in older individuals.

**KEYWORDS :** CT, MDCT, Skull, Pubis, Symphysis, Sternum.

### INTRODUCTION:

Age estimation in older persons over 25 is exceedingly tricky in live cases. In older people, age can be estimated by the sutural closer of the skull, and the fusion of sternum parts may give us an estimate. Bone examination by X-ray is not able to see all the information. Scientific estimation of an individual's age, whether living, dead, or human remains, is a vexing problem for medical jurists in civil and criminal matters. (1) Age determination becomes difficult as the age advances, particularly after 40 years with conventional methods. MDCT is extremely useful for quickly seeing any point of suture or fusion.

Medical jurists face a challenging task in estimating the age of humans, whether alive or deceased. (1) Any visible suture fusion indicates a mature individual, unlikely below age 20. (2) The disappearance of sutures can be influenced by various factors such as sex, race, climate, genetics, and diet. (3) The fusion occurred earlier on endocranial sutures than on ectocranial sutures by 5-10 years. (4) The pubic symphysis is formed by the adjacent oval-shaped articular surfaces of the two pubic bones (facies symphysealis), the Interpubic disk (discus interpubicus), and the supporting ligaments.

They are covered by hyaline cartilage, and their thickness is affected by age. (5) Pubis symphyseal surface morphological changes are used to evaluate the individual's age. Sternum examination also gives information about the broad age of the individuals. The symphysis pubis is the single best criterion for determining the age of the individual after 25 years of age. (6)

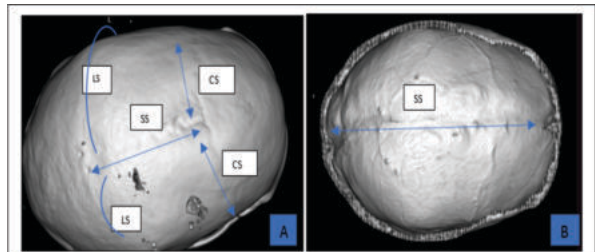
### METHOD:

A 55-year-old male came to the hospital for the treatment. Age confirmed by voter ID, Adhar, and verbally confirmed age, during treatment for the diagnosis of the disease treating doctor advice whole body CT scan. After obtaining the consent to use the soft copy of CT, we use it for the teaching and research purposes.

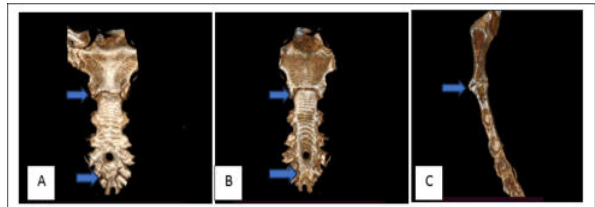
After receiving the soft copy of the CT scan, I used the Discom software to view and analyze the skull suture, sternum, and pubis symphysis. I employed multiplanar reconstruction and 3D volume rendering techniques to analyze the suture, fusion, and pubis symphyseal surface. Based on the findings of the analysis, I formed a conclusion.

### CT observation of skull, sternum, and Pubis symphysis surface:

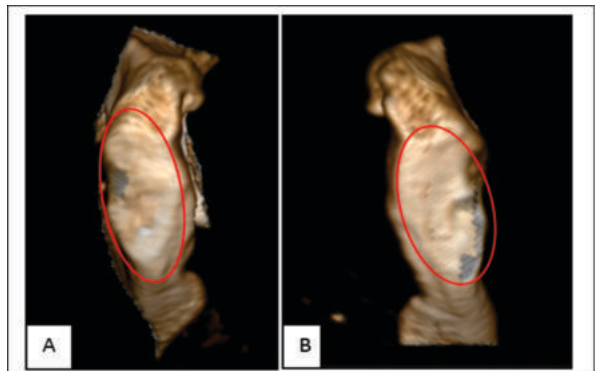
In skull, we saw sagittal coronal and lambdoid suture on CT by multiplanar reconstruction method findings as per the pic 01. Sternum and pubis symphysis findings observation done by the 3D volume rendering technique, as per the pic 02 & 03.



**Figure 1** A: ectocranial skull suture posterior and middle sagittal suture found fused, anterior 1/3 sagittal suture found not fused, lambdoid suture found fused, coronal suture upper 1/2 found not fused. B: endocranial sagittal suture found fused. (LS=Lambdoid suture, SS=sagittal suture, CS=coronal suture)



**Figure 2:** A, B Anterior and posterior view of sternum showing fusion of xiphoid process fused with and body and manubriosternal joint found not fused. C: Lateral view sternum manubrium sternal joint not fused.



**Figure 3A & B:** left and Right pubis symphyseal surface oval, smooth, upper, and lower edge raised prominent.

**DISCUSSION:**

Bone examination cannot be done on live individuals in physical manner or with the naked eye. A CT scan is a better choice to estimate the age of an older adult. CT and MRI scans have been used to evaluate age by measuring the pubis symphysis, but few studies have examined morphological changes to the pubis symphyseal surface. We are following the Indian book reference is not based on CT scan findings and is not written as a research-based reference. Various sutural fusion and surfaces were Observed and compared with the reference quoted in the book as reference no 06 and 07.

**Table 2**

1.	Suture/joints	Our CT Findings	Anil Agg Start -completed (yrs.)	KSN Reddy yrs.
2.	Inner table sagittal	Fused	20-35	20
3.	Sagittal posterior 1/3-	Fused	25-40	30-40
4.	Sagittal anterior 1/3-	Not Fused	25-40	40-50
5.	Sagittal middle 1/3-	Fused	25-40	50-60
6.	Coronal upper 1/3-	Not Fused	25-40	50-60
7.	Coronal lower 1/3-	fused	25-40	40-50
8.	Lambdoid upper 1/2-	Fused	25-45	50-60
9.	Lambdoid lower 1/2-	Fused	25-45	60-70
10.	Temporal suture-	Not fused	45-65	80
11.	Sternum body segments -	Fused	15-25	15-25
12.	Manubrium with body-	Not fused	60-70	60
13.	Body with xiphisternum –	Fused	40	40
14.	Pubis symphysis RT	Symphysial face oval, surface smooth, with raised upper and lower ends	45-50	50-55
15.	Pubis symphysis LT	Symphysial face oval, surface smooth, with raised upper and lower ends.	45-50	50-55

In Thai people, the ectocranial coronal suture began to fuse at 22-54 years in males and 25-59 years in females. The ectocranial lambdoid suture began to close at age 17-62 years in males and 17-74 years in females; complete obliteration of sagittal was found at age 17-83 years in males and 28-72 years in females. Full closure was found at ages 21-83 years in males and 26-74 years in females. (8) Todd and Lyon, in 1924, said sagittal sutures start fusion in 22 years. (9-11) Non CT study done by Anmol Upreti in Nepal and Khandare et al said that sagittal suture starts fusing between 25-30 yrs. and closes entirely at 60-65 yrs. Coronal suture starts fuses between 25-30 yrs. and fully closes at 55-60 yrs. Lambdoid suture starts fuses at 25-30 yrs. & completely closes at 65-70 yrs. (12,13) Many studies have been done to know the age by morphological shape and size variation of pubis symphysis. (14,15)

In males, the minimum age of fusion on the endocranium is 40 years for both the sagittal and coronal sutures and 50 years for the lambdoid sutures. In females, the minimum age is 40, 33, and 53 years for the sagittal, coronal, and lambdoid sutures, respectively. The maximum age for non-union of sutures on the endocranium in males is 42, 45, and 55 years for the sagittal, coronal, and lambdoid sutures, respectively. For females, it is 45, 45, and 55 years for the sagittal, coronal, and lambdoid sutures, respectively. (4) The sagittal suture typically closes between the ages of 61 to 65 years, while the coronal suture usually closes between the ages of 56 to 60 years. The lambdoid suture, on the other hand, typically closes between the ages of 66 to 70 years old. (13) Manubrium fused with body in age above 50 years and xiphoid process fused with body 40-45 years. (16)

**Opinion:**

After the age of 25, the standard deviation of age increases, making it difficult for a doctor to suggest a specific age range. The manubrium is

not fused with the body, showing an age of less than 60 years. The symphyseal surface is oval and smooth, suggesting an age of over 50 years. Therefore, the estimated age is 55 +/- 5 years.

**CONCLUSION:**

Multidetector CT is the preferred modality for age estimation in live cases due to its efficiency and availability in most districts and big hospitals. Unlike X-ray examinations, CT scans enable us to see various skull sutures, sternum joints, and pubis symphyseal surfaces, which is crucial in old age. Age estimation on live cases is needed in multiple conditions, such as job applications, identification, and retirement planning.

**REFERENCES:**

1. Singh P, Medicine F. Age Estimation in Old Individuals By. JIAFM. 2004;26(1):971-4.
2. Bernard Knight; Forensic Pathology, 2nd Edn, Oxford University Press Inc.198 Madison Avenue: New York, 1996; p 122. 5.
3. Nandy A. Principal of Forensic Medicine, 2nd Ed. New Central Book Agency (P) Ltds Calcutta. 2001 .p78-80.
4. Masih WF, Gupta S, Jaiswal P, Chand AE, Saraswat PK. Morphological Study Of Vault Suture & Its Correlation With Age In Central Rajasthan. Natl J Med Res. 2014;1:19-22.
5. Testut J, Latarjet A: Traite d'anatomie humaine, ed 8. Paris, France, Gaston Doin et Cie, 1928.
6. Aggrawal A. Essentials of Forensic Medicine and Toxicology. 1st ed. Delhi: Avichal Publishing Company; 2016. 55-64 p.
7. Reddy KN. The Essentials of Forensic Medicine & toxicology. 25th ed. Murthy OP, editor. Jaypee Brothers Medical Publishers(P) Ltd; 2022. 53-58 p.
8. Papadopoulos T, Abraham A, Sergelidis D, Bitchava K. Original article Ερευνητική. 2011;2(January):119-23.
9. T.W. Todd, D. Lyon, Cranial suture closure. Its progress and age relationship. Part III.—endocranial closure in adult males of Negro stock, Am. J. Phys. Anthropol. 8 (1) (1925)47-71.
10. T.W. Todd, D. Lyon, Endocranial suture closure. Its progress and age relationship. Part I.—adult males of white stock, Am. J. Phys. Anthropol. 7 (3)(1924)325-384.
11. T.W. Todd, D. Lyon, Suture closure—its progress and age relationship. Part IV.—ectocranial closure in adult males of Negro stock, Am. J. Phys. Anthropol. 8 (2) (1925) 149-168.
12. Upreti DA. Determination of age from fusion of skull vault sutures. Int J Forensic Med. 2019;1(1):04-6.
13. Bhise S. Age estimation from cranial sutures – a Postmortem study Original article : Age estimation from cranial sutures – a Postmortem study. Int J Health Biomed Res. 2016;(May 2015):192-202.
14. Lottering N, Reynolds MS, MacGregor DM, Meredith M, Gregory LS. Morphometric modelling of ageing in the human pubic symphysis: Sexual dimorphism in an Australian population. Forensic Sci Int. 2014;236:195.e1-195.e11.
15. Dudzik B, Langley NR. Estimating age from the pubic symphysis: A new component-based system. Forensic Sci Int. 2015;257:98-105.
16. Krishn vij. Text Book of Forensic Medicine and Toxicology. 5th ed. Elsevier; 2011. 43 p.