



Research Article

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Evaluation epiphyseal fusion on region of interest Femur bone distal section for identification of age 15 to 20 years by using X ray

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Abstract

Background

Age identification can be estimated based on epiphyseal fusion located in the region of interest of the distal femoral bone. There is an age difference in fusion epiphysis Indonesian compared to other countries. This is due to differences in population, nutrition, and individual respectively. This cross-sectional study aims to investigate the relationship between the stage of epiphyseal union on the bone of the femur and biological age.

Objective

This research is expected to be applied as media of age identification on body frame without doing cleansing of body tissue, nor in human being alive and simplify and shorten age identification process.

Methods

Distal femur x-ray images will be examined in men and women by age 15 to 20 years. Epiphyseal fusion is divided into five specific stages of the femur, tibia and fibula. Fusion is rated as stage 0: beginning union

1: initial union, stage 2: active union, stage 3: recent union, and stage 4: complete union

Results

Based on the age distribution of 15 to 20 years, the second phase will begin at the age of 15 to the age of 17 years and will follow the second stage based on the development and age. Epiphyseal fusion in the second stage is more common at the age of 15 years. First stage epiphyseal fusion in men begins at <15 years and <15 years in women.

Conclusions

The results of this study indicate that biological age forensic identification can be estimated based on epiphyseal fusion

Keywords: Epiphysis, Epiphyseal Fusion, Biological Age, Femur

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Introduction:

Age identification aims to determine the approximate or age estimate of an unknown or doubtful person. Determining age is expected to assist the authorities in resolving the legal process of individuals involved in criminal proceedings (Dharmesh, et al 2011).

Age is principally divided into three chronological age, mental age, and biological age. Chronological age is the calculation of age that begins at the birth of a person until the current time. Mental age is the calculation of age is seen based on the level of one's mental ability. Biological age is the calculation of age based on the biological maturity of a person, along with the increasing stage of growth and development of body structure in the form of physical changes and maturation of organs so that each stage of the process of change can be associated with the age of an individual (Dharmesh, et al 2011).

A person's biological age can be determined by epiphyseal fusion because the maturation of epiphyses can show that the bone has reached the end point of the growth period or is still in its infancy. When the epiphyseal fusion has reached the perfect then someone has reached a certain age of 18 years for women and age 20 for men (Bakthula & Agarwal 2014).

There are several methods of determining biological age based on fusion of epiphany by matching the standard table of Greulich and

Pyle in 1959, the Girdany and Golden 1952 standard tables and the Tanner Whitehouse 1962 method. Based on each method using the X-ray method as media to see the development of epiphyseal fusion. Tanner Whitehouse's method is done by dividing the area of the hand into 20 regions or Regions of Interest (ROI). Each ROI location is then determined to be in a certain phase based on the division by Tanner Whitehouse and the estimated age is done by summing the stage of each ROI then adjusted to Tanner Whitehouse table (Bakthula & Agarwal 2014).

Regions of Interest (ROI) of epiphyses are present in 20 regions and each region is spread over the bones in the shoulders, elbows, hands, hips, knees and legs. The epiphyses scattered in human bones have at least two epiphyses and sometimes more (the femur has four epiphyses). The ribs each have two epiphyses.

On the other hand metacarpal and metatarsal each have only one epiphysis. Vertebrae each have at least 5 episodes (Bakthula & Agarwal 2014, Koesbardiati 2012).

Epiphyseal fusion is divided into four phases: beginning union, active union, recent union and complete union. Each epiphyseal fusion phase is seen by the union between bony parts such as diaphysis, metaphysis and epiphyses that have become a bone unity as a result of the ossification process. Previous studies have suggested the epiphyseal fusion of the femur begins in a person 16 years old for women and 18 years for men, and in some other studies epiphyseal fusion occurs at age 15 in the ulna, humerus and radius bones. Epiphyseal fusion may differ in individual individuals because of differences in each sex, in which population the individual is and the difference in bone location, it is this that affects a person's biological age difference and results in an evaluation of fusion epiphyseal no longer appropriate (Bakthula & Agarwal 2014).

Generally to assess epiphyseal fusion is done by using bone that has been cleared of soft tissue, it will obviously take time in the identification process if the

victim is found in a state of skeletal component still partially or completely coated with soft tissue or in humans still alive so that evaluation uses X-rays will greatly assist the identification process under these circumstances, where we can see the inside of the body in humans who still have soft tissue or are still alive (Dharmesh, et al 2011).

Based on the need for identification in Indonesia that is still minimal and the level of completeness of the equipment for identification,

the researcher feels the need to investigate the fusion of epiphyses on the distal bone of the femur using X-ray as a medium to identify the biological age from the age of 15 years to 20 years due to their respective differences the individual may affect the epiphyseal fusion phase so as to determine the biological age of a person needs to be reconciled. This research is expected to know the age based on the epiphyse fusion phase in Indonesian people because of the lack of data of epiphyseal fusion in Indonesia and can be applied as media of age identification on the body frame without doing the cleaning of body tissue, as well as in human life and facilitate the identification process.

Method:

Kind of Research:

This research is a cross-sectional research design. The sample population in this study were all the results of bone marrow Femur photographs of male and female bone trauma patients aged 15 to 20 years in Dr Soetomo Hospital Surabaya.

The five stages of epiphyseal union are identified as described by O'Connor et al. Anterior, posterior and lateral radiographs are used simultaneously when assessing the unified epiphyseal stage and are seen on the basis of a radiolucent gap. radiolucent gap is closely related to epiphyseal fusion because the radiolucent gap is formed as a result of the distance between the epiphyses and the diaphyses. The five stages of epiphyseal union as described by O'Connor et al. Are :

Stage 0 - Non-union: diaphysis and epiphyse not yet fused so it can still be distinguished. (Figure 1). there is a very noticeable radiolucency gap (O'Connor et al 2008).

Stage 1 - Early union: epiphyse and diaphysis begin to unite. the radiolucent strips begin to narrow and not continuously from the anterior to the posterior or medial to the lateral, indicating that unity has begun centrally (O'Connor et al 2008).

Stage 2 - The active union: epiphyse and diaphysis stick together, radiolucent sticks forming long and intermittent lines (figure 2) (O'Connor et al 2008).

Stage 3 - The last states: epiphyse and diaphysis now form a unit of bone. the radiolucent strips are already very thinner and are beginning to be hard to observe (O'Connor et al 2008).

Stage 4 - Complete union: epiphyse and diaphysis are united as a single bone. the radiolucent strip disappears completely and can not be observed again (figure 4). (O'Connor et al 2008).



figure 1 : Non Union



figure 2 : Active Union



figure 3 : Recent Union



figure 4 : Complete Union

Result:

Table 1 shows the number of male subjects at each stage with age. 10 men in each group. At the age of 15 years is dominated by the first stage. early constriction of male radiolucency occurred at the age of 16 years. radiolucency begins to disappear at the age of 18 to 20 years (Table 1). Table 2 providing the number of women at each stage of the association with respect to age. at the age of 15 years women have started entering the second stage. and at the age of 16 the radiolucent began to disappear (Table 2)

Age (year)	Number of subject n	Femur stage of union				
		0	1	2	3	4
15	10	6	4			
16	10	2	5	3		
17	10		1	8	1	
18	10			4	6	
19	10			2	7	1
20	10				6	4

Table 1: Number of male subjects (n) at each stage of union for the distal femur

Age (year)	Number of subject n	Femur stage of union				
		0	1	2	3	4
15	10		6	4		
16	10		3	6	1	
17	10			8	2	
18	10			4	5	1
19	10			1	7	2
20	10				8	2

Table 2 : Number of female subjects (n) at each stage of union for the distal femur

Discussion:

Epiphyseal fusion in males:

The results showed fusion in the male femur at the age of 16-17 years has been in the second phase. at the age of 15 years new epiphyseal fusion occurs in men. This shows the difference from previous studies conducted on European-American men

who had closed at the age of 16-17 years, while at the age of 15-17 years in this study showed all the samples did not exist in the first stage. This can be due to different genetic, hormonal and nutritional factors among Asians, especially Indonesians and Europeans (Black et al., 2010).

Epiphyseal fusion in women:

Current research shows that femoral epiphyseal fusion in women aged 15-20 years, second stage of epiphyseal fusion occurs from the age of 15 years and at the age of 18 occurs in the fourth stage. Previous studies conducted in Europe and the United States show that closure of the female proximal femoral epiphysis from the age of 11- 13 years. (Black et al., 2010).

Conclusion:

The conclusion of this study is that femur epiphyseal fusion begins in men aged >15 years and in women at age <15 years. There is a diversity of epiphyseal fusion even in women aged >18 years already in stage four.

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