

Appearance of Secondary Ossification Centers in Elbows of Philippino Children in PGH

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ABSTRACT : Roentgenographic views of the normal elbow of 95 Philippino children in PGH aged 1-18 years were examined. There were 69 males and 26 females. Subjects with no hormonal disturbances and no pathology of the elbow were included. This study had shown that the sequence and age of appearance of secondary ossification centers started with the capitellum at 2 years of age for both sexes, followed by the radial head at age 6 for males and age 4 for females then the medial epicondyle at 9 and 6, the trochlea at 11 and 9, the olecranon at 11 and 9 and the lateral epicondyle at 13 and 11 years of age. This study has also shown that the ossification center appeared earlier in females than in males. Compared to the American, the ossification centers appeared at a later age for Philippino children.

INTRODUCTION

Familiarization with secondary ossification centers in elbows of children and their age of appearance has not been given much importance and most of the time has been overlooked. Henceforth, radiographic examination of a traumatized elbow often results in confusion and uncertainty about the appearance of its normal structures. This frequently leads to additional radiographic examination of the contralateral elbow which can be inconvenient both physically and financially to the injured patient. Familiarization with the different components of the elbow joint in different ages is then essential for recognition of radiographic subtleties that occur with elbow trauma. This then should serve to do away with comparison views. Furthermore, knowledge of the maturation sequence facilitates a rough estimate of bone age matched against the patient's chronological age. It was, then, the purpose of this study to determine the age of appearance of

secondary ossification centers in elbows of Filipino children in order to minimize confusion and dispense with the need for a contralateral view. Attempts were also made in this study to compare appearance of the secondary ossification centers between male and females and between Filipinos and American children.

MATERIALS AND METHODS

PGH patients aged 1 to 18 years with normal elbows qualified for the study. Children with previous trauma or inflammatory conditions of the elbow or hormonal diseases were excluded. A total of 95 children were seen. Roentgenographic films composed of AP and lateral views. The gender was further subdivided into their specific age groups. A child is considered as belonging to that age or age group if X-ray views were taken within 6 months after his last birthday. On the other hand, if X-rays were taken 6 months after his last birthday, he was considered to belong to the next age group. For instance, if X-rays were taken in a 5 year and 5 month-old child, he was still considered a 5 year-old. A 5 year-old and 7 months child was then considered as 6 years old. Elbow X-rays were then examined for the presence of secondary ossification centers composed of the capitellum, radial head, medial epicondyle, trochlea, olecranon and lateral epicondyle, and these were tabulated. Comparison was also made with the average age in which these centers appear in American children.

RESULTS

In males (Table 1), the secondary ossification center of the capitellum was the first secondary to appear by 2 years of age. The radial head presented in all 7 year-old boys. However, 66.6 per cent of 6 years old children manifested this already. The medial epicondyle appeared next, occurring in 80 per cent of 9 years old males. But there was one case in which it was presented in an 8 years old. The trochlea became visible in all 11 year-old boys, however, this was already presented in 20

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per cent and 33 per cent of 9 and 10 years old children respectively. The olecranon began to show by the 11th year and it became evident in all by the 12th year. Finally, the lateral epicondyle could be visualized at 13 years of age.

In females (Table 1), the capitellum was likewise presented by the age of 2. The radial head began its appearance by the 3rd year. By age 4, it was already presented in 50 per cent of that group. The medial epicondyle also became visible by age 3 years (33 per cent) and 4 years (25 per cent). Neither 5 year-old female was examined nor included. Both radial head and medial epicondyle were already presented by the 6th year. Both the trochlea and olecranon were already visible by the 9th year but were not presented among 7 and 8 years old females. The lateral epicondyle appeared last and became prominent by age 11 years occurring in 100 per cent of the population of that specific age group.

TABLE I.
Age of appearance of secondary ossification
centers in at least 50 per cent of the population
of that specific age group

	MALES	FEMALES
CAPITELLUM	2	2
RADIAL HEAD	6	4
MEDIAL EPICONDYLE	9	6
TROCHLEA	11	9
OLECRANON	11	9
LATERAL EPICONDYLE	13	11

DISCUSSION

Based on this study (Table II), it can be said that the sequence and age of appearance of secondary ossification centers (if we are to consider that each must be presented in at least 50 per cent of the population of a specific age group) starts with the capitellum at 2 years of age for both sexes, followed by the radial head 6th and 4th year for males and females year for male), the medial epicondyle (9th year for male and 6th year for female), the trochlea (11th year for male and female), the olecranon (11th year for male and 9th year for

female). Finally, the lateral epicondyle shows itself by 13 and 11 years for boys and girls respectively. It can also be deduced that among PGH patients included in the study, females have earlier appearance of these centers than males except for the capitellum which appears by the second year of life in both sexes. Explanation is given by the fact that females mature earlier. Compared to the average American children, Filipino children have quite a delay in appearance of these centers. Brodeur gave the following ages of appearance of the different ossification centers in American children (Table II).

TABLE II.

	Average Age in Americans	Philippino Children in PGH Males	Females
CAPITELLUM	1-2	2	2
RADIAL HEAD	5	6	4
MEDIAL EPICONDYLE	4	9	6
TROCHLEA	8	11	9
OLECRANON	9	11	9
LATERAL EPICONDYLE	10	13	11

The disparity between the average American and Filipino children in this study can be accounted for by the fact that all Filipino subjects included were PGH patients who were presumed to belong to the lower income bracket where malnutrition is not uncommon. With malnutrition, there is less calcium intake which can affect the process of endochondral ossification at the epiphyseal growth plate.

The appearance of the radial head prior to the medial epicondyle based on this study is not considered an unusual event. Brodeur reported that the radial head appeared as early as the third year of life and also as late as 8 years of age. One of the limitations on this study was the small sample size. It is then recommended that in further studies, a larger population size should be used, better and thorough screening of subjects should be emphasized. Correlation must also be made with weight, height and the presence of secondary sexual characteristics.

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