

A cross sectional study to evaluate the carrying angle in a tertiary care set up in eastern India.

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Abstract: The carrying angle of the elbow is defined as the angle formed by the long axis of the arm and the long axis of the forearm in the frontal plane when the elbow is fully extended and the forearm is supinated forearm. This cross sectional study was conducted in the outpatient department of a tertiary care set up in Kolkata for a period of 6 months from June 2016 to December 2016 with a total of 50 males and 50 females within the age 5 years to 18 years. Goniometer was used for measurement of carrying angle. Of the 100 children's included in the study mean age was 12.99+/-4.005, with mean BMI being 19.279+/-3.8088. Mean carrying angle on right side was 11.93+/-2.831 degree and on left side was 10.23+/-2.786 degree. On comparing the carrying angle in females and males there was significant difference ($p < 0.001$) between them with carrying angle of 9.97+/-2.71 degree, 11.93+/-2.62 degree on right side and 9.33+/-2.86 degree, 11.57+/-2.38 degree on left side respectively. In 5-12 yrs age group there was significant difference in the carrying angle between females and males with 11.34+/-2.82 degree, 9.43+/-1.48 degree on right side and 10.30+/-3.34 degree, 8.17/-1.48 degree on left side respectively. In 12-18yrs age group, there was significant difference in the carrying angle between females and males with 12.83+/-3.03 degree, 10.87+/-1.67 degree on right side and 12.29+/-3.0 degree, 10.06+/-0.015 degree on left side respectively. The carrying angle was more in females and on right side.

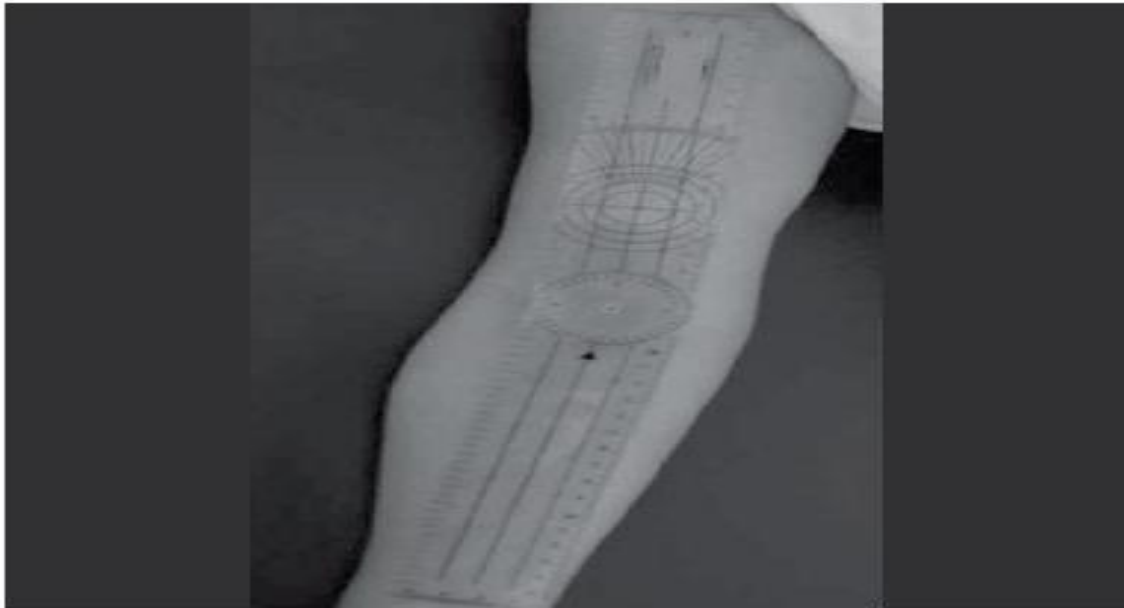
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I. Introduction:

The carrying angle of the elbow is defined as the angle formed by the long axis of the arm and the long axis of the forearm in the frontal plane when the elbow is fully extended and the forearm is supinated forearm. The angle is formed as a result of trochlear groove being vertical anteriorly but on the posterior aspect it runs obliquely distally and laterally. This results in formation of carrying angle in extension when posterior aspect of the oblique groove makes contact with the trochlear notch of ulna and the angle is marked during flexion when trochlear notch lies on the vertical groove in the anterior aspect. Carrying angles of both elbows helps in the evaluation of deformities around the joint which may guide the management protocol. Apes and humans are distinguished from other primate species in possessing carrying angle at the elbow [1]. Usually the carrying angle is greater in females than in males and the difference has been considered to be due to ligamentous laxity at the medial elbow or asymmetrical bone growth [2]. However, few workers have reported no significant difference in carrying angle of males and females of any age group [3]. Studies have shown that there is a gradual increase in the carrying angle with skeletal maturation. The carrying angle of the elbow changes with age in a predictable manner [4]. Variation in carrying angle among age groups, gender and race has been reported in different studies. The average value of the carrying angle is 12.5 ± 0.57 degrees in male and 15.26 ± 0.45 degrees in females [5]. Following figure represents the clinical method of measurement of the carrying angle [7].



II. Material and Methods:

This cross sectional study was conducted in the outpatient department of a tertiary care set up in Kolkata for a period of 6 months from June 2016 to December 2016. Total 50 males and 50 females within the age 5 years to 18 years were included in the study after obtaining informed consent. Individuals with history of fractures around the elbow and shoulder joint and with any congenital condition of elbow and shoulder were excluded from the study. For the purpose of analysis two set of age groups were made. The groups were 5-12 years and 13- 18 years.

Method of data collection:

- The carrying angle of both the upper limbs was measured while keeping the elbow completely extended. The angle was measured in three trials and then the average was taken as the final carrying angle. Goniometer was used for measurement of carrying angle. Bicipital groove, biceps brachii tendon at its insertion and palmaris longus tendon at the wrist were palpated and marked as anatomical landmarks to demarcate the median axes of the arm and the forearm respectively. Measurement of carrying angle was taken on the left side as well as on the right side to find out difference on both sides.
- Stature meter was used to measure the height. Height was measured in erect anatomical position from vertex to heel with bare foot.
- Weight of the patient was taken by the digital weighing machine.
- Body Mass Index (BMI) was measured using formula $BMI = \text{Weight in Kg} / (\text{Height in cm})^2$

III. Results:

Of the 100 children's included in the study mean age was 12.99+/-4.005 yrs, with mean BMI being 19.279+/-3.8088. Mean carrying angle on right side was 11.93+/-2.831 degree and on left side was 10.23+/-2.786 degree. On comparing the carrying angle in females and males there was significant difference ($p < 0.001$) between them with carrying angle of 9.97+/-2.71 degree, 11.93+/-2.62 degree on right side and 9.33+/-2.86 degree, 11.57+/-2.38 degree on left side respectively. In 5-12 yrs age group there was significant difference in the carrying angle between females and males with 11.34+/-2.82 degree, 9.43+/-1.48 degree on right side and 10.30+/-3.34 degree, 8.17/-1.48 degree on left side respectively. In 12-18yrs age group, there was significant difference in the carrying angle between females and males with 12.83+/-3.03 degree, 10.87+/-1.67 degree on right side and 12.29+/-3.0 degree, 10.06+/-0.015 degree on left side respectively. The carrying angle was more in females and on right side.

IV. Conclusion:

Determination of the carrying angle is useful in the management of elbow displacement, fractures and surgical planning for elbow reconstruction. This study has demonstrated that gender and dominant side are important factors that affect the value of the carrying angle. We found positive correlation between these two variables with the carrying angle. Further studies required to look for the correlation of the carrying angle and other parameters.

V. Discussion:

The carrying angle, which is found even in utero and is completely developed in a newborn is an outward angulation of the supinated forearm with the elbow extended [5]. In this study, we found that on comparing the carrying angle in females and males there was significant difference ($p < 0.001$) between them with carrying angle of 9.97 ± 2.71 degree, 11.93 ± 2.62 degree on right side and 9.33 ± 2.86 degree, 11.57 ± 2.38 degree on left side respectively. Similar to the findings of the present study, Rajesh B et al. showed significant differences in the angle between the different groups of subjects within the study population [7]. Shiva Prakah SS et al. had performed the study with 120 children with mean age 11.99 ± 4.005 yrs and mean BMI 19.326 ± 3.8088 which is similar to our study [5]. In Indian scenario, very much similar to the findings of this study, Shiva Prakah SS et al has reported that in 5-12 yrs age group, there was significant difference in the carrying angle between females and males with 11.47 ± 2.82 degree, 8.47 ± 1.48 degree on right side and 10.60 ± 3.34 degree, 8.07 ± 1.48 degree on left side respectively. In 12-18yrs age group there was significant difference in the carrying angle between females and males with 12.90 ± 3.03 degree, 10.97 ± 1.67 degree on right side and 12.30 ± 3.0 degree, 10.83 ± 0.015 degree on left side respectively [5]. Similar to our study, several workers like Sharma et al and Shiva Prakah SS et al, also reported that the carrying angle was more in females and on right side [3,5] while Terra et al, did not found any significant difference [6].

References:

- [1]. Larson Gs. Embryology and phylogeny. In: MORREY BF (ed), The elbow and its disorders, 2nd edition, W.B. Saunders Company, Philadelphia, 2000, 5-73.
- [2]. Vichard Lim, Natasha Ashley Jacob. The carrying angle of elbow, An Anthropometric Study on the Carrying Angle of Elbow among Young Adults of Various Ethnicities in Malaysia, Nat J of Int Res Med. 2014; 5(6):2230-9969.
- [3]. Sharma K, Mansur DI, Khanal K, Haque MK. Variation of Carrying Angle With Age, Sex, Height and Special Reference to Side, Kathmandu Univ Med J. 2013; 44(4):315-318.
- [4]. Golden DW, Jhee JT, Gilpin SP, Sawyer JR. Elbow range of motion and clinical carrying angle in a healthy pediatric population. J Pediatr Orthop B. 2007; 16:144-9.
- [5]. Dr. Shiva Prakah SS, Dr. Amardeep G and Dr. Manjappa CN. Evaluation of the carrying angle of the elbow joint in children's and adolescents and its correlation with various parameters. International Journal of Orthopaedics Sciences 2017; 3(3): 996-999
- [6]. Terra BB. Evolution of the carrying angle of the elbow: A clinical and radiographic study. Acta Ortop Bras. 2011; 19(2):79-82.
- [7]. Rajesh B, Reshma VR, Jaene RC, Somasekhar IT, Vaithilingam A. An evaluation of the carrying angle of the elbow joint in adolescents. Int J Med Biomed Res. 2013; 2(3):221-225.

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