Evaluation of carrying angle in 1st yr. Medical students of SVS medical college, Mahabubnagar

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Abstract

Background: The carrying angle is defined as the acute angle made by the median axis of the upper arm with that of the fully extended and supinated forearm, and thus it measures the lateral obliquity of the forearm. Aim of this study is to evaluate the elbow carrying angle by clinical measurement to check if there is a statistically significant difference among carrying angles of males and females of same age group and to study variation in angle, sex, and also special reference to side dominance and to know variation of carrying angle in females considering weight & hip circumference.

Materials and methods: 147 students of 1st yr. mbbs students of svs medical college were selected for the study. Out of which 94 were females and 53 were males. Carrying angle was calculated in both males and females for both upper limbs in standing position with forearm supinated and elbow extended by using goniometer Materials: goniometer, measuring tape, weighing machine.

Results: Data was analyzed by Graph Pad Prism 6.01 version. All p-values less than 0.05 were considered as statistically significant. Carrying angle is more in females than in males, i.e median carrying angle in females is 16 on right side, 9 on left side. In males mean carrying angle is 10 on right side, 6 on left side.

Conclusion: From the study we conducted there is significant difference in carrying angle among males and females of same age group. Dominant side carrying angle more than non-dominant side. There is no significant relationship between carrying angle and hip circumference in our study in females. There is no significant relationship between carrying angle and weight in our study in females.

Keywords: Carrying angle, elbow, supination, extension

Introduction

The carrying angle is defined as the angle made by the median axis of arm and forearm in full extension and supination [1]. The angle is neutralized when forearm is flexed or pronated from extended or supinated position [2]. It permits forearm to clear the hips during walking and is important when carrying objects. angle is formed by long axis of arm to long axis of forearm [3]. The average angle in males is 5 degrees whereas in females it is about 10 degrees. It is formed because trochlear groove is vertically oriented anteriorly and obliquely oriented posteriorly. The trochlea is not a simple pulley as its medial flange more than its lateral, projecting to a lower level so that plane of joint is 2cm distal to inter-epicondyline. In humans, however arm and forearm are not positioned in a straight line, this parameter varies according to age [4], gender [5, 6], hyperextension of the elbow [7], dominant upper limb [8] anthropometric characteristics such as height [9] and can be measured by simple clinical and radiographic technique [5]. Apparent difference in carrying angle may be due to more joint laxity in female permitting greater degree of extension. This study attempts to determine the carrying angle of elbow in subjects of same age group and different genders and between dominant and non-dominant hand. This angle plays important role in walking, swinging, and carrying objects. The angle is more on the dominant side than on the non-dominant side. The knowledge of its variations is important especially for the handling of traumatic lesions that affect the pediatric elbow [5].

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This information will be of help in studying the biomechanics of the elbow joint.

**Aims and Objectives**
1. To evaluate the elbow carrying angle by clinical measurement among 1st yr. mbbs students of svs medical college and also to check if there is a statistically significant difference among carrying angles of males and females of same age group
2. Objective is to study variation in age, sex, and also special reference to side dominance
3. To know variation of carrying angle in females considering weight & hip circumference

**Materials and Methods**

**Subjects:** 147 students of 1st yr. mbbs students of svs medical college, mahabubnagar were selected for the study. Out of which 94 were girls and 53 were boys

**Exclusion Criteria**
No previous fractures of the upper limb
No skeletal deformities

**Methodology:** after taking due consent from the students and permission from ethical committee the study was conducted. The subjects are asked to stand in anatomical position (Fig 1&2) (stand up straight, roll his/her shoulders back and elbow was fully extended and the forearm fully supinated) The carrying angle was measured using goniometer. The arms of the goniometer (fig 3) are kept into a straight line and the goniometer’s measurement plate placed at the fulcrum of one elbow. One arm of the goniometer is aligned along the middle of the person’s upper arm. The goniometer’s other arm is moved along until it lined up along the middle of the person’s forearm. The angle is recorded from the read out on the measurement plate. The process was repeated for the other elbow

**Observations were tabulated**

**Study design:** observational study
**Study place:** svs medical college mahabubnagar
**Sample:** 147 students
**Sampling technique:** randomized sampling
**Duration:** 2months

**Observation and Results**

**Statistical Analysis:** Data was analyzed by Graph Pad Prism 6.01 version. The comparison between two groups for score data was done by Mann Whitney test/ Wilcoxon Rank Sum Test. The data was summarized by Median ± IQR (Inter Quartile Range). All p-values less than 0.05 were considered as statistically significant.

**Table 1:** The comparison between male and female for the parameter age (in years)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameter</th>
<th>N</th>
<th>Range</th>
<th>Median (IQR)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Age (in years)</td>
<td>53</td>
<td>17 - 21</td>
<td>18 (17 - 19)</td>
<td>0.327</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>94</td>
<td>17 - 19</td>
<td>18 (17 - 18)</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion:** There is no significant difference between male and female for the parameter age (in years). That means both groups are same.

**Table 2:** The comparison between male and female for the parameter Carrying angle (in degrees) for Right upper limb

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameter</th>
<th>N</th>
<th>Range</th>
<th>Median (IQR)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Carrying angle (in degrees) for Right upper limb</td>
<td>53</td>
<td>4 - 18</td>
<td>10 (8 – 11.5)</td>
<td>0.000</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>94</td>
<td>5 - 22</td>
<td>16 (14 - 19)</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion:** There is significant difference between male and female for the parameter carrying angle (in degrees) for right upper limb.
Table 3: The comparison between male and female for the parameter Carrying angle (in degrees) for Right upper limb

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameter</th>
<th>N</th>
<th>Range</th>
<th>Median (IQR)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Carrying angle (in degrees)</td>
<td>53</td>
<td>4 - 14</td>
<td>6 (5 - 9)</td>
<td>0.0002</td>
</tr>
<tr>
<td>Female</td>
<td>for Left upper limb</td>
<td>94</td>
<td>4 - 20</td>
<td>9 (6 - 12)</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion:** There is significant difference between male and female for the parameter carrying angle (in degrees) for left upper limb.

Table 4: The comparison between Carrying angle (in degrees) score for Left upper limb and Right upper limb for the group female

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameter</th>
<th>N</th>
<th>Range</th>
<th>Median (IQR)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right limb</td>
<td>Carrying angle (in degrees)</td>
<td>53</td>
<td>4 - 14</td>
<td>6 (5 - 9)</td>
<td>0.000</td>
</tr>
<tr>
<td>Left limb</td>
<td>Score</td>
<td>94</td>
<td>4 - 20</td>
<td>9 (6 - 12)</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion:** There is significant difference between left upper limb and right upper limb in carrying angle (in degrees) scores for female group.

Table 5: The comparison between Carrying angle (in degrees) score for Left upper limb and Right upper limb for the group male

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameter</th>
<th>N</th>
<th>Range</th>
<th>Median (IQR)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right limb</td>
<td>Carrying angle (in degrees)</td>
<td>53</td>
<td>4 - 14</td>
<td>6 (5 - 9)</td>
<td>0.000</td>
</tr>
<tr>
<td>Left limb</td>
<td>Score</td>
<td>94</td>
<td>4 - 20</td>
<td>9 (6 - 12)</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion:** There is significant difference between left and right upper limb in carrying angle (in degrees) scores for male group.

Table 6: The correlation between dominant Hand Carrying Angle (In Degrees) and HIP circumference in female

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>r</th>
<th>p</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Hand Carrying Angle (In Degrees)</td>
<td>15.96</td>
<td>3.50</td>
<td>94</td>
<td>0.015</td>
<td>0.993</td>
<td>Not Significant</td>
</tr>
<tr>
<td>HIP circumference</td>
<td>35.61</td>
<td>2.51</td>
<td>94</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion:** There is no significant relationship between dominant hand carrying angle and hip circumference.
and it is also considered as secondary sexual characteristic. Carrying angle measurement helpful in reconstruction of elbow disorders observed after treatment of distal humerus fractures and evaluating traumatic elbow injuries. Greater carrying angle in female is considered as secondary sexual characteristic because according to some workers there is no difference in carrying angle in males and females up to puberty but in females it is increased after puberty. Even though changes in the carrying angle have only cosmetic value, an evaluation of the same can help the medical practitioner in the management of certain elbow disorders. An increase in the carrying angle is abnormal, particularly if it occurs unilaterally. If the angle is increased beyond the average, it is called cubitus valgus. The present study depicts the existence of sexual dimorphism where females have carrying angle more than males. This supports the fact that the carrying angle is a secondary sexual characteristic. Also, this study reveals that right carrying angles are greater than the left ones. The result of the study is useful in the management of elbow fractures, epicondylar disease and surgical planning for elbow reconstruction.

Conclusion: Our study confirms variation in carrying angle which is greater in females than in males of same age group, and it is greater on dominant side than non-dominant side, we have 4 subjects with left hand dominant side they have carrying angle more on left than on right side. There is no significant relationship between carrying angle and hip circumference in our study in females. There is no significant relationship between carrying angle and weight in our study in females. We have not considered parameters like height, BMI, they may have some influence on development of carrying angle.

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Conflicts of interest: Nil

References