Characteristics of the Baumann's angle in Hong Kong Chinese children

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This study defined the characteristics of Baumann's angle in a local population. One hundred and sixty-eight radiographs were studied and categorised into age groups at two-year intervals. Two observers measured all the angles and the data was analysed by computer using various statistical methods. The mean value was 70.1° in boys and 69.9° in girls; no statistically significant difference could be demonstrated in the different sex or age groups. However, some differences to Western studies were noted. This could be important information for the management of supracondylar fractures of the elbow in children.

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Key words: Humeral fractures; Elbow

Introduction

Supracondylar fractures of the humerus are known to have a high incidence of complications.[1] The most commonly reported is the unsightly deformity of cubitus varus,[2-4] where the elbow extends laterally. An accurate and reliable assessment method to prevent this from happening is needed.

Clinical assessment of the carrying angle after fracture reduction is difficult and inaccurate because of the swelling, bulky dressing, and plaster. Most people rely on radiographic methods. Three methods are commonly used: 1) metaphyseal-diaphyseal angle; 2) humeral-ulnar angle; and 3) Baumann's angle (humerocapitellar angle).[5] Both methods one and two have their limitations clinically and Baumann's angle remains a good indicator in the assessment of post-reduction alignment.[6,7]

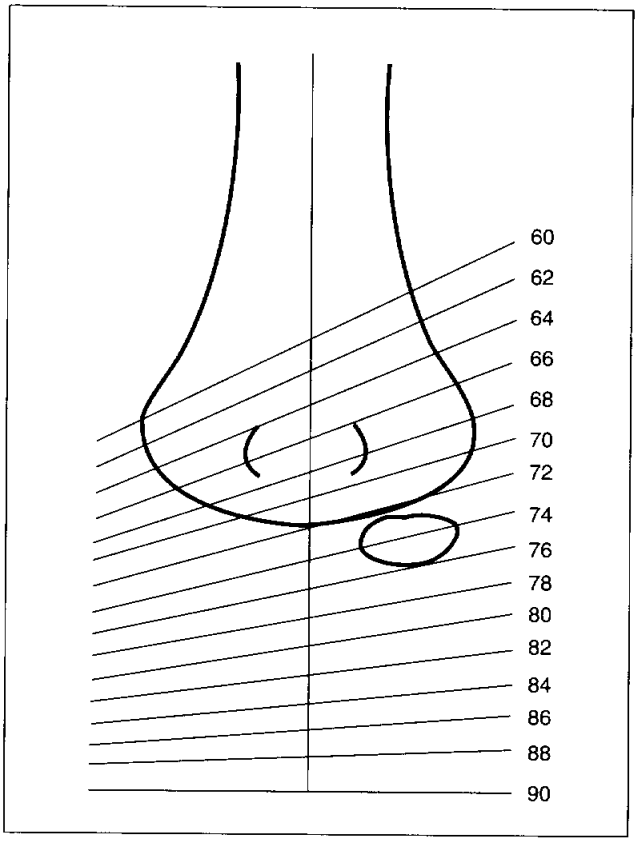

Fig 1. Measurement with an overlay grid of angles

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Table 1. Table showing the sample size, average angles, and SD values for all age groups in the two sexes

	Age groups (y)						
	A	**B**	**C**	**D**	**E**	**F**	**Overall**
Boys	11	13	18	14	8	2	66
Average angle	71.6°	70.2°	70.0°	70.4°	68.0°	69.0°	70.1°
SD	7.47	6.40	6.06	5.88	2.14	1.41	5.8
Girls	9	7	10	9	4	0	39
Average angle	72.2°	68.9°	70.6°	68.4°	67.5°	–	69.9°
SD	6.74	8.47	4.43	3.97	4.12	–	5.7

A 2-3 y B 4-5 y C 6-7 y D 8-9 y E 10-11 y F 12-13 y

References from the literature, however, are few and there is practically no local data that can be applied in clinical practice in Hong Kong.

Subjects and methods

A retrospective study was conducted on the radiographs of 168 normal elbows of local Chinese children who had been admitted for management of contralateral, supracondylar, humeral fractures. Sixty-three radiographs were excluded because of poor quality or unsatisfactory projections. The remaining radiographs were then categorised into six age groups at two-year intervals, from A to F, from two years old to thirteen years old, respectively.

A transparency with a grid of angles on it for measuring purposes was given to two observers. Each line on the transparency represented an increment of 2° (Fig 1). The longitudinal axis was determined by a line that bisected the humeral shaft. The line of physis was difficult because of different configurations in different age groups. In the younger children, the metaphyses were more rounded and any linear portion of the lateral half was used. If no linearity existed, a tangent line was drawn directly opposite the centre of the capitellar physis. For concave or sigmoidal physeal configurations, the prominences at either end were used as landmarks (Fig 2).

This procedure was repeated by the two observors two weeks after the first assessment to ascertain intraobserver consistency. All data was entered into a computer and analysed with statistical methods that included the Student's *t* test, variance, and regressional analyses.

Results

The results are shown in Table 1. They show the size, means, and SD values for all age groups in all the boys and girls. The mean value in boys was 70.1° with a standard deviation of 5.8° and that in girls was 69.9° with a standard deviation of 5.7°. No statistically significant difference between the sexes could be demonstrated. The distribution of the angles is shown in Figure 3. The mean value of the whole group was 70.0° with a standard deviation of 5.8°.

The intra-observor and inter-observor differences were tested using the two-sample paired Student's *t*-test. The results are shown in Table 2. There was no significant intra-observor or inter-observor difference statistically, since all the P values were greater than 0.05.

Table 2. Table showing the results of two-sample paired Student's *t*-test for detecting inter-observor and intra-observor difference. A1 and A2 represent data collected by observor A at the first and second attempt, respectively. B1 and B2 represent data collected by observor B at the first and second attempt, respectively.

	A1 vs A2	B1vs B2	A1vs B1	A2 vs B2
P value	0.377	0.955	0.691	0.689

Discussion

From our analysis, we found some difference between these results and those in the literature. Williamson et al proposed a mean value of 70° with a standard deviation of 4°. We found almost the same value but our standard deviation was larger by 1.8°. Normal values reported by Baumann[5] were from 75° to 80° and those by Worlock were 75°.[6] It seems that Hong Kong children have a wider distribution of the Baumann's angle, although the average values are close to those of their Western counterparts.

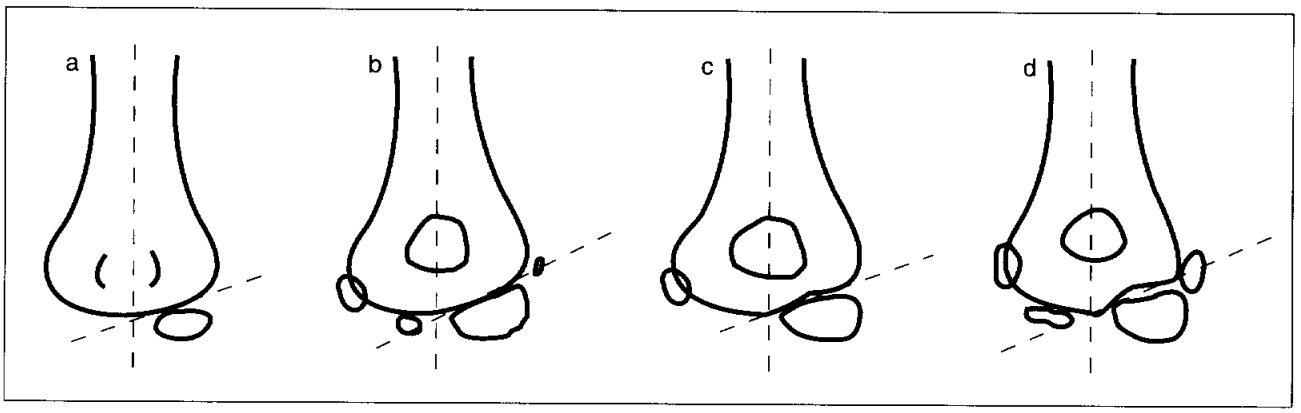

Fig 2. Differing configurations of the distal humerus and landmarks used for measurement of the Baumann's angle

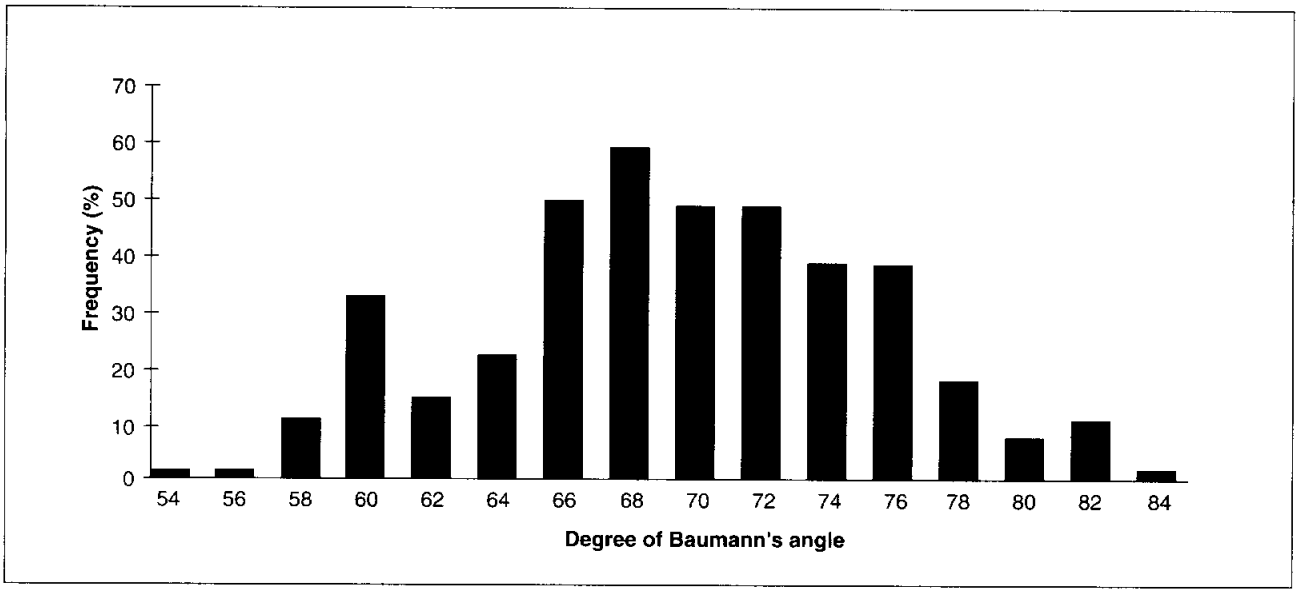

Fig 3. Overall distribution of the Baumann's angle in Chinese children aged between two and 13 years

Conclusion

This series showed that the normal range of the Baumann's angle was wider in the local population than that quoted in the western literature. The major difference was in the lower limit only. The upper limit (81.5°) was practically the same as in Williamson's series (81°).[8] This information should be borne in mind when using the Baumann's angle to assess the reduction alignment in supracondylar fractures of the humerus in children.

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