Original Article

COMPARING THE BRAIN GROWTH IN NORMAL CHILDREN AND THOSE WITH CONGENITAL HEART DISEASES

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ABSTRACT

Background and Objective: Congenital heart diseases is one of the important factors which will decrease the growth rate of different parts of human body. In children who are suffering from heart diseases, due to heart failure as a result of poor blood supply, the growth of brain and skull will be effected leading to complex phenomenon in cephalometry. The aim of this study was to measure the length, breadth, height, circumference of the head, calculation of brain volume, weight, and cephalic index among healthy children compared with children with congenital heart diseases.

Methods: This study was carried out in 474 cases 276 normal cases as control group and 198 cases were selected as patient group between the age of one month to six years.

Results: The cephalometric indices of brain in both control and patients groups at the age of one to thirty six months were increased, followed by decrease in growth of brain. These indices among the congenital heart disease patients showed less growth in brain volume.

Conclusion: Reduction of head dimensions in children with congenital heart disease in early life, might be due to the lack of O2 and poor blood supply to brain cells. Careful attention by parents and physicians can ensure early diagnosis thus restoring normal growth.

KEY WORDS: Anthropology-cephalometry-brain, Volume-head, Circumference-cephalic indics.

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INTRODUCTION

Anthropology is the science of man which deals with physical characters and the quantitative measurement of different parts of human body. Cephalometry is one of the most important branch of anthropology in which the dimensions of head and face can be determined. These dimensions are used to show indices for studying brain growth and formation of all types of head and face. The dimensions of the brain, volume and weight, play important role in life. The human brain mostly develop at embryonic period, but after birth the rate of brain development will significantly increase.[1,2] Studies on a particular group of age have shown the dimensions of an infant body would be the fundamental dimensions in later development. Therefore the knowledge of normal ranges and normal indicses are particularly important. One of these indices which indicated the normal anthropological measurements is the brain growth that reaches its maximum size after the birth between one month to six years of age. However, bone development in such children is a complicated

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phenomenon which can be measured by in cephalometry.[3] Appropriate fetal brain growth depends upon the cerebral blood flow.

Different congenital heart defects could occur due to the differences in anatomy and physiology, which alter the intrautrine blood flow. Thus, variable brain growth is expected in different congenital heart defects that is reflected by variability in head circumference at birth.[4] Malnutrition in children with congenital heart defects compared with those without symptoms, had a significant reduction in head circumference.[5]

The congenital heart diseases is one of the important factors that will decrease the growth rate of different parts of human body is well documented.[3,6] Among the children who are suffering from heart failure because of lack of blood supply can largely effect the growth of brain and the skull as well, which itself is the complex phenomenon in field of cephalometry. Clinically the knowledge of the above effect could be helpful in both diagnosis and prevention of such diseases. This study was conducted to measure the length, breadth, height, and circumference of the head, calculation of brain volume and weight, and cephalic indices in normal children in comparison with those suffering from congenital heart diseases.

METHODS

The present study was carried out by convenient random sampling on 474 of cases in both sexes, 276 cases as control and 198 patients. Both groups were categorized in the range of one to six- month and in eleven groups of one to seventy two month of age. The normal cases were enrolled from nursery hall, kindergarten and preschools, and the patient were selected from angiography and echocardiology departments of Ahwaz hospitals during Nov.2001, Nov.2002. Children who have been known as abnormal cases such as mental retardation, surgical history and twins were excluted from the study.

In order to measure the cephalometric indices appropriate equipments such as anthropometer, calliper cephalometer, gonimeter and measuring tape were used for measuring length, breadth, height and circumference of the head. For maximum cranial length, summit of glabella to farthest occipital point, maximum cranial breadth, greatest breadth at right angles to median plane have been measured. Distance between tragus and vertex for auricular height and from frontal bone to inion for cephalic perimeter were measured. Cranial capacity which is correlated to brain volume has been calculated from linear measurements of the length, breadth and height of cranium (in millimeters) by formulae:

Males: 0.000337 (L-11)(B-11)(H-11) + 406.01cc
Females: 0.000400 (L-11)(B-11)(H-11) + 206.60cc.

In these formulae, L and B length and breadth, and H is the auricular height.[3] The brain weight was calculated as m= pv. In this formulae P is special gravity of brain(1.035) and V is brain volume. For calculation of cephalic index, maximum cranial breadht/maximum cranial length were multiplied by 100. The data was recorded in special form and statistical method of t- test and soft ware of SPSS for windows was used for analysis.

RESULTS

Mean and standard deviation(SD) of different parameters are shown in (Table-I). Analysis of data has shown the greatest rate of growth on head dimensions, in both groups reaches the maximum during the first to six months after that the growth rate was decreased. The studied population in the anthropologic indices such as length, breadth, height, and circumference of the head, and brain volume and weight, from the first to thirty six months were increased, follwed by decrease in growth rate. Parameters in control group when compared with to patients group showed growth in head and dimensions. The most changes in height occurred between 5 to 18 month of ages. Mean and SD of cephalic indices in control and case groups were 82.02±4.33, 84.60±3.37 respectively. There was significant difference between two

Table-I: various parameters of head

	Control		*Case*		
Different Parameters	*Mean*	*SD*	*Mean*	*SD*	*P.value*
Head length(mm)	166.72	8.09	150.26	8.14	0.000
Head breadth(mm)	136.61	3.43	127.20	4.92	0.000
Auricular height (mm)	114.05	3.14	105.85	4.02	0.000
Head circumference (cm)	48.07	2.59	44.67	2.75	0.004
Brain volume(cm3)	993	58.27	913.80	57.93	0.000
Brain weight(gr.)	1140.10	56.23	959.33	55.80	0.000
Cephalic index	82.02	4.33	84.60	3.37	0.000

groups($P<0.05$). Head was classified by cephalic indices, so brachycephalic type with (39.7%) was dominant and dolichocephalic type with (3.3%) was the least in both (control and case).

DISCUSSION

The results of this study indicated that reduction in head dimensions in different age groups of children who are suffering from congenital heart disease indicates the reduction in growth of the brain which is due to the lack of O2 and poor blood supply to brain cells. Yung and co-workers[7] had studied 305 neonatal autopsies for correlation between the head circumference (HC) and crown-rump length (CR). They found that when HC were significantly smaller than CR, there were a higher incidence of congenital heart disease. Manzar 2005[4] have found that, victims with congenital heart defects had small head size at birth. Our results confirm Yung and Manzar studies. An anthropological study in University of Niairobi Health Service, Kenya[8] also mentioned head circumference in victoms with congenital heart disease are smaller than normal population, which was similar to our results. Donofrio 2003[9] reported the fetus with congenital heart disease have circulatory abnormalities that may compromise cerebral oxygen delivery. Our studies have showen the effect of congenital heart malformation in growth of brain volume and weight, and head circumference among the children suffering from conginental heart disease.

CONCLUSION

It is recommanded that diagnosis and treatment of patients who are suffering from heart diseases should be started soon after birth or in the early childhood. This ensures proper growth of children.

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