ANTHROPOMETRIC CHANGES OF SKULL IN THE CHILD WITH NEUROPSYCHIC DEFICIENCY

M. F. GAVRIŞ

County Hospital of Drobeta Turnu-Severin

Abstract: *Children with mental retardation present certain cranial dysmorphisms. The author has studied the extent to which these dysmorphisms are characteristic to these children. The studies were carried out on 110 children with mental retardation aged between 4 and 18 years old and on a witness batch (control group) made up of 101 neuropsychically healthy children aged 4-18. The cranial perimeter, anteroposterior diameter, biparietal diameter were significantly decreased in the children with mental retardation as compared with the witness batch, in an inverse relationship with the deficit severity. The parameters of the viscerocranium, the distance between tragus and glabella presented a harmonious development, in a slower rate than for the witness batch. The children with neuropsychic deficiency present a relative microcephaly corresponding to the severity of the mental retardation. The viscerocranium develops independently of neurocranium and of the mental retardation severity.*

Keywords: *anteroposterior diameter, biparietal diameter, chin-tragus distance, chin-glabella distance, neuropsychic deficiency, children.*

Rezumat: *Copiii cu retard mental prezintă unele dismorfii craniene. Autorul îşi propune să studieze în ce măsură aceste dismorfii le sunt caracteristice. Studiul cuprinde 110 copii în vârstă de la 4 la 18 ani cu retard mental şi un lot martor de 101 copii de la 4 la 18 ani, neuropsihic sănătoşi. Perimetrul cranian, diametrul anteroposteior, diametrul biparietal este semnificativ scăzut la copiii cu retard mental, în relaţie inversă cu severitatea deficitului, comparativ cu lotul martor. Parametrii viscerocraniului, distanţa menton-tragus şi menton-glabelă au prezentat o creştere armonioasă, cu un ritm inferior martorilor. Copilul cu deficit neuropsihic prezintă o microcefalie relativă potrivit severităţii retardului mental. Viscerocraniul se dezvoltă independent de neurocraniu şi severitatea retardului mental.*

Cuvinte cheie*: diametrul anteroposterior, biparietal, distanţa menton-tragus, menton-glabelă****,*** *retard mental, copil.*

INTRODUCTION

The neuropsychic deficiency or the mental retardation represents a clinical reality during childhood. Its frequency among the infantile population is estimated by Landgren and his collaborators as an easy mental retardation of 1,5% in the seven-year-old children (quoted twice). The severe mental retardation is diagnosticated in 0,3-0,4% in the three-year-old children, after Aicardi (quoted twice). The serious forms of sequelar encephalopathy have a frequency of 0,15-0,25% in the general population (1).

The neuropsychic deficiency or the mental retardation is a complex entity that does not define a disease, being a permanent, non-progressive state, polymorph etiologically and clinically, which may be defined by two main criteria, according to DSM-IV:

1. Decrease of the cognitive performances reflected in an intelligence quotient below 70 and a difference of two years in the school start period and a mental age below 14 years old in adults.
2. A minus in the social adaptation capacity in at least two of the functioning areas of the person: communication, self-service, living within family, self-management, school, labour abilities, skills in health care and body safety.

The IQ defined as the relation between the mental age and the chronologic one multiplied by 100, remains the main criterion for diagnosing the mental retardation. A value of the IQ below 70 means something for the psychical deficiency and may be accompanied by a varied somatic, neurological, psychiatric symptomathology (3). The dysmorph aspects may complete the clinical picture of the mentally retarded person, being assessed taking into account anthropometrical and somatic criteria.

WORKING HYPOTHESIS

As I have worked in a placement centre for children with neuro-psychomotor deficiencies, where I could notice certain cranial dysmorphisms in mentally retarded children, I decided to study the extent to which these dysmorphisms are characteristic to these children by evaluating certain parameters accepted as assessment criteria.

MATERIAL AND METHOD

I included into my study 110 children mentally retarded in comparison with 101 witnesses of the same age. The study batch comprising 110 mentally retarded children came from the Placement Centre No. 6 and from „Constantin Pufan" School of Drobeta Turnu-Severin, as well as children coming from familial placement of the

same city. The witness batch comprised 101 healthy children coming from family environment, school pupils of the General School No. 6, and from „Domnul Tudor" high school of the town of Drobeta Turnu-Severin.

Both batches were grouped in terms of age and gender.

The 110 mentally retarded children were aged between 4-18 and I distributed them on age groups, such as: the first age group was between 4-7 and included 5 children, the age group 8-11 had 9 cases, the age group 12-13 had 15 cases, the age group 14-16 had 65 cases and the age group 17-18 included 16 cases. Regarding gender, the mentally retarded children group included 38 girls and 72 boys.

The cases of mental retardation were also grouped in three sub-groups, taking into account the intelligence quotient: easy mental retardation was encountered in 32 cases with the IQ = 59,34 ± 6; mild mental retardation was encountered in 17 cases with the IQ = 43,76 ± 3; serious mental retardation was observed in 61 cases with the IQ = 24,62 ± 7.

The control group (the witness batch) included children aged between 4 and 18, distributed in the following age groups: the age group between 4-7, 5 cases, the age group between 12-13, 24 cases, the age group 14-16, 49 cases, the age group 17-18, 9 cases. Regarding gender, the control group had 46 girls and 55 boys.

In each case, I personally measured the cranial perimeter with non-extensible metric band and the anteroposterior diameter, the biparietal diameter, the chin-tragus distance and the chin-glabella distance with the calibrator.

The cranial perimeter, the anteroposterior and biparietal diameter established the parameters of the neurocranium and chin-tragus and chin-glabella distance defined the parameters of the viscerocranium.

Within the limit of the possibilities given by the observation sheets and by the school medical records, I got neuropsychic diagnosis for the study batch, data regarding the origin environment of both batches' subjects, as well as their length and weight at birth.

For the interpretation of the measurements made to the mentally retarded children batch, I had in view the relation between the cranial perimeter, the anteroposterior and biparietal diameter and the neuropsychic diagnosis, gender, origin environment and the IQ, as an expression of the neurocranium, as well as the chin-tragus and chin-glabella distance, as an expression of the viscerocranium.

The control group comprising 101 healthy children, term pregnancy, equal length and weight at birth presented a normal IQ. The same anthropometric characters were taken into account.

The results of the measurements made were interpreted statistically, based on ANOVA analysis of variance of the non parametric test Kruskal-Wallis and of Spearman relation quotient.

I consider significant the following values $p \leq 0,05$ and $r \geq 0,50$.

RESULTS

Length and weight at birth and the subjects' age registered significant differences between the batches and variances in relation with the neuropsychic diagnosis (NPI).

The cranial perimeter, the anteroposterior and the parietal diameter, chin-tragus distance and chin-glabella distance recorded significant variances between batches and in relation with the neuropsychic diagnosis (NPI). Table I.

The NPI batch presented variances of the cranial perimeter in relation with the severity of the mental retardation, due to the parietal diameter and chin-tragus distance. The subjects' gender was reflected only in the chin-tragus distance in favour of the boys. Table II.

The witness batch recorded a progressive increase with significant variances of all neurocranium and viscerocranium parameters, with high values in boys. Table III.

The results of the children from Drobeta Turnu-Severin are in accordance with those observed by Puia in Cluj-Napoca in the school pupils of 6,5-11,5 years old. (5).

DISCUSSIONS

Regarding the interpretation of the comparative results of the mentally retarded children batch and the control group (witness batch), one may say that the study batches are comparable in terms of age and gender.

The results obtained from the mentally retarded children batch proved that the intelligence quotient reflected the severity of the mental retardation without any difference in relation with the subjects' gender. At equal ages, at the beginning of the study, gender and the weight and length at birth differences did not influence the cranial anthropometric parameters.

The anteroposterior diameter in correlation with the biparietal diameter suggests the harmonious development of the neurocranium. Chin-tragus distance in correlation with chin-glabella distance in both genders pleads for the harmonious development of the viscerocranium.

Viscerocranium presents its own rhythm of development, independently of the severity of the mental retardation.

The severity of the neuropsychic retardation that influenced both neurocranium and viscerocranium show the global impact on the cranial development.

The cranial perimeter of the severe mental retardation cases pleads for microcephaly, taking into account the biparietal diameter.

The cases of severe mental retardation presented smaller length and lower weight at birth, what pleads for a prenatal cause of cerebral sufferance. Fearon and his collaborators (4) reported a smaller volume of the brain in the adults who had a very low weight at birth. The results of the control batch of Drobeta Turnu-Severin are in accordance with those observed by Puia in the school pupils of 6,5-11,5 years old, in Cluj-Napoca, (4).

CONCLUSIONS

1. Cranial perimeter, anteroposterior and biparietal perimeter indicate a relative microcephaly in the children with neuropsychic deficiency.
2. Smaller neurocranium in the mentally retarded children is in relation with the retardation severity.
3. Viscerocranium has its own rhythm of development as against neurocranium.

BIBLIOGRAPHY

1. Benga I., Introducere în Neurologia Pediatrică, Ed. Dacia Cluj-Napoca 1994; 104-105. (Introduction in Pediatric Neurology).
2. Dragomir D., Pleşca D., Retardarea mentală în pediatrie Tratat Ediția I, Ed. Medicală Bucureşti 2001; 1164. (Mental Retardation in Paediatrics).
3. Dragomir D., Pleşca D., Retardul mental în pediatrie Tratat Ediția I, Ed. Medicală Bucureşti 2001;1126-1128.
4. Fearon P., O'Connel P., şi colab. Brain Volumes in Adult Survivors of Very Low Birth Weight: A Sibling-Controlled Study: Paediatrics 2004; 1143:367-371.
5. Puia A., Repere actuale în creşterea somatică a şcolarului mic. Acta Medica Transilvanica 2002; 8:83-86. (Present Benchmarks in the Somatic Development of the Little School Pupil).

Table I. Anthropometrical data of neurocranium and viscerocranium

Batches	Batches distribution	IQ	Weight at birth (g)	Length at birth (cm)	Age (years)	Cranial perimeter (cm)	Antero posterior diameter (cm)	Biparietal diameter (cm)	Chin-tragus (cm)	Chin-glabella distance (cm)
Mentally retarded children batch	P.C	26,20±9,45 (63)	2565±695 (46)	47,44±3 (38)	14,82±3 (63)	50,65±2,71 (63)	15,94±0,89 (63)	11,26±1,27 (63)	9,92±0,89 (58)	9,04±0,88 (58)
	F.P.	39,89±15,36 (5)	2900±697 (4)	48,00±5 (4)	8,00±5 (5)	47,70±3,45 (5)	13,40±1,67 (5)	9,99±2,38 (5)	8,30±1,64 (5)	8,20±1,35 (5)
	School for mentally retarded children.	54,64±9,74 (42)	3134±339 (38)	50,55±1 (38)	14,23±1 (42)	52,50±1,99 (42)	16,16±1,02 (42)	12,81±0,61 (42)	10,59±0,78 (42)	9,61±0,70 (42)
Witness batch		99,0±0 (101)	3117±333 (72)	50,13±2 (72)	13,62±3 (101)	53,55±1,92 (101)	16,79±0,88 (101)	13,53±0,79 (101)	10,73±1,15 (101)	9,63±1,22 (101)
		p=0,0000	**p=0,000002**	**p=0,0000**	**p=0,006**	**p=0,0000**	**p=0,0000**	**p=0,0000**	**p=0,000**	**p=0,00008**
NPI Diagnosis	R.M.U.	59,34±7,61 (32)	3083±393 (28)	50,44±1 (27)	13,3±3 (32)	52,06±2,65 (32)	15,81±1,46 (32)	12,46±1,3 (32)	10,25±1,23 (32)	9,32±0,96 (32)
	R.M.M.	43,76±3,03 (17)	2887±405 (15)	48,40±3 (15)	14,1±2 (17)	51,48±2,23 (17)	16,02±1 (17)	12,26±1,3 (17)	10,43±0,9 (16)	9,56±0,85 (16)
	R.M.S.	24,62±7,32 (61)	2646±444 (45)	48,10±3 (38)	14,8±3 (61)	50,71±2,83 (61)	15,93±0,93 (61)	11,28±1,3 (61)	9,94±0,98 (57)	9,08±0,87 (57)
Witness batch		99,0±0 (101)	3117±333 (72)	50,13±2 (72)	13,6±3 (101)	53,55±1,92 (101)	16,79±0,88 (101)	13,53±0,79 (101)	10,73±1,15 (101)	9,63±1,22 (101)
		p=0,0000	**p=0,0004**	**p=0,00007**	**p=0,07**	**p=0,000**	**p=0,000001**	**p=0,0000**	**p=0,00063**	**p=0,008**

Table II. Cranial parameters, N.P.I. diagnosis and gender.

PARAMETER	N.P.I. DIAGNOSIS			Gender	
	R.M.U.	R.M.M.	R.M.S.	Girls	Boys
Cranial perimeter (cm)	52,06±2,65 (32)	51,48±2,23 (17)	50,71±2,83 (61)	50,3±2 (38)	51,6±2 (72)
	p=0,03			**p=0,01**	
Anteroposterior perimeter (cm)	15,81±1,46 (32)	16,02±1 (17)	15,93±0,93 (61)	15,50±1,26 (38)	15,76±1,34 (72)
	p=0,80			***P=0,319***	
Biparietal perimeter (cm)	12,46±1,3 ((32)	12,26±1,3 (17)	11,28±1,3 (61)	10,94±1,30 (38)	11,28±1,27 (72)
	p=0,0002			**P=0,190**	
Chin-tragus distance (cm)	10,25±1,23 (32)	10,43±0,9 (16)	9,94±0,98 (57)	9,77±0,9 (36)	10,29±1,09 (69)
	p=0,049			**P=0,01**	
Chin-glabella distance (cm)	9,32±0,96(32)	9,56±0,85 (16)	9,08±0,87 (57)	9,04±0,8 (36)	9,04±0,8 (36)
	p=0,139			**P=0,11**	
QI	59,34±7,61 (32)	43,76±3,03 (17)	24,62±7,32 (57)	37,84±12 (38)	37,59±18 (72)
	p=0,0000			**P=0,53**	

R.M.U. = easy mental retardation; R.M.M. = mild mental retardation; R.M.S. = severe mental retardation; ( ) = number of cases;

Table III. Anthropometric parameters in the witness batch

	No. of cases	Age (years)		Anteroposterior diameter (cm)	Biparietal diameter (cm)	Chin-tragus distance (cm)	Chin-glabella distance (cm)
		Girls	Boys				
Witnesses	101	12,93±3	14,20±2	15,20±0,4 (4-7/5)*	12,40±0,5	7,80±0,8	7,40±0,5
				16,54±0,8 (8-11/14)*	13,03±0,6	9,64±0,6	9,03±0,5
				16,66±0,7 (12-13/24)*	13,50±0,5	10,85±0,9	9,75±1
				17,03±0,8 (14-16/49)*	13,80±0,7	11,21±0,7	9,87±0,6
				17,16±0,7 (17-18/9)*	13,55±0,8	11,11±0,6	10,22±1
Gender	**Girls**	46		16,33±0,7	13,30±0,8	10,38±1	9,31±1
	Boys		55	17,18±0,8	13,72±0,6	11,02±0,7	9,90±0,7
Gender		**p=0,07**		***p=0,00001***	***p=0,007***	**p=0,00005**	***p=0,00004***
Age groups				***p=0,0001***	***p=0,0002***	***p=0,0000***	***p=0,000002***

( )* represents the age group / number of cases of the age group;