Inner Canthal, Outer Canthal and Inter Pupillary Distance in Newborns

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Hypertelorism (increased interpupillary distance) and hypotelorism (decreased interpupillary distance) form important components of many syndromes(1). Clinical evaluation of hypertelorism may be misleading due to optical illusion produced by a low nasal bridge, lateral displacement of inner canthi or short palpebral fissure(2). Therefore, there is a need for objective evaluation of hypertelorism.

There are few good studies giving norms for ocular measurements, for Western infants, children(3) and newborns of different gestational ages(4). Only few studies from India have tried to establish norms for ocular measurement in infants(5) and children(6). In one study(5) no newborns were included and in another(6) only 18 newborns were included without any reference to their gestational ages. There is no reported study, in the Indian literature, giving ranges for various ocular measurements in newborns at different gestational ages. The present study is an attempt towards this direction. Many babies with malformation syndromes are born prematurely, therefore, there is a need to know the range for ocular measurements at different gestational ages.

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Material and Methods

To define standards for ocular measurements, *i.e.,* inner canthal distance, outer canthal distance and interpupillary distance in the newborns, 817 consecutive live borns with a gestational period ranging from 26-42 weeks were subjected for ocular measurements defined by Feingold and Bossert(3) using a venier caliper used for odontometry (Dentaurum A=ord No. 042-750). Care was taken not to injure the child with sharp edges of the caliper by restraining the head. The babies with malformations were excluded from the study. Gestational age was calculated from the first day of the last menstrual period and in every case, clinical assessment of gestational ages were performed by the Dubowitz scoring system(7).

The interpupillary distance was calculated by using the formula suggested by Feingold and Bossert(3), *i.e.,* interpupillary distance = 0.7 + 0.59 inner canthal distance + 0.14 outer canthal distance. The values for intercanthal distance, outer canthal distance and inter pupillary distance are presented as mean and ± 2 SD values for different gestational ages. As no statistical difference was found for different parameters in boys and girls, the values for both sexes were combined.

Results

The values at different gestational ages for inter canthal distance, outer canthal distance and inter pupillary distance are presented in *Tables I, II & III & Fig.* The mean interpupillary distance was 30.1 mm at 28 weeks of gestation and 39.3 mm at 41 weeks.

TABLE I—*Outer Canthal Distance at Different Gestational Ages*

Gestation (wk)	No.	Mean (mm)	SD (mm)	Normal range
26	5	43.5	4.1	35.4- 51.6
28	14	46.8	8.2	30.4- 63.1
30	8	50.3	4.9	40.5- 60.1
31	5	51.2	6.4	38.5- 64.0
32	12	58.0	8.1	41.7- 74.1
33	7	50.8	3.5	43.7- 57.9
34	12	56.3	6.6	43.2- 69.4
35	14	56.1	5.9	44.4- 67.9
36	30	58.7	5.0	48.7- 68.8
37	36	62.1	6.0	50.2- 74.1
38	83	62.3	7.5	47.3- 77.3
39	162	62.6	5.0	52.7- 72.6
40	311	64.4	4.7	55.0- 73.9
41	99	65.7	5.0	55.7- 75.7
42	19	70.0	3.7	62.6- 77.4

TABLE II—*Inner Canthal Distance at Different Gestational Ages*

Gestation (wk)	No.	Mean (mm)	SD (mm)	Normal range
26	5	17.7	3.7	10.3- 25.1
28	14	17.4	3.0	11.4- 23.4
30	8	16.9	3.9	9.0- 24.7
31	5	14.5	1.8	11.0- 18.0
32	12	18.4	1.6	15.2- 21.6
33	7	18.4	3.8	10.8- 26.0
34	12	17.5	3.4	10.7- 24.2
35	14	17.6	1.9	13.9- 21.4
36	30	18.1	2.2	13.7- 22.4
37	36	18.2	2.1	13.9- 22.5
38	83	18.8	2.1	14.5- 23.0
39	162	19.2	1.9	15.3- 23.0
40	311	19.5	2.2	15.2- 23.8
41	99	19.7	2.1	15.5- 23.9
42	19	19.2	2.1	15.0- 23.3

Discussion

Values for interpupillary distance for newborns of different gestational ages have been established for Israeli infants by Merlob *et al.*(4). Because of normal racial

TABLE III—*Interpupillary Distance at Different Gestational Ages*

Gestation (wks)	Mean (m)	SD (mm)	Normal value (mm)	
			Mean –2SD	Mean +2SD
26	29.6	4.1	21.3	37.8
28	30.1	4.5	21.2	39.1
30	30.3	3.8	22.8	37.8
31	30.3	3.5	23.3	37.2
32	32.3	4.2	24.0	40.6
33	32.4	3.5	25.4	39.4
34	34.0	4.5	25.1	43.0
35	34.1	3.2	27.6	40.6
36	35.4	2.7	30.0	40.9
37	36.9	3.2	30.6	43.2
38	37.3	3.5	30.3	44.4
39	37.7	3.3	31.1	44.3
40	38.6	2.3	34.1	43.2
41	39.3	2.3	34.7	44.0
42	40.7	2.4	35.9	45.5

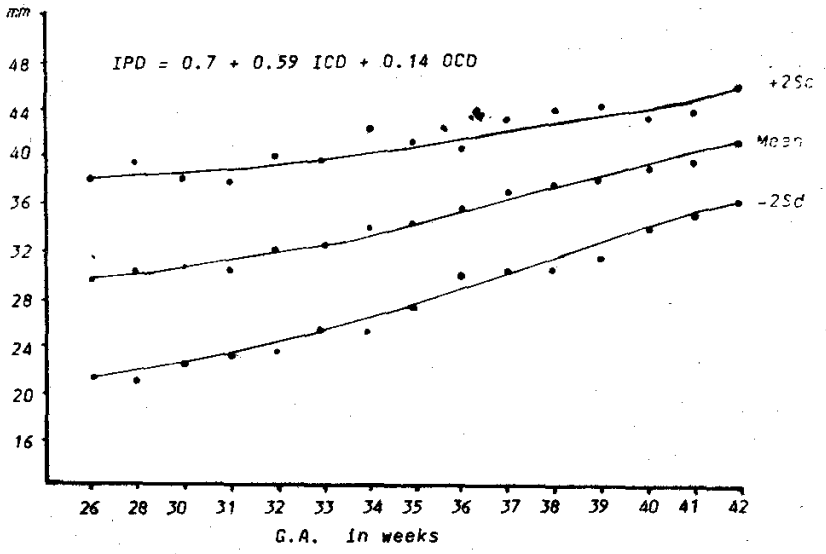

Fig. Interpupillary distance at different gestational ages. IPD = interpupillary distance, ICD = inner canthal distance, OCD = outer canthal distance, GA = gestational age.

differences in the shape and proportions of the skull, there is a need for establishment of norms for interpupillary distance in different races for proper diagnosis of hypotelorism or hypertelorism(2). In order that hypertelorism be diagnosed, both the dis-

tance between inner and outer canthi should be increased. If only the distance between inner canthi is increased, the patient is said to have pseudo-hypertelorism, probably due to broad bridge of the nose(5). Inter pupillary distance is the most accurate measure of ocular hypertelorism. As the centre of pupil is not affected by any of the soft tissues surrounding the eye, like narrow palpebral slits, epicanthic folds, *etc*., that can cause optical illusion; so it can serve as a reliable aid for determining hypertelorism(2).

The values obtained for interpupillary distance in the present study cannot be compared with the two earlier studies reported from India, because in one, no newborns were included(5) and in another, though 18 newborns were included, the inter pupillary distance is stated to have been measured directly by joining the central points of pupils(6), which at best can only be a gross approximation especially in a newborn. Merlob *et al*. measured 87 term and 111 preterm Israeli newborns between the gestational ages of 27 to 41 weeks to define ranges for various ocular measurements. They used the same formula suggested by Feingold and Bossert(3) to calculate interpupillary distance, as in our study. The mean values for interpupillary distance at 28 and 41 weeks in our study were 30.1 and 39.3 mm, respectively. The corresponding values in Israeli newborns were 37.0 mm and 43.5 mm(4). This difference may be a racial characteristic. The racial difference in the inner canthal and interpupillary distance have been reported earlier(2).

The values presented in the present communication will help in objective evaluation of hypo and hypertelorism in Indian babies. Though there are exhaustive lists of conditions causing hyper and hypotelorism(1,4,8) a few important conditions are mentioned here for ready reference.

Hypotelorism is seen in 5p-, Trisomy 13, Trisomy 21, holoprosencephaly, Meckel Gruber syndrome, Coffin-Siris syndrome, Williams syndromes, etc.

Hypertelorism is seen in Trisomy 8, $4p^+$, $4p^-$, $5p^+$, $5p^-$, Triploidy syndrome, Penta X, XXXX, XXXXY, Aarskog syndrome, Noonan syndrome, fetal aminopterin syndrome, fetal hydantoin syndrome, fetal Warfarin syndrome, Apert syndrome, Pfeiffer syndrome, Saethre-Chotzen syndrome, Robert's syndrome, Rubinstein Taybi syndrome, oculo-dento-digital syndrome, G-syndrome, Robinow syndrome, hypertelorism-hypospadiasis syndrome, Weaver syndrome, Sotos syndrome, Larsen syndrome, Pyle disease, LEOPARD syndrome, Sjogren Larsson syndrome, Di-George sequences, *etc.*

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Disseminated Tuberculosis and Cardiac Rhabdomyomata

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Primary cardiac tumors are rare in children. Rhabdomyomas constitute more than 60% of cardiac tumors and generally present within the first year of life(1,2). We report a case of multiple rhabdomyoma of the heart in a 10-month-old patient with disseminated tuberculosis.

Case Report

The patient was a full term male boy, born to a 22-year-old primigravida. The mother was an open case of pulmonary tuberculosis receiving anti-tubercular treatment. The child had completed his primary immunization including BCG which was given in the neonatal period. The child achieved normal milestones but had frequent upper respiratory tract infections, gastroenteritis and failure to thrive. At 3 months of age he was admitted to the hospital with 4 days history of high fever, breathlessness and productive cough. On examination, he was severely malnourished (marasmus) and moderately dehydrated. The abdomen was distended with free fluid. There was an ejection systolic murmur grade 2/6 in the mitral and aortic areas. The roentgenogram of the chest showed miliary mottling. A 2-dimensional echocardiogram showed congenital bicuspid aortic valve with stenosis. The child died 3 days after admission.

At autopsy, the pleural and pericardial surfaces and the lung parenchyma were studded with miliary tubercles. The hilar lymph nodes were enlarged and caseous. The liver, spleen, kidneys and adrenals also showed multiple tubercles. The loops of the intestines were matted with numerous enlarged caseous lymph nodes in the mesentry.

The heart was enlarged and weighed 90 g. There were grey-white nodular masses on the epicardial surface. The right atrium, right ventricle and the pulmonary valves had pin head sized greyish nodules on the endocardium. The left ventricular cavity was distorted by large nodular masses protruding into the outflow and sinus portions. The interventricular septum was thickened and bulging onto the right and left side (*Fig. 1.*).

Multiple sections taken from various organs were processed and stained with hematoxylin and eosin. Sections from the

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