Bone dysplasias and mental functioning

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Summary

Fourteen patients suffering from various degrees of bone dysplasia and mental handicap with superimposed neuroses or psychotic episodes are reported. Known biochemical and chromosomal causes are noted. Mental states associated with syndromes and mental malfunctioning or impairment because of skeletal defects or other factors are briefly discussed. High IgE was noted in the three cases of bone dysplasias suffering from chromosomal anomalies. Importance of early diagnosis, treatment and genetic counselling in bone dysplasias to prevent mental disorder is emphasized.

THE second verse of the most frequently used Juvenal's dictum—'Mens sana in corpore sano'—is again the most appropriate motto for this lecture. The mental malfunctioning associated with the dysplastic skeleton in man has been frequently portrayed in folklore, holy books, history, architecture (e.g. gargoyles), circus and, of course, in medicine.

When studying the bone dysplasias one learns that they are always associated with other anomalies and the defects of mind of various degrees. To appreciate the complexity of defects one has to look at embryological developmental stages of the fetus where, day by day, especially in the first trimester, teratogenic agents according to their concentration and duration can cause endless permutation of maldevelopments and malfunctions (Jancar, 1975).

To illustrate these points, fourteen patients with bone dysplasias are presented from a total of approximately 1400 mentally handicapped in the Stoke Park group of hospitals. There were also others. The physical anomalies of these patients are described together with their secondary superimposed mental disorders caused by these malformations.

Case reports

(A) Biochemical causes

Case 1. Phenylketonuria. Female, 22 years old with an IQ of 15. She is irritable and aggressive,

suffers from microcephaly, ectrodactyly of both hands and feet and spastic paraplegia (Fig. 1). She was 6 weeks premature, weighed 3.20 kg and her mother suffers from mild hypothyroidism.

Case 2. Lesch-Nyhan syndrome (familial hyperuricaemia). Male, 28 years old, IQ below 20, with severe behaviour disorder including aggression and temper tantrums. He had two brothers and a nephew suffering from the same disorder. Self mutilation and choreo-athetosis are also present (Fig. 2). He is microcephalic, of small stature (height 137 cm). His mother suffered from diabetes mellitus (Jancar and Wiley, 1973).

Case 3. Mucopolysaccharidosis type 1 (Hurler syndrome). Male, died at the age of 12 years. His mental age was below 2 years (height 119 cm). His language, motor-development, adaptive and social behaviour were all profoundly retarded. He had an older brother who also suffered from Hurler syndrome and who died at the age of 14 years. His mother was traced back to her home in Germany and three generations of this family had this disorder.

(B) Chromosomal anomalies

Autosomal anomalies

Case 4. Ring chromosome 18. Male, 30 years old, with an IQ of 26. He is aggressive and impatient, because of inability to communicate and is hypochondriacal at times. The patient is microcephalic with cleft palate, of small stature (146 cm) and suffers from asthmatic attacks and eczema of hands and feet (IgE, 748 i.u./ml, normal 30-400 i.u./ml).

Sex chromosome

Case 5. XXXXY. Male, 29 years old, IQ 23 (Fig. 3). He is very shy and introverted, kleptomaniac and very frustrated owing to inability to use arms because of dislocation of both elbow joints. Since surgical re-construction of the elbow joints, he has very much improved mentally, converses

FIG. 1. Phenylketonuria: ectrodactyly of both hands.

FIG. 2. Lesch-Nyhan syndrome: close-up of the face showing fresh and healed self-inflicted scars and abnormally set ears.

FIG. 3. XXXXY syndrome: frontal view of patient.

more freely and works in the occupational therapy department. He has bilateral radio-ulnar synostosis with delayed union of epiphyses and other features of XXXXY syndrome. His height is 183 cm (IgE, 1700 i.u./ml) (Jancar, 1964).

Case 6. YY syndrome. Male, 63 years old, IQ 62, with superimposed manic-depressive episodes. He was convicted of arson. He suffers from diabetes mellitus, slight exophthalmos, myopic chorio-retinal degeneration and has prominent lips and lower jaw. Testes are very small, His height is 189 cm with valgus deformities of both hip joints (IgE, 3310 i.u./ml) (Jancar, 1968).

(C) Other syndromes

Case 7. Acrocephalosyndactyly (Apert syndrome). Male, 62 years old, IQ 39, slightly deaf. He is an introvert, inclined to be shy, solitary and rather suspicious, has all the skeletal anomalies of the skull, upper and lower limbs typical of Apert syndrome. His height is 161 cm. He worked for many years with the stoker in the hospital boiler house (Bates, 1933).

Case 8. Chondrodysplasia punctata (Conradi disease). Male, 20 years old, blind and partially deaf and has no speech. He is mentally severely retarded with a mental age below 2 years. He has bilateral retinal detachments, nystagmus and early cataracts at 9 years of age. The patient is a short limbed dwarf (approximate height 105 cm) with marked lumbar lordosis and bilateral dislocated hips (Fig. 4), limitation of all joint movements and bilateral talipes. His cleft palate was repaired at the age of 2 years.

Case 9. Mandibulo-facial dysostosis (Berry-Franceschetti syndrome). Male, 67 years old with an IQ of 33. He is very shy and solitary. An audiogram shows no hearing at all in the left ear and defective hearing in the right. The tomography of ears revealed absence of the ossicles of both ears. The right lateral semicircular canal is short, wide and fused with the vestibule and there is an associated distortion of the right oval window.

He does not speak. The patient has a mentally defective younger brother with skeletal anomalies of the face. His parents were second cousins. He has anti-mongoloid palpebral fissures. S-shaped lower eyelids with bilateral coloboma, poorly formed ears, maxillas, malar bones and mandible with under-developed condyles (Jancar, 1962).

Case 10. Bird-headed dwarfism (Seckel syndrome). Female, 22 years old, IQ 46. Emotionally very unstable, she has outbursts of bad temper, aggression

and hysteria. She was a full-term baby and weighed 1.81 kg. Her mother had hydramnios. At the age of 9 years she developed left sided hemiplegia. Her height is 132 cm. She is microcephalic with a prominent nose, bilateral camptodactyly of little fingers and has residual left hemiparesis.

Case 11. Smith-Lemli-Opitz syndrome. Male, 11 years old, with a mental age of 2 years. He has no intelligible speech and suffers from periods of severe agitation, tantrums and even self-mutilation. The patient is illegitimate, born 3 weeks premature, weight 1.90 kg and is a dwarf (height 108 cm). He has bilateral epicanthic folds with ptosis of eyelids, a cleft palate, malformed teeth and skull.

Case 12. Klippel-Feil syndrome. Female, 39 years old, IQ 12. She has no speech and at times becomes very frustrated because of inability to communicate and difficulty in gripping (bimanual synkinesis). Her height is 133 cm. At 1 year of age she had surgical repair of spina-bifida and meningocele. She has a short neck and absence of head movements because of fused cervical vertebrae (Fig. 5), also an enlarged lower jaw, kypho-scoliosis, pes planus, genu valgum and convergent squint (Peters, 1962).

Case 13. Osteogenesis imperfecta (Fragilitas ossium). Male, died at 36 years of age, IQ 22. His articulation was defective and speech limited. He was very moody, aggressive and unco-operative, severe epileptic with slow cerebration because of anti-convulsive drugs. He had blue sclerae, keratoconus and multiple old fractures of the skeleton and attacks of paroxysmal tachycardia (Jancar, 1969a).

Case 14. Reno-facial dysplasia (Potter syndrome). Male, 40 years old, IQ 57. Emotionally he is very unstable, conscious of his defective left ear, quarrelsome, suspicious with occasional paranoid overlay. He suffers from congenital absence of the left ear and external meatus, facial asymmetry (Fig. 6), also micrognathia, abnormal dentition, congenital abnormality of the right urinary tract for which he was surgically treated in 1968, and persistent nocturnal enuresis. Since receiving surgical reconstruction of his left ear his mental condition has gradually improved and he is at present living outside the hospital on a trial basis (Jancar, 1969b).

Discussion

From this small specially selected sample of fourteen cases of bone dysplasias which represent 1% of the total hospital population, it is evident that the more physically affected patients are, the more they are likely to suffer mental defects. All the cases

FIG. 4. Chondrodysplasia punctata: lateral view revealing short-limbed dwarfism with marked lumbar lordosis.

FIG. 5. Klippel-Feil syndrome; profile of the patient showing the short neck.

FIG. 6. Renc-facial dysplasia: close-up of the face; note the asymmetry and absence of the left ear.

are suffering from severe mental handicap and some have superimposed neurotic or even psychotic episodes.

Apart from the direct effect of teratogenic agents on the development of the central nervous system, there are other defects of the tissues or other factors which prevent or delay normal development of the mind, for example: cleft palate affects feeding, nutrition, growth; it increases risk of infection (Smith-Lemli-Opitz syndrome) and later affects speech and communication (ring chromosome 18, Conradi syndrome). Defective dentition can create similar problems. Blindness (Conradi disease) and deafness (Berry-Franceschetti syndrome) both severely impair mental development. Defective locomotion (Hurler syndrome, XXXXY, Conradi disease, Seckel syndrome, Klippel-Feil) and neurological lesions (phenylketonuria: Lesch-Nyhan syndrome) lead to frustration, agitation, aggression, introversion and depression. Associated excessive height (XXXXY, XYYY) or dwarfism (Lesch-Nyhan syndrome, ring chromosome 18, Conradi disease, Seckel syndrome, Smith-Lemli-Opitz) also contribute to defective mental functioning.

Anti-convulsive drugs, as given in the case of osteogenesis imperfecta, may impair the cerebation. It is important to check the blood levels of these drugs.

Patients with facial defects (Apert syndrome; Potter syndrome) can develop neuroses and even psychotic episodes. The patient with Potter syndrome improved mentally after the provision of an artificial ear.

Rejection or ridicule of these patients can be an additional mental trauma to them.

This sample, consisting of most severely physically

and mentally affected patients, also illustrates the importance of an early diagnosis and, whenever possible, early medical, surgical or other treatments of bone dysplasias and of course genetic counselling, thus preventing or ameliorating mental malfunctioning.

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References

- BATES, R.M. (1933) *Mental Deficiency—Stoke Park Studies. First series* (Ed. by Richard J. A. Berry), p. 202. MacMillan and Co. Ltd, London.
- JANCAR, J. (1962) Mandibulo-facial dysostosis (Berry-Franceschetti syndrome) associated with severe mental subnormality and consanguinity. *Proceedings of the London Conference. Scientific Study of Mental Deficiency*, 1, 329.
- JANCAR, J. (1964) Mentally defective males with XXXXY chromosomes. *Proceedings of the International Copenhagen Congress for the Scientific Study of Mental Retardation*, 1, 179.
- JANCAR, J. (1968) XYYY with manic depression, *Lancet*, ii, 970.
- JANCAR, J. (1969a) Paroxysmal tachycardia, epilepsy, fragilitas ossium and mental retardation. *Bristol Medico-Chirurgical Journal*, 84, 17.
- JANCAR, J. (1969b) Potter's syndrome with mental retardation (Aurorenal syndrome: reno-facial dysplasia). *Journal of Mental Deficiency Research*, 13, 8.
- JANCAR, J. (1975) Neuro-cutaneous disorders and mental functioning. *British Journal of Psychiatry*, 126, 105.
- JANCAR, J. & WILEY, YVONNE (1973) Lesch-Nyhan syndrome (familial hyperuricaemia). *Acta Universitatis Carolinae Medica*. Prague, Monograph 56, 183.
- PETERS, J.J. (1962) Two cases of Klippel-Feil syndrome associated with severe mental subnormality, *Radiography*, 28, 316.