Inherited disorders in the black population of southern Africa

Part III. Multifactorial, chromosomal and congenital conditions

P. BEIGHTON, M. C. BOTHA

Summary

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The anthropological, demographic and historical background of the black population of southern Africa and the inherited haematological disorders in this group were reviewed in Part I of this article. Part II was devoted to genetic disorders. In this section the multifactorial, chromosomal and congenital conditions encountered in the black population are discussed.

Multifactorial disorders in the newborn black population

A number of important 'multifactorial' disorders present in the newborn are the consequence of the interaction of genetic predisposition and environmental determinants. Since some of these conditions are potentially lethal, it is difficult to obtain incidence figures, especially in unsophisticated circumstances. Estimates of the rate of occurrence are important, however, in planning health services and for comparison with other parts of the world in order to elucidate the environmental component.

The only available figures based upon up-to-date surveys of large numbers of consecutive newborn infants are those obtained during the past decade in Bloemfontein and at Baragwanath Hospital, Johannesburg. In this context, it must be emphasized that figures quoted for South African centres in the 1966 World Health Organization global project may well be erroneous and should be treated with circumspection.

Important multifactorial disorders in newborn infants in the black population are discussed below. Multifactorial conditions which manifest in adulthood are usually very different in their pathogenesis and general implications, and for these reasons are reviewed separately.

Cleft lip and palate

Cleft lip (CL) with or without cleft palate (CP) usually has a multifactorial aetiology but these abnormalities may also occur as components of genetic and congenital syndromes and rarely as an autosomal dominant disorder. The overall frequency of CL and CP in black neonates at Baragwanath Hospital has been estimated at 0,3 per 1000, which is much lower than in whites.

Congenital dislocation of the hip

Congenital dislocation of the hip (CDH) is present in about 1 per 1000 white infants. At one time it was supposed that this condition did not occur in South African blacks, but in a survey of 10 000 neonates delivered in hospital in Bloemfontein an incidence figure of 1,5 per 1000 was calculated. 1 A week after birth hip instability was present in only 3 babies in this series, giving a frequency of 0,3 per 1000. These figures are only 10% of those quoted for Western Europe. It thus appears that CHD is present, but in low frequency, in the black population.

Congenital talipes equinovarus

Congenital talipes equinovarus or clubfoot occurs in about 1 per 1000 neonates in Europe. The corresponding figures for black neonates in southern Africa are 3,5 per 1000 (Bloemfontein) 2 and 1,55 per 1000 (Baragwanath Hospital). 1 Patients with additional anomalies were included in the former survey, while both unilateral and bilateral involvement was counted in the latter, so it is difficult to reach firm conclusions concerning relative population incidences.

Hydrocephalus

In the survey at Baragwanath Hospital 0,3 per 1000 liveborn babies had uncomplicated hydrocephalus. 1 This abnormality has many causes, both congenital and acquired, and for these reasons comparison between populations is difficult.

Neural tube defects

The determination of firm incidence figures for the clinically important neural tube defects (i.e. spina bifida and anencephaly) is fundamental to programmes of prevention by antenatal measures including amniocentesis, maternal serum screening and vitamin supplementation.

Anencephaly. Anencephaly causes stillbirth and available incidence data must be regarded as minimum estimates, as ascertainment is probably far from complete. The most recent figures are 0,4 per 1000 in the Baragwanath Hospital survey and 0,34 per 1000 in the Cape. 3 As with spina bifida, which shares a common pathogenetic mechanism, the apparent incidence in the black population is lower than in Western Europe.

Spina bifida. Incidence figures for spina bifida or meningocele have been quoted as 0,7 per 1000 live births in the Bloemfontein survey, 2 0,78 at Baragwanath Hospital, 1 and 0,22 in the Cape. 3,4 An estimate of 1,25 per 1000 comes from Durban. 3 The figures based on hospital deliveries are probably reasonably accurate but at present it is impossible to be sure whether there are genuine tribal and regional variations, or secular trends. It seems, however, that the incidence of spina bifida is generally lower in blacks in southern Africa than in the white population.

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Multifactorial disorders in the adult black population

It is becoming increasingly evident that there is a genetic component in a number of very common conditions which usually present in adulthood. The situation is complex, since environmental factors also play an important role and it is also likely that there is considerable heterogeneity. Disorders of this type are currently attracting a great deal of attention; those of special importance are discussed below.

Ankylosing spondylitis

Ankylosing spondylitis occurs in about 1 per 1,000 white males, but fewer than 10 affected blacks have been reported in a population of more than 20 million. The very strong association of ankylosing spondylitis with the HLA-27 allele, which is uncommon in blacks, partially explains this situation. However, in view of the great rarity of the disorder, it is likely that additional mechanisms are operative.

Articular disorders

There are considerable discrepancies in the relative frequencies of a variety of articular disorders which have a multifactorial aetiology, with a significant genetic component. This problem has been the subject of several epidemiological surveys in black populations undertaken principally by the Department of Orthopaedic Surgery, University of the Witwatersrand, Johannesburg. The findings, which have been described in detail elsewhere, are summarized below.

Rheumatoid arthritis has been shown to be rare in tribal Xhosas, uncommon in rural Tswanas and present in appreciable prevalence in deriblized blacks in Soweto, Johannesburg.6,7,9

Gout is rare in tribal circumstances but encountered with increasing frequency in urban black communities. Elevation of serum uric acid levels underlies clinical gout and population surveys have shown a progressive rise with sophistication of lifestyle.10-12

Osteoarthritis differs in blacks and whites by virtue of the anatomical distribution of involved joints. In particular, non-syndromic degenerative arthritis of the hip joint, which is common and age-related in whites, is rare in the black population. Similarly, Heberden's nodes on the terminal phalanges in digital osteoarthritis are very uncommon in blacks.11,13,14

Hypermobility is a component of a number of articular disorders. The age and sex relationships of the range of joint movements has been documented in Tswana and Xhosa populations since this factor may influence the development and population prevalence of multifactorial deformities such as hallux valgus.15-17,19

Chromosomal disorders

The estimated frequencies of Down, Turner's, Klinefelter's and the fragile-X syndromes from cytogenetic laboratories in our own and other centres are generally lower in blacks in southern Africa than in the white population.24-26 As with other disorders, this situation could represent incomplete recording. The lethal chromosomal conditions, trisomy 13 and 18, are also apparently less common in blacks, but this observation is also probably the consequence of recording bias, since many abnormal stillbirths in rural areas are never referred for cytogenetic investigation. Intersex is an exception, since this group of disorders occurs in high frequency in the black population. However, this condition is heterogeneous and although several categories have a chromosomal basis, the prevalent forms seem to be non-genetic.

Congenital malformations

A wide variety of non-genetic congenital malformations occur in the black population but it is not known whether these differ significantly in terms of type or frequency from those in other communities. The well-defined malformations which we have encountered in clinics and institutions are listed in Table I and those of special importance are briefly discussed.

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Arthrogryposis multiplex congenita

Arthrogryposis multiplex congenita is a heterogeneous group of disorders in which multiple contractures are present at birth. A review of the local situation in terms of an analysis of 250 affected South Africans, of whom a significant proportion were blacks, has recently been published.38

Conjoined twins

In the period 1977 - 1980 30 sets of conjoined twins were born in southern Africa. Of these, 19 were black. The environmental factor responsible for this 'epidemic' has not been identified but it was evidently active in all populations and geographical regions.30-32

Ear pits

Ear pits are innocuous depressions in the pre-auricular region immediately anterior to the tragus. In a Natal survey they were
found to exist in 3% of normal Zulus and it is our impression that they are common in other tribal groups. By contrast, ear pits are relatively uncommon in white populations.

**Limb reduction defects**

Limb reduction defects, in which components of limbs are absent or maldeveloped, are a common cause of severe handicap. We have encountered several hundred affected people in all ethnic groups, including the black population of southern Africa. No formal analysis has been undertaken but it is our impression that limb defects in blacks do not differ in terms of anatomical type or frequency from those in other populations.

**Miscellaneous disorders**

A few conditions specific to the black population seem to have a genetic component, although this has not yet been proven. Because of their clinical and theoretical importance, they are discussed.

**Blount’s disease**

Blount’s disease presents in infancy as bowlegs and appears after walking has started. Although more than 400 affected black infants have been seen since 1970, the condition is virtually absent in other populations. The condition is due to wedging of the epiphyses and metaphyses at the knee joint and it may be the result of mechanical forces generated by adduction of the knees when the infant is carried on the mother’s back. However, Blount’s disease is rare in some populations where babies are carried in this way, so it may be assumed that there is also a genetic predisposition.

**Mseleni joint disease**

Mseleni joint disease is a severe form of progressive degenerative osteo-arthritis present in more than 1000 affected people in a localized region of Zululand. The condition causes crippling and represents a major public health problem in this remote locality. The aetiology is unknown, but family clustering is suggestive of a genetic component. Meleni joint disease is at present under intensive scrutiny by several groups of investigators under the aegis of the South African Medical Research Council.

**Transkei foot**

Transkei foot is lateral angulation of the 5th toes which causes disability when the sufferers attempt to wear shoes. The deformity was recognized in several large Xhosa families living in the Tsolo region of Transkei and pedigree data are consistent with autosomal dominant inheritance.

**Discussion**

The frequency and distribution of genetic disorders in any well-defined population is the result of the long-term activity of environmental factors and past events, such as immigration and endemic disease. Thus the pattern of inherited conditions in a community is a reflection of historical circumstances. Of more immediate importance is the fact that the information concerning frequency of specific genetic disorders in any population is crucial for the establishment of services for the medical and genetic management of inherited disease.

The common multifactorial conditions with a complex genetic component are a major cause of morbidity. Documentation of secular trends and discrepancies in relative prevalences of these disorders between different communities will provide important information contributing to the understanding of their pathogenesis. Since the underlying biological mechanisms are influenced by genetic factors which may be polymorphic, the genetic composition of an individual or population might be found to be relevant to the choice of drug therapy.

The basic cause of chromosomal disorders and congenital malformations is unknown, but comparison of prevalence with and between different populations may eventually yield information concerning the causal mechanisms. Accumulation and analysis of cytogenetic data using computer facilities may prove to be highly productive in this respect.

In the three parts of this article we have endeavoured to give an overview of present knowledge about inherited disorders in the black populations of southern Africa. Limitation of space has precluded greater detail but this can be found in the articles quoted as references. We recognize that there are many areas in which information is scanty and doubtless there are many omissions. Nevertheless we hope that we have succeeded in providing a reasonable perspective for present-day planning and future comparisons.

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**REFERENCES**

Body cooling as a method for reducing hyperthermia
An evaluation of techniques

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Summary
The most important objective in the treatment of heatstroke and related conditions is to reduce the body core temperature to safe levels. Subjects performed at an external work rate of 54 W in hot, humid conditions (dry-bulb 40°C, wet-bulb 35°C), and a recent innovation to achieve body cooling, i.e. strategically placing instant cold packs (ICPs) strategically placed to cover the large vessels of the neck, axillae and groin, was evaluated under controlled laboratory conditions. We found that this procedure was not significantly more effective (P > 0.5) than passive body cooling in bringing about a 2°C reduction in rectal temperature. Moreover, covering the whole body with ICPs plus induced evaporative cooling produced higher cooling rates than those achieved by the strategic placement of ICPs (0.0340°C/min and 0.0344°C/min respectively) (P < 0.01).

By definition, heatstroke represents a condition in which elevated body temperatures are causally related to tissue damage, often of an irreversible nature. Although tissue damage is widespread, the outcome for the patient depends mainly on the degree of injury to the nervous system, the kidneys and liver, the latter two organs almost invariably being damaged. The extent of tissue injury is not only related to the absolute rise in body core temperature but also to the duration thereof above a certain critical limit.

Heatstroke is a medical emergency; if effective treatment is delayed or withheld through non-recognition, mortality rates of up to 80% may be recorded. The most important objective in the treatment of heatstroke is therefore to reduce body temperature to safe levels, i.e. to a rectal temperature between 38.0°C and 38.5°C, as quickly as possible. Obviously, the method of achieving this is important, the traditional procedures being the following: (i) whole-body immersion in an ice-water mixture; (ii) use of ice-packs; and (iii) enhancing evaporative cooling through various combinations of water and air sprays. Relatively recently the use of 'instant' cold packs (ICPs), strategically placed to cover the large vessels of the neck, axillae and groin, has been acclaimed at both local and overseas endurance events, the rationale being to obviate the major objections to the use of an ice-water bath, namely intense peripheral vasconstriction, shivering and patient discomfort. In view of the success reported under 'field' conditions, a comparative study under controlled laboratory conditions was undertaken to evaluate the merits of this innovation and to compare it with evaporative cooling.