



POSNA

The Core Curriculum

Multifactorial disorders

Objectives

1. Define multifactorial inheritance
2. List 3 conditions of orthopaedic interest that are presently regarded as being multifactorial in their inheritance pattern

Discussion point

1. What method(s) can be used to achieve greater precision in investigating multifactorial inheritance?

Discussion

Multifactorial traits result from the interaction of one or more environmental factors and two or more genes. In contrast to single gene disorders, multifactorial genes can express continuous variation, that is distribution of phenotypic expression from one extreme to another in a continuous fashion. Skin color and height would be examples of this type of multifactorial inheritance. This is not always the case, however, as many multifactorial conditions of orthopaedic interest have a distinguishable phenotype. Idiopathic scoliosis, rheumatoid arthritis, clubfoot, developmental dislocation of the hip, and myelomeningocele are all transmitted via multifactorial inheritance. For example, the effect of folic acid administration to pregnant mothers in reducing the incidence of myelomeningocele is an excellent example of an environmental influence on phenotypic expression. The incidence of multifactorial traits in first degree relatives is higher than the population at large, but much less than that noted in single gene disorders. For example, the risk of clubfoot in first degree relatives is 25 times normal, 5 times higher in second degree relatives, and twice as common in third degree relatives. Complex segregation analysis, which requires large numbers of families, was used by Rebbeck to study the inheritance of clubfoot. They concluded that clubfoot was transmitted by a single gene defect with an additional effect (either another gene or an environmental factor). Prenatal counseling for multifactorial disorders is much more complex than for single gene disorders.

References

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