Medical genetics: advances in brief

Allogenic bone marrow transplantation for lysosomal storage diseases

Commentary. Bone marrow transplantation for lysosomal storage diseases

Bone marrow transplantation has been used for about 10 years to treat patients with inherited lysosomal storage disorders. This report is a retrospective analysis of 63 such patients to assess success and risks of the procedure. The transplants were done for a variety of conditions and in a number of centres although very similar protocols were used in all cases. The mortality from the procedure itself was 10% if an HLA identical sib donor was available, and two to three times this if an unmatched donor was used. Follow up after a successful transplant was available on only 28 of the original cohort; for the remainder there was either transplant rejection, transplant related mortality, or follow up of less than one year. There was good evidence that expression of some clinical features after transplantation, particularly of visceromegaly. There was little or no progression of other, such as skeletal problems, during follow up. Where there was significant neurological deficit before transplantation, it was likely that there would be disease progression. The potential mechanisms of bone marrow transplantation to benefit this group of patients are the replacement of macrophages laden with storage product with enzymatically competent cells, the transfer of normal enzymes and the clearance of storage product from the tissues because of the reduced levels in the circulation. As Waclaw and Dobrenis suggest in their commentary, there are few data to suggest that replaced enzyme will be able to cross the blood brain barrier, and further doubts about what the potential benefits of transplant of cells or enzymes may be influenced by the disease process and the pathological sequelae of the metabolic defect may not be readily reversed. The study by Hoogerbrugge et al is hampered by small numbers in each disease category and incomplete data on follow up, but does seem to show that clinical experience bears out these uncertainties, and that in particular there is little evidence for neurological benefit in bone marrow transplantation for patients with lysosomal storage disorders.

ANGELA BARNICOAT

Evidence for a distinct region causing a cat-like cry in patients with 5p deletions

Deletions of 5p are associated with a contiguous gene syndrome known as the cri du chat syndrome, because of the characteristic cat-like cry with which patients present at birth. Additional features may include failure to thrive, microcephaly, hypertelorism, epicanthic folds, hypotonia and severe mental retardation. The authors of this report have studied families in which patients with 5p— have the cat-like cry in isolation, or just in association with mild developmental delay. They used FISH to determine the precise location of the deletions in each family, and found that all the deletion breakpoints in their four families were within a 1.2 cM chromosomal region implicated in the full blown syndrome described previously, in which patients have the characteristic dysmorphic features and severe developmental delay. DNA clones mapping to the chromosomal region associated with the cat-like cry will be useful diagnostic tools, enabling distinction between 5p deletions involving 5p15.2, which will result in severe developmental delay (as observed in most cri du chat syndrome patients) and smaller deletions restricted to 5p15.3, which result in the isolated cat-like cry, associated with a much better prognosis.

FRANCES FLINTER

Specification of the neurobehavioural phenotype in males with fragile X syndrome

In recent years increasing attention has been focused on the identification of specific “behavioural phenotypes” in different chromosomal and other genetic syndromes. Of these, fragile X syndrome has perhaps been the most extensively studied. This paper reports the findings of a multidisciplinary team from Baltimore comprising neurogeneticists, psychiatrists, and paediatricians. They carried out a comprehensive examination of 31 males with fragile X syndrome and 30 age, sex, and IQ matched controls. The Vineland Adaptive Behaviour Scales and the Aberrant Behaviour Checklist, which are both well established instruments for measuring behavioural profiles, were used and both parents and teachers participated in the study. The number of CCG repeats within the FMR1 gene was recorded in each case. The results were analysed using a myriad of statistical analyses, and a distinctive pattern of aberrant behaviour among males with fragile X syndrome, which was different from the aetiologically heterogeneous control group of males of the same age and developmental level, emerged from the study. Fragile X males were more hypertensive with excessive activity, restlessness, impulsivity, and distractibility. They tended to talk excessively and talk to themselves to a greater extent than the control group, frequently repeating words and phrases. They had repetitious, stereotyped movement of the hands, arms, and body but did not display self-injurious behaviour. On the Vineland scale, which assesses self-help, communication, socialisation and daily living skills, no characteristic pattern was seen in the fragile X males, though they did rate higher on daily living skills than the other two domains. More fragile X subjects meet diagnostic criteria for attention deficit hyperactivity disorder, stereotypy-habit disorder, and for past or present autistic disorder. There was no linear association between the size of the fragile X amplification and the phenotypic profile. These findings extended those of previous reports. The authors propose that the purpose of such a study as helping to elucidate the neurodevelopmental pathways of normal behaviour and psychopathology, aiding design of symptomatic treatments for prevention and aiding research into the efficacy of interventions strategies. They suggest that the fragile X mutation may have specific effects on brain development and function in the areas which mediate behavioural inhibition or self-regulation. It is important to recognise, however, that many of the behavioural characteristics noted, for example, hand flapping, hyperactivity, and excessive talking, have been reported as part of the behavioural phenotype of other syndromes such as Angelman and Williams syndromes and care must be taken before attributing the behaviours to a specific effect of the FMR1 gene. We are now becoming aware that recognition of the behavioural phenotype can aid diagnosis of many disorders. For the clinical geneticist involved in diagnosis, direct research in fragile X is also generating mutations in the coding sequence of one of two transforming growth factor-β (TGF-β) receptor genes. Normally the products of these genes form a heteromeric complex which ensures that signals from TGF-β itself inhibit epithelial cell proliferation. In 12/38 human colon cancer cell lines, however, a nucleotide protection assay showed a marked reduction or absence of type II TGF receptor transcripts. This reduced expression was found in 9/11 cell lines with microsatellite instability and 3/27 cell lines without. No TGF-β binding was detected in cell lines with reduced expression. Subsequently three different frameshift mutations were detected in seven of the cell lines with reduced expression and microsatellite instability. All three mutations had removed one or two bases from a short repetitive sequence of 10 adenosines in the 5′ half of the type II gene leading to a truncated protein. The presence of the mutations in original tumour material and not in normal tissue was confirmed. The cell lines were derived from a variety of colon cancer sources including two HNPPC and five colorectal DNA repair gene mutations. Progression from constitutional mutation through microsatellite instability and receptor gene mutations to the proliferation of epithelial cells released from growth inhibition is an attractively direct model for the development of some colon cancers. One immediate practical consequence is that it is possible to screen for a variety of cancers by looking for type II TGF-β receptor mutations in stools.

JILL CLAYTON-SMITH

Inactivation of the type II TGF-β receptor in colon cancer cells with microsatellite instability

One of the most intriguing recent findings in cancer genetics was the discovery that predisposing mutations in no less than four genes identified in DNA repair were involved in the inherited element of hereditary non-polyposis colon cancer (HNPPC) while short repetitive DNA sequences (microsatellites) from HNPPC tumours frequently showed variation in the number of repeats. This study examined whether this was associated with cancer. 70 patients with colorectal cancer were studied, 33 of whom had HNPPC. Tumours with microsatellite instability were found in 16/33 HNPPC and 17/37 non-HNPPC patients. The 35 tumours from HNPPC patients showed a number of somatic mutations in the second intracellular loop of the type II TGF β receptor (TGF-βRII). This region is known to be critically important in TGF-β signal transduction, and the authors suggest that inactivation of the receptor is likely to play a major role in tumour progression. They propose that loss of TGF-βRII is a marker of HNPPC and suggest that its use as a marker for surveillance and in the detection of screening patients may be possible.
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