22.4% in controls. The prevalence of HLA B7 was also higher in idiopathic haemochromatosis than in controls (38.4% v 11.3% and 14.6%).

An association between the haemochromatosis gene and the A3B7 haplotype has been seen in all series throughout the world.³ Associations with A3B14,^{3,8} A11B35 and A11B5,³ A1B8⁸ and A3B35⁹ were also observed in different countries.

The association with A3B7 was observed in five probands of our series. The A3 antigen showed linkage with other B, not B7, antigens in four probands. In five probands with A3B7 phenotype pedigree analysis showed that only four of five genotypes accorded with the proband's genotypes.

Our results agree with data reported from other countries; A3 is significantly more common on idiopathic haemochromatosis chromosomes regardless of the presence or absence of B7 or B14, and A3 (and to a lesser degree A11) is the independent idiopathic haemochromatosis allele marker.³

The number of heterozygotes, identified through pedigree studies, agrees with the expected prevalence according to published findings,¹⁰ the number of homozygotes, however, was small. The probability of finding HLA identical (homozygote) family members through pedigree studies is influenced by different factors: the recessive mode of inheritance, the gene prevalence in the population, and number of siblings in the family, etc.

The HLA identical, but disease free sibling,

was a 40 year old woman with regular menses. The transferrin saturation value and the serum ferritin concentration were normal. She may be an example of incomplete expressivity or recombination.^{2,4} A detailed investigation of DNA polymorphism would be required to explain this finding. Extended family and population studies are necessary in Hungary to establish the prevalence of the gene and the likely role of haplotypes other than A3B7.

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Cytogenetic analysis of a granulocytic sarcoma in a patient without systemic leukaemia

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Abstract

Granulocytic sarcoma is a rare complication of leukaemia. Occasionally it presents before the development of systemic leukaemia when diagnosis may be difficult. A case of granulocytic sarcoma occurring in a patient with no overt evidence of leukaemia, but in whom cytogenetic analysis of the bone marrow showed a clonal t(12;13) translocation, is reported. Cytogenetic analysis of tissues in this disease may indicate evidence of systemic disease before overt morphological changes.

Granulocytic sarcoma is a rare tumour, defined as a "localised tumour mass composed of immature cells of the granulocytic series".¹ The most common sites of presentation are bone, periosteum, soft tissue, lymph node and

skin. The tumour may develop during the course of acute myeloblastic leukaemia (AML), chronic myeloid leukaemia (CML), or other myelodysplastic disorder. Alternatively, the tumour precedes leukaemia by some months.² When granulocytic sarcoma presents without blood or bone marrow manifestations of leukaemia, the diagnosis may be missed.³ Histological diagnosis can be difficult and many patients are initially diagnosed as having high grade lymphoma.⁴⁻⁶ Often the first indication of misdiagnosis is the lack of response to treatment.

Case report

A 52 year old man presented with a rapidly enlarging chest wall mass, initially thought to be a high grade non-Hodgkin's lymphoma. Staging investigations showed no evidence of disease elsewhere and he was treated with

Karyotype of abnormal cell line: 46,XY,t(12;13)(p12;q12)

three cycles of chemotherapy (cyclophosphamide, adriamycin, vincristine and prednisolone). After a partial response the tumour continued to grow and a second biopsy was performed. This time some of the tumour cells showed cytoplasmic granularity, suggestive of myeloid differentiation; chloroacetate esterase (CAE) and antilysozyme positivity supported the diagnosis of granulocytic sarcoma. Review and further staining of the first biopsy specimen showed similar findings and the initial diagnosis was revised. The only haematological abnormality, found in the peripheral blood at presentation and at the time of the second biopsy, was hyposegmentation of the nucleus in a proportion of the neutrophils (pseudo-Pelger-Huet anomaly). The peripheral blood cell counts were normal and there were no other dysplastic features. Bone marrow specimens were obtained at presentation and at the time of the second biopsy and showed no other features of dysplasia, no excess of blast cells, and no evidence of other infiltration. Cytogenetic analysis of the second tumour biopsy specimen showed an apparently normal 46, XY karyotype, but simultaneous analysis of bone marrow cells showed an abnormal 46,XY/46,XY,t(12;13)(p12;q12) karyotype (figure). In view of the persisting tumour and the cytogenetic abnormality in the marrow, the patient was given local radiotherapy followed by further chemotherapy (daunorubicin, cytosine, and thioguanine). Unfortunately, he died shortly afterwards following a cerebral haemorrhage.

Discussion

This patient remained free of systemic leukaemia until his death nine months after granulocytic sarcoma was diagnosed. The only signs of disease were the presence of the pseudo-Pelger-Huet anomaly in peripheral blood and the chromosome translocation in bone marrow. Unexpectedly, the translocation was not observed in the tumour cells. This probably reflects our failure to culture malignant cells from the tumour sample, and suggests that the karyotypically normal cells were derived from normal tissue surrounding the tumour.

Granulocytic sarcoma is thought to occur more frequently in association with myeloid leukaemias showing the t(8;21) translocation.⁷ It may be that associations with rarer specific

chromosome abnormalities will emerge as more data accumulate. Russell *et al* report a similar case of granulocytic sarcoma preceding acute myelomonocytic leukaemia (AMML), in which cytogenetic analysis of marrow showed an abnormal cell line, with a pericentric inversion of chromosome 16, associated with myeloblastic leukaemia (AML) FAB type M₄Eo.⁸ The authors suggest that progression of this tumour to AML M₄Eo is a recurring association and, if treated aggressively with the appropriate chemotherapy when the tumour is diagnosed, carries a more favourable prognosis.

Although the t(12;13)(p12;q12) abnormality we describe is not recognised as a specific marker in malignancy, we have recently observed two other cases in which rearrangements involving 12p12 have been the sole abnormality. In the first, a patient with AMML, we found an identical t(12;13)(p12;q12) translocation, and in the second, a child with AML, we reported a similar t(12;13)(p12;q14) abnormality. The translocations in all three cases seem to be unbalanced with partial deletion of the short arm of chromosome 12 (12p12-pter). The histology and cytochemistry of these cases suggest no common features except that in each case the disease is of myeloid origin. Abnormalities involving 12p12 have frequently been reported, usually in myelodysplastic syndromes and acute non-lymphocytic leukaemia, and most commonly in secondary disorders when additional chromosome changes are also present. Reports suggest that partial deletion of 12p is non-randomly associated with secondary leukaemia, rather like monosomy 7 or 7q.⁹

Monitoring cytogenetic changes in bone marrow in patients likely to develop systemic disease is helpful in the early detection and treatment of leukaemic transformation.

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