

The Application of DNA-Polymorphisms in Paternity Testing

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INTRODUCTION

Most cases of disputed paternity can be adequately resolved by testing the conventional blood group, serum and enzyme systems, perhaps completed by testing the HLA system. The analysis of DNA polymorphisms is a very useful additional system for distinguishing falsely accused non-fathers from "true" fathers and for providing convincing evidence in favour of paternity in cases of non-exclusions. The purpose of this presentation is to report the results from some extraordinary paternity cases in which the analysis of DNA polymorphisms greatly helped clear up the paternity.

MATERIALS AND METHODS

Routine paternity testing consisted of the conventional serological analysis of the red cell antigen systems ABO, MNSs, Rhesus, Kell, P, Duffy, Kidd, Lutheran and Colton, the serum proteins Gm, Km, Hp, Gc, C3, Bf, Tf, PLG and Pi, the red cell enzymes aCP, PGM₁, AK, ADA, 6-PGD, GPT, EsD and GLO, and leucocyte antigens HLA A, B, C by means of standard techniques.

DNA was extracted from EDTA-blood using a non-organic solvent procedure or, in some special cases, by phenol-chloroform extraction. After quantification and control for high molecular weight, 6 µg DNA were digested with the restriction enzymes Hae III or Hinf I at a concentration of 5 U/µg DNA following the manufacturer's specifications. Fractionation of DNA was performed by electrophoresis in 1% agarose, followed by Southern blotting and hybridisation with ³²P-labelled DNA probes, YNH24 (Promega), MS31 and g3 (ICI, Cellmark diagnostics). The radioactive fragments were visualized by autoradiography.

RESULTS

Case I: The parentage of a putative father as well as of a putative mother of two children was disputed. Investigations of the conventional systems resulted in a single second-order exclusion for both of the parents to child I. The parentage of child II was excluded for both in the HLA system. DNA polymorphisms resulted in two exclusions of the putative mother to child I and three exclusions to child II. For the putative father, only one exclusion was found to child I. Paternity was excluded, but consanguinity has to be assumed.

	Rhesus	Kidd	Gm	Km	HLA
Child I	CcD.Ee	Jk(a-b+)	(1,2,-3,-11,21)	(1,3)	A2,A28; B51,B60; Cw3
Child II	ccD.EE	Jk(a+b+)	(1,2,-3,-11,21)	(-1,3)	A3,A31; B7,Bw75/w76; Cw1,Cw3
P. Mother	CcD.Ee	Jk(a-b+)	(-1,-2,3,11,-21)	(1,3)	A2,A29; B14,B51; Cw8
P. Father	CCD.ee	Jk(a+b-)	(1,-2,3,11,21)	(1,-3)	A1,A28; B35,B51; Cw4

Locus Probe	D2S44 Hae III/YNH24	D7S21 Hinf I/MS31	D7S22 Hinf I/g3
Child I	2.0 - 1.7 kb	5.7 - 4.2 kb	5.4 - 3.4 kb
Child II	3.7 - 3.3 kb	5.6 - 4.1 kb	6.3 - 5.4 kb
Putative Mother	2.1 kb	7.1 - 6.9 kb	7.1 - 4.5 kb
Putative Father	3.7 - 0.8 kb	5.6 kb	10.8 - 5.4 kb

Case 2: An apparent "silent" allele transmittance was observed at the acP locus. No exclusion occurred in the HLA system. Investigating Hae III/YNH24 polymorphism, a fragment of different size was found for the putative father and the child, whereas no exclusion occurred in Hinf I/MS31 and Hinf I/g3 (Fig. 1). The reason for the similarity but exclusion was that the putative father had sent his brother to the blood test.

	acP	HLA
Child	acP B	A2,A29; B35;B51; Cw4
Mother	acP B	A2,A3; B8,B51; Cw7
Putative Father	acP A	A24,A29; B35,B44; Cw2,Cw4

Locus Probe	D2S44 Hae III/YNH24	D7S21 Hinf I/MS31	D7S22 Hinf I/g3
Child	3.2 - 1.1 kb	6.8 - 5.7 kb	6.7 - 5.2 kb
Mother	1.7 - 1.1 kb	6.7 - 5.7 kb	6.1 - 5.2 kb
Putative Father	2.9 - 1.9 kb	6.8 - 6.2 kb	6.7 - 6.1 kb

Case 3: The putative father died before the birth of the child. Blood investigation of the deceased was unsuitable as he received blood transfusions before he died. Therefore, muscle and tendon specimen were investigated by DNA polymorphisms (Fig. 2). Combining the results of these DNA polymorphisms and those of the conventional blood group systems of his mother, a plausibility of paternity $W > 99.999\%$ was obtained.

	Kell	acP	HLA
Child	Kk	BC	HLA A11,Aw33; B17,B60; Cw3
Mother	kk	AB	HLA A3,A11; B35,B60; Cw3,Cw4
Mother of the dead Putative Father	Kk	BC	HLA A2,Aw33; B17,B35; Cw3,Cw4

Locus Probe	D2S44 Hae III/YNH24	D7S21 Hinf I/MS31	D7S22 Hinf I/g3
Child	3.0 - 1.8 kb	6.5 - 4.6 kb	3.1 - 1.7 kb
Mother	1.8 kb	7.5 - 4.6 kb	6.8 - 3.1 kb
Putative Father	3.0 - 1.8 kb	6.5 - 4.6 kb	3.0 - 1.7 kb
Mother of the P.F.	3.0 - 1.6 kb	6.3 - 4.6 kb	3.0 - 1.7 kb

Fig. 1

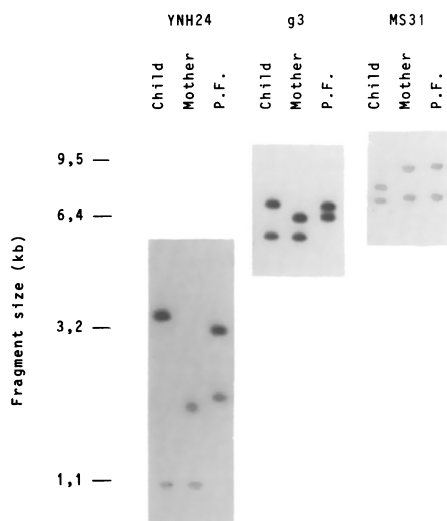


Fig. 2

