ISOELECTRIC FOCUSING OF Gc, Tf AND Pi SUBTYPES IN A NORTHERN ITALIAN POPULATION

T. Nagai[+], T. Ikeda[+], G. Rossi[+], M. Salviati[++] and O. Prokop[+++]

+: Department of Legal Medicine, Teikyo University School of Medicine, Tokyo-173, Japan

++: Laboratory of the Central Immunotransfusion and Human Genetics, Hospital of Vicenza, Vicenza-36100, Italy

+++: Department of Forensic Medicine, Humboldt University, Berlin-1040, GDR

Summary

The data on the distribution of Gc-, Tf- and Pi-polymorphisms in the northern Italian population presented in this paper are important for population genetics and forensic medicine. Fresh blood samples were obtained from unrelated northern Italian people mainly from the Vicenza area. The polyacrylamide gel isoelectric focusing technique for Gc, Tf and Pi was in agreement with Nagai and Geserick et al.

The following gene frequencies in the northern Italian population are calculated:

Gc^{1F}=0.153 Gc^{1S}=0.571 Gc^{2}=0.275 Gc^{V}=0.001 (Variant)

Tf^{C1}=0.788 Tf^{C2}=0.169 Tf^{C3}=0.042 Tf^{D}=0.001

Pi^{M} =0.972 Pi^{S} =0.021 Pi^{Z} =0.002 Pi^{F}=0.002

The observed and expected values assuming a HARDY-WEINBERG equilibrium were in good agreement and only one Gc variant (Gc2-1F-1S) found by means of immunofixation technique.

Introduction

The determination of protein polymorphisms for genetic and forensic investigations was at first based on electrophoretic procedures: gel electrophoresis, immunoelectropheresis and immunofixation electrophoresis. After introduction of the isoelectric

Advances in Forensic Haemogenetics 1
(c) Springer-Verlag Berlin Heidelberg 1986

Advances in Forensic Haemogenetics 1
Edited by B. Brinkmann and K. Henningsen
© Springer-Verlag Berlin Heidelberg 1986

focusing with a higher resolution capacity new genetic heterogeneities of proteins were discovered.

With the isoelectric focusing technique Frants and Eriksson were able to identify three subtypes of the commom phenotype PiM of the Pi-system. In the same way, Constans and Viau showed that the Gc^{1} allele divides into two allele: Gc^{1F} and Gc^{1S}. Kühnl and Spielmann have found two subtypes of the common Tf^{C} allele: Tf^{C1} and Tf^{C2}. In 1979 and 1980 new Tf^{C} subtypes were observed: Tf^{C3} (Kühnl and Spielmann), Tf^{C4} and Tf^{C5} (Constans et al.).

The data on the distribution of Tf-, Gc- and Pi-polymorphisms in a northern Italian population presented in this paper were evaluated to be important for population genetics and forensic medicine.

Material and Methods

Fresh blood samples were obtained from unrelated donors of a northern Italian district mainly from the Vicenza area. Serum was separated promptly and transported by airplane with dry ice.

The polyacrylamide gels isoelectric focusing (PAGIF) for Gc, Tf and Pi were agreement with Geserick et al.[1] and Nagai.[2]

Results

Table 1 summarizes the results of Tf-subtyping by PAGIF. The position of the main bands of TfD is similar to the electrophoretic mobility observed after gel electrophoresis. The gene allele frequencies of Tf^{C1}, Tf^{C2} and Tf^{C3} were calculated, but it was not possible to calculate the frequency of Tf^{C4} and Tf^{C5} because the sample of 595 sera were not containing Tf^{C4} and Tf^{C5} subtypes.

Advances in Forensic Haemogenetics 1
(c) Springer-Verlag Berlin Heidelberg 1986

Table 1. Results of Tf-typing

	Obs.		Exp.		Gene
Type	No.	%	No.	%	frequencies
C1	369	62.0	369.5	62.1	Tf^{C1} = 0.788
C1C2	159	26.7	158.5	26.6	Tf^{C2} = 0.169
C1C3	40	6.7	39.4	6.6	Tf^{C3} = 0.042
C1D	1	0.2	0.9	0.2	Tf^{D} = 0.001
C2	18	3.0	17.0	2.9	
C2C3	6	1.0	8.4	1.4	
C3	2	0.3	1.0	0.2	
Total	595	100.0	594.7	100.0	

Table 2. Result of Gc-typing

	Obs.		Exp.		Gene
Type	No.	%	No.	%	frequencies
1F	14	2.4	14.0	2.3	Gc^{1F} = 0.153
1F1S	104	17.4	104.3	17.5	Gc^{1S} = 0.571
1S	196	32.8	194.7	32.7	Gc^{2} = 0.275
2 1F	51	8.5	50.2	8.4	Gc^{V}(variant)
2 1S	186	31.2	187.5	31.4	= 0.001
2	45	7.5	45.2	7.6	
2 V	1	0.2	0.3	0.1	
Total	597	100.0	596.2	100.0	

Advances in Forensic Haemogenetics 1
(c) Springer-Verlag Berlin Heidelberg 1986

Table 3. Result of Pi-typing

	Obs.		Exp.		Gene
Type	No.	%	No.	%	frequencies
M	563	94.6	562.4	94.5	Pi^{M3} = 0.972
M S	23	3.9	24.3	4.1	Pi^{S} = 0.021
M Z	2	0.3	2.0	0.3	Pi^{Z} = 0.002
F M	6	1.0	5.8	1.0	
S	1	0.2	0.3	0.1	Pi^{F} =00.005
Total	595	100.0	594.8	100.0	

The distribution of Gc subtypes studied in a northern Italian population is shown in table 2. The observed and expected values assuming a HARDY-WEINBERG equilibrium were in good agreement and only one Gc variant (Gc2-1F-1S bands) found by means of immunofixation technique.

The table 3 demonstrates the results of Pi subtyping received by PAGIF. 94,6 % of the tested samples have the same phenotype PiMM.

Discussion

The distribution of Tf is nearly similar to the results observed in European populations: Tf^{C2} = 0.1691 in Berlin, GDR (Geserick and Patzelt), Tf^{C2} = 0.1689 in Hessen, FR^{G} (Kühnl). Moreover, in a population of GDR the gene frequency of Tf^{C3} was calculated to be 0.0632.

Testing the Gc system a polymorphism was recognized including the three common genes and only one variant (Gc2-1F-1S bands). This system is certainly useful for forensic medicine in cases of identification and disputed paternity. Using the immunofixation technique we were not able to identify uncommon variant of Gc.

Advances in Forensic Haemogenetics 1
(c) Springer-Verlag Berlin Heidelberg 1986

This method is simple, fast, and more reliable than conventional immunoelectrophoresis.

The data on Pi polymorphism are received from isoelectrofocusing carried out for Tf subtyping. The presented Pi gene frequencies with a very frequent Pi^M and rare genes Pi^S, Pi^Z and Pi^F show a good agreement with many reports on population of different human populations.

References

1) Geserick, G. and Nagai, T.: Studies on Serum Group in Japanese Population. Teikyo Med. J. 4 : 123-126, 1981.

2) Nagai, T.: Gc Subtypen und neue Varianten im Berliner Untersuchungsgut. Ärztl. Lab. 28 : 256-258, 1982.

Advances in Forensic Haemogenetics 1
(c) Springer-Verlag Berlin Heidelberg 1986