Z Rechtsmed (1983) 91:135–138

Zeitschrift für
Rechtsmedizin

A Rare Phenotype C3, F–F0.8 Encountered in Three Successive Generations of One Family

C. Brandt-Casadevall, N. Dimo-Simonin, and H.-R. Gujer

Institute of Forensic Medicine, University of Lausanne, Rue César-Roux 29/31, CH-1005 Lausanne, Switzerland

Summary. In the course of a disputed paternity case, a rare phenotype of factor C3 (F–F0.8), not described so far, has been found in three generations of one and the same family. The frequency in the population of such a phenotype is not known.

Key words: Disputed paternity – C3, rare phenotype – C3 system

Zusammenfassung. In einer strittigen Vaterschaftssache wurde im C3-System der bisher noch nicht beschriebene seltene Phänotyp F–F0,8 festgestellt, dessen Häufigkeit bislang noch unbekannt ist. Das bei Kind und Putativvater vorhandene F0,8 ließ sich bei einer Familienuntersuchung über drei Generationen zurückverfolgen.

Schlüsselwörter: Vaterschaft – C3, seltener Phänotyp – C3-System

The polymorphism of factor C3 of human complement was first described by Wieme and Demeulenaere in 1967 [18]. A little later, in 1968, it was reported simultaneously by Alper and Propp [2] and by Azen and Smithies [5]. Ever since this polymorphism has been the object of numerous studies in genetics, especially concerning application in forensic medicine [8, 10, 17].

This polymorphism is genetically controlled by two autosomal codominant genes, but rarely some anomalies in the expression of one of the alleles were reported [3, 4, 9, 13].

There are two main alleles: S (slow) and F (fast) and at least 22 variants, the denomination of which is determined by their electrophoretic mobility [15]. In European populations, the frequency of $C3^S$ allele is about 80%, with significant deviations for some ethnic groups, such as the Lapps, where the frequency of $C3^S$ may reach 91–98%, or the French Basque population, where $C3^S$ is met with a frequency of about 70%. The frequency of allele $C3^F$ is approximately 20% [6].

Offprint requests to: C. Brandt-Casadevall, M.D. (address see above)

Because of the rarity of variants, their exact frequency is not known; their number is estimated at about 1% for variants of all kinds [6].

Though allele $F^{0.8}$ has already been reported by different authors, its association with allele F had not been described so far. We describe here this rare phenotype encountered in three successive generations of one and same family.

Material and Methods

Human Sera

The blood samples were obtained by puncture of vena mediana cubiti. After centrifugation and decantation of the cellular elements, the sera were stocked at −80°C until they were used.

High Voltage Electrophoresis on Agarose Gel

The electrophoresis was performed according to the technique of Teisberg [16]. After electrophoresis, fixation and drying, gels were stained with Serva Blau R.

Hemolytic Activity of the Complement

The hemolytic activity of complement CH50 was measured with a continuous flux system on a Technicon Auto-Analyser [14].

Determination of C3 Concentration

The quantitative analysis of C3 component of each serum was determined by radial immunodiffusion according to Mancini [12].

Results and Discussion

In the course of a disputed paternity case, we detected phenotype C3 F–F0.8 in the child's and in the presumed father's sera, whereas the mother had phenotype F.

During the 1st Symposium and Workshop on the polymorphism of factor C3 of human complement, which took place in Bonn in June 1972, it was decided that the Laboratory of the Institute of Forensic Medicine at the University of Bonn (Prof. Ch. Rittner) would be considered from then on as reference laboratory so that new variants could be compared with a stock of reference sera [1]. Thus, having determined the presence of a rare mobility for factor C3 F0.8, we sent the sera to this laboratory where the accuracy of our results was confirmed. Figure 1 shows the phenotype F–F0.8.

According to the scarcity of factor F0.8 we were able to consider its inheritance as a sound proof of paternity. Besides, the probability of paternity, according to Essen-Möller [7], being 99.9985% (logarithm $y/x + 10 = 5.1762$ according to Hummel's calculation tables [11]) even without taking factor C3 into account, our evaluation put into words was: "paternity practically proved."

In the father's family, all the members interviewed agreed to submit to a blood sampling with a view to a genealogic research. In Fig. 2, we can see the transmission of allele in this family. All people whose serum was analyzed were quite

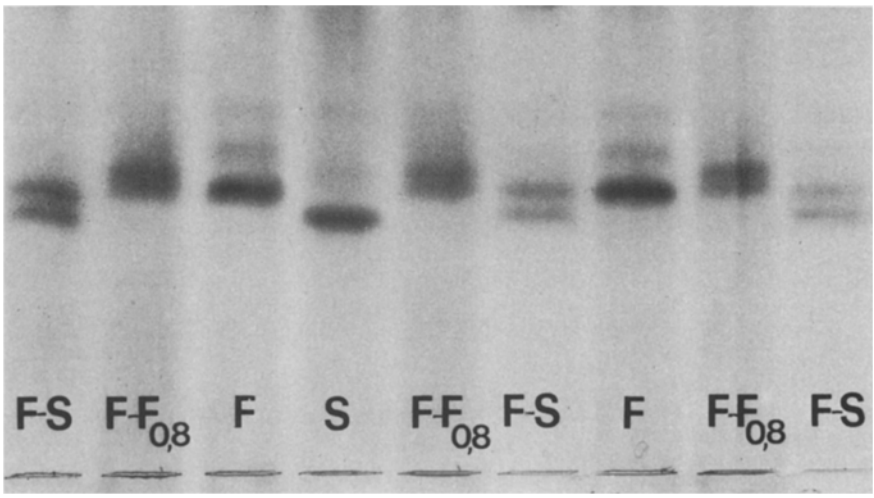

Fig. 1. Electrophoretic determination of C3 F-F0.8 compared with other phenotypes

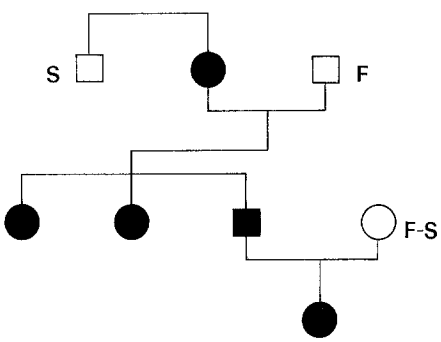

Fig. 2. Genealogic tree of family B. In *black:* the phenotype C3 F-F0.8

healthy. Hemolytic activity (CH50) as well as the content of factor C3 for each serum gave results within the limits of normality.

It must be noted that, if factor C3 generally constitutes an important element in the whole of "genetic marker systems" in the case of research in the establishment of paternity, it may become a most important clue (a "practical" proof) when a rare variant inherited by the child is encountered.

Acknowledgements. The authors wish to express their thanks to Professor Ch. Rittner, Laboratory of the Institute of Forensic Medicine at the University of Bonn, and to Dr. M.-J. Stelling-Auderset, Central Laboratory of Hematology, Hospital of the University of Geneva, for their scientific contributions.

References

1. Alper CA, Azen EA, Geserick G, Goedde HW, Rittner Ch, Teisberg P, Wieme R (1973) Statement on the polymorphism of the third component of complement in man (C3). Vox Sang 25 : 18–20

2. Alper CA, Propp RP (1968) Genetic polymorphism of the third component of human complement (C'3). J Clin Invest 47 : 2181–2191
3. Alper CA, Propp RP, Klemperer MR, Rosen FS (1969) Inherited deficiency of the third component of human complement (C'3). J Clin Invest 48 : 553–557
4. Alper CA, Rosen FS (1971) Studies of a hypomorphic variant of human C3. J Clin Invest 50 : 324–326
5. Azen EA, Smithies O (1968) Genetic polymorphism of C'3 (β_{1C}-globulin) in human serum. Science 162 : 905–907
6. Davrinche C, Rivat C (1982) Polymorphism of the third component of human complement. Blood Transf Immunohaematol 25 : 199–213
7. Essen-Möller E, Quensel CE (1939) Zur Theorie des Vaterschaftsnachweises auf Grund von Ähnlichkeitsbefunden. Deutsch Z Gerichtl Med 31 : 70–96
8. Geserick G, Prokop O, Waltz H (1980) Results on forensic application of the C3 system. Z Rechtsmed 85 : 1–4
9. Hoppe HH, Goedde HW, Agarwal DP, Benkmann H-G, Hirth L, Jansen W (1978) A silent gene ($C3^-$) producing partial deficiency of the third component of human complement. Hum Hered 28 : 141–146
10. Hoste B, Brocteur J, Suys J, Andre A (1977) Polymorphism of the third component (C3) of complement and of transferrin (Tf) in Belgium. Z Rechtsmed 80 : 55–59
11. Hummel K, Ihm P, Schmidt V (1971) Biostatistische Abstammungsbegutachtung mit Blutgruppenbefunden. Fischer, Stuttgart
12. Mancini G, Carbonara AO, Heremans JF (1965) Immunochemical quantitation of antigens by single radial immunodiffusion. Immunochemistry 2 : 235–254
13. McLean RH, Weinstein A, Damjanov I, Rothfield N (1978) Hypomorphic variant of C3, arthritis, and chronic glomerulonephritis. J Pediat 93 : 937–943
14. Nydegger UE, Achermann LM, Lambert PH, Miescher PA (1972) A simple automated method for complement estimation in a continuous flow system. J Immunol 109 : 910–913
15. Rittner C, Rittner B (1974) Report of 1973/1974 of the reference laboratory for the polymorphism of the third component (C3) of the human complement system. Vox Sang 27 : 464–472
16. Teisberg P (1970) High voltage agarose gel electrophoresis in the study of the C3 polymorphism. Vox Sang 19 : 47–56
17. Teisberg P (1972) Application of the C3 system in paternity cases. Vox Sang 22 : 213–221
18. Wieme RJ, Demeulenaere L (1967) Genetically determined electrophoretic variant of the human complement component C'3. Nature 214 : 1042–1043

Received May 16, 1983