

IgD CONCENTRATION: A MARKER IN BLOODSTAIN ANALYSIS

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Introduction

The technique of antibody-profile investigation was introduced into bloodstain analysis by King (3) and was later extended (7). IgD antibodies have - as far as we know - not yet been investigated in bloodstains. However, the serum IgD concentration displays certain properties which could make its application in forensic practice possible:

- The serum IgD level of a particular adult is almost invariable with exceptional changes occurring only in cases of illness and towards the end of a pregnancy (6).
- The IgD values of different individuals may vary by more than a thousandfold. The IgD level of newborns can not be measured by single radial immunodiffusion (SRID) (4). The extremely varied adult values (ranging from 0.14 to 400 mg/l) are reached during childhood (4,5) and are obviously subject to a trimodal distribution (1,6). A genetic influence on the serum IgD level is considered very probable (1,2,4).

These properties of IgD encouraged us to experiment with quantitative IgD measurements in the differentiation of bloodstains.

Materials and Methods

First of all, artificial bloodstains (on cotton fabric, air-drying, storage at 22°C) and sera from 40 subjects were investigated (Table 1). This was followed by the investigation of practical forensic cases. Stain elution was with the necessary minimum of distilled water (12 h, 4°C).

Determination of IgD concentrations was by SRID (partigen plates and IgD standard of Behring, FRG). Sample volumes were 20 μ l (at the beginning 30 μ l in the case of stain eluates). Diffusion period of 2 days. Staining with Amido-black. Sensitivity at 10 mg IgD/l. Standard deviation 4,9. Along with the IgD determination, quantitative IgG tests were carried out using the same technique. Thus the dilution of the eluates in relation to the serum was determined by using a second marker with a high serum concentration so that the findings based on the IgD content of the eluates could be verified. The ratio between the dilution of the serum and that of the eluates was usually 1:3.

Results and Discussion

Artificial bloodstains

The results are summarized in Table 1.

Table 1: Quantitative determination of IgD in sera and corresponding bloodstain eluates

subjects (n)	age (years)	IgD-concentrations (mg/l)		storage time of bloodstains (days)
		serum	eluate	
newborns (10)	—	10 × < 10	10 × < 10	53-55
children (10)	1-13	2 × < 10 1 × 10 7 × 30-119	2 × < 10 1 × < 10 7 × 22-39	20-53
adults (20)	21-77	8 × < 10 7 × 14,5-27 5 × 31-174	8 × < 10 7 × < 10 5 × 24-87	9-14

The experimental subjects (Table 1) can be classified in three groups (cf. also Figure 1a and 1b):

- clearly measurable serum IgD concentrations (7 children, 5 adults) so that the stain IgD content could easily be measured and did not exhibit noticeable loss of activity even after storage periods of up to 53 days;
- serum IgD concentrations little above the sensitivity of the investigation technique used (1 child, 7 adults),

thus the stain IgD content could not be demonstrated because of the relative dilution of the eluates.

- serum IgD concentrations below the sensitivity of the investigation technique used (10 newborns, 2 children, 8 adults) so that IgD measurements in the stains were impossible.

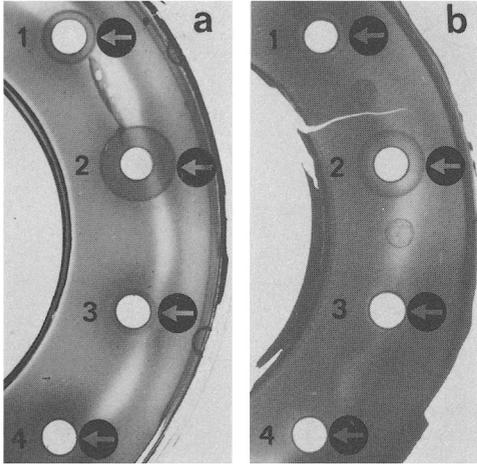


Figure 1:
SRID for IgD concentration determination. Adult samples (1-4).

a) sera (20 µl)
b) corresponding stain eluates (30 µl)

- 1/2: IgD level of (a) and (b) clearly measurable
3: IgD level of (a) little above sensitivity; IgD of (b) not measurable
4: IgD level of (a) below sensitivity; IgD of (b) not measurable

The best conditions for differentiating between stains of two individuals occur when one individual has a clearly measurable serum IgD concentration and the other has an IgD level below sensitivity. A person with no measurable serum IgD level can not be regarded as the source of stains with a measurable IgD content. Conclusions can generally be drawn in other cases, too, if the persons concerned come from different serum IgD concentration ranges.

Cases from forensic practice

The following example may serve as a case in point: A man shot his wife dead and afterwards inflicted a bullet wound on himself, but survived.

Blood properties of the suspect:

A₁ ccD.Ee Gm(1-2-4+10+21-) Km(1-) PGM₁ a₂-a₁ IgD: 26 mg/l

Blood properties of the victim:

B cc(dd)ee Gm(1-2-4+10+21-) Km(1-) PGM₁ a₄-a₁ IgD:<10 mg/l

The results of the investigation of 5 stains are shown in Table 2. Because of the bloodgroup-typing results, the

stains 1 to 4 can be assigned to the suspect and stain 5 to the victim. This is verified by IgD determination in 4 cases since the victim can not be regarded as a source of stains with a measurable IgD content. Sections of original plates of the case are represented in Figure 2.

Table 2: Results of serological bloodgroup typing and quantitative IgD determination in 5 bloodstains in a practical case

	1	2	3	4	5
ABO	A H				B H
Rh	ambiguous	ccD.Ee			cc(dd)ee
Gm	1-2-4+10+21-				
Km	1-				
PGM1	a2 - a1				a4 - a1
IgD(mg/l)	22	26	ambiguous	precipitate (beyond standard curve)	< 10

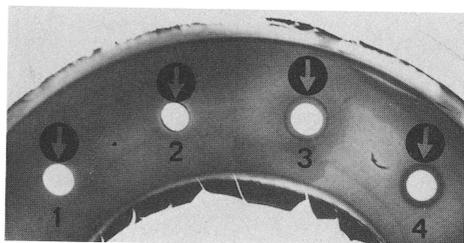


Figure 2:
SRID for IgD concentration determination. Sera and stains in a practical case.

1: victim serum < 10 mg/l
2: stain 5 < 10 mg/l
3: suspect serum 26 mg/l
4: stain 1 22 mg/l

More sensitive investigation techniques such as radio-immunoassay, could in some cases contribute to an improvement in differentiating stains on the basis of their IgD content. But our first results obtained by SRID also show that the IgD concentration can be a further marker in antibody profiling in bloodstains.

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