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Studies on Alcohol Gelation of Serum

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STUDIES ON ALCOHOL GELATION OF SERUM

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Lewin (1) described a gelation reaction which takes place in human blood serum when it is mixed with an equal quantity of 80 per cent ethyl alcohol in vitro. Varying degrees of rigidity of the mixture were noticed with sera from different persons. In this study an attempt was made to discover whether there was any correlation between the degree of gelation and the type of disease had by hospitalized patients. In later studies search was also made for correlation of this reaction with composition and physical properties of the sera.

The procedure used was to separate serum from freshly-drawn blood within an hour or two after drawing; to mix 0.2 ml. of it with 0.2 ml. of 80 per cent by volume ethyl alcohol in an 0.8 x 7.5 cm. glass test tube at room temperature; and to read the reaction at 5 min., 30 min., 1, 2 and 3 hours. The degree of gelation was recorded as 3+ if the tube could be inverted without moving the gel; 2.5+ if it could be turned through 90° without immediately running down the tube; 2 + if it was a turbid gel but would not stand a 90° tilt. Degrees of gelation below this were noted as 1.5+, 1+ and .5+ for beginning gelation. The reactions given in the tables are the maximum gelations attained with the time at which they were noted. A syneretic separation of a water phase occurred in most reaction tubes after about three hours; sometimes, as early as one hour. When this happened the readings were discontinued. Lewin (1) failed to describe such a reaction in his experiments, and we are not prepared to explain the discrepancy.

The patients from which the serum was obtained were from the general run of hospitalizations.

Table I shows that there is no predominance of the stronger gelations among patients with malignant or benign tumors or cysts.

Several patients with gastrointestinal lesions were noticed to give complete reactions; however, table II shows sera from patients with duplicate diagnoses having from weak to complete gelations.

It can be seen from table II that white blood counts, taken at the time the serum was obtained, give little hint of a connection

Table I — Malignancy, Tumor and Cyst Group.

Patient	Reaction	Time	Diagnosis
26	3+	1 hr.	Infectious mononucleosis
71	3+	30 min.	Ca. of stomach
107	3+	30 min.	Ovarian cysts
124	3+	30 min.	Adv. Ca. of prostate
125	2½+	1 hr.	Ca. of lungs
126 [1]	2½+	30 min.	Ca. of cervix
86	2+	2 hrs.	Myomatous uterus
67	2+	30 min.	Dermoid ovarian cysts
78	2+	30 min.	Breast cyst
123	2+	2 hrs.	Ca. of breast
101	2+	30 min.	Carcinoid of appendix
131	1½+	3 hrs.	Myomatous uterus
129	1+	2 hrs.	Ca. of rectum
128 [1]	1+	2 hrs.	Lung malignancy
127 [1]	1+	1 hr.	Ca. of cervix

[1] Patient receiving X-ray treatment.

Table II — Known or Possible G. I. Lesions.

Patient	Reaction	Time	W. B. C.	Diagnosis
10	3+	2 hr.	40,560	Gastric ulcer
16	2½+	1 hr.	14,700	Intest. Obstruction
17	3+	5 min.	17,800	Appendiceal abscess
18	2½+	5 min.	7,300	Shot wounds
71	3+	30 min.	8,000	Ca. of stomach
111	2½+	30 min.	8,300	Peptic ulcer
133	3+	30 min.		Peptic ulcer
117	2½+	1 hr.	4,900	Diverticulitis
29	2+	1 hr.	8,900	Peptic ulcer
42	1½+	1 hr.	6,200	Duodenal ulcer
82	2+	2 hr.	6,200	Peptic ulcer
83	2+	2 hr.	4,100	Tumor of cecum
85	2+	2 hr.	6,500	Ca. of stomach
90	2+	1 hr.	7,300	Duodenal ulcer
134	1+	2 hr.	3,400	Duodenal ulcer

Table III — Reactions of 3+ in one hour or less.

Patient	W. B. C.	R. B. C.	Total Protein	Diagnosis
10	40,500	5.60		Gastric ulcer
17	17,800	4.19	7.26g.	Appendiceal abscess
19	17,750	5.25	7.62"	Lymphangitis
26	6,100	4.58	6.70"	Mononucleosis
27	8,000	4.40	7.47"	Hemorrhoids
71	8,000			Ca. of stomach
77	13,500	4.80		Lung edema
84	15,600	4.25		Pneumonia
107	7,200	4.30	7.60"	Ovarian cysts
124	16,900	4.09		Ca. of prostate
133	6,800	2.90		Peptic ulcer

between the intensity of gelation and the defense against invasion.

Although all of the very high white counts listed in table II are accompanied by strong to complete gelations, table III shows some complete (3+) reactions in relatively short time for which the corresponding white counts cover a wide range from normal up. Hence, it seems that no correlation can be established.

Table III presents a wide range of red cell counts, but no relation with the reaction seems evident. No markedly abnormal differential white counts were encountered, except that of patient 26.

The total serum protein values included in table III were done by a modification of the Johnston and Gibson method for plasma proteins (2). No abnormality of total protein was noticed for this group despite the varied gelation reactions.

Many patients were classified into two groups, those having appendectomies and those having moderately severe infections.

Table IV

	Positives	Negatives
Appendectomies		
Number of cases — 18.		
Number showing positive reaction ($2\frac{1}{2}$+ or more) — 4.		
Serum proteins	8.4-8.75 gm.	5.9-9.0 gm.
W. B. C.	10,000-14,000	range
R. B. C.	4.0-5.10	range
Specific gravity		1.021-1.039
Infections		
Total number of cases — 24		
Positives ($2\frac{1}{2}$+ or more in 2 hr.) — 15		
Negatives ($2\frac{1}{2}$ + or less) — 9		
No correlation with intensity of reaction and total protein, specific gravity, W. B. C. or R. B. C.		
Both classes include the following diagnosis: Heart infections, mastoiditis, dermal ulcers, abscesses, septic abortions, pnepmonia, G. U. infections and influenza.		

Appendectomies show a range of blood counts, serum proteins, and serum specific gravities; except for the white counts these are within normal limits, yet the serum gelations are not alike. Infections show altered composition and physical properties of serum. No sedimentation rates were performed, but sera expected to have increased rate were not consistent in showing stronger gelations. This confirms Lewin (1). That author also found some parallelism between gelation rate and Takata-Staub positive sera. Correspondingly we examined some sera for concentration of globulin fraction by the method of Naumann (3). Table V shows normal euglobulin values in disregard of varied gelation reactions. Patient 130 was an exception, having lowered globulin; however, her gelation was not different from many normals.

Table VI gives maladies expected to produce marked blood changes either directly or through liver damage, but no rapid or complete gelation is noticed.

Table V — Globulin Fraction Study.

Patient	Reaction	Time	Globulin	Diagnosis
126	2½+	1 hr.	±	Ca. of cervix
127 [1]	1+	1 hr.	±	Ca. of cervix
128 [1]	1+	1 hr.	±	Lung malignancy
129	1+	1 hr.	±	Ca. of rectum
130	1½+	1 hr.	—	Menorrhagia
131	1½+	2 hr.	±	Myomatous uterus
132	1½+	2 hr.	±	Undetermined
133	3+	30 min.	±	Peptic ulcer

1 Receiving X-ray treatment.

Table VI — Maladies Expected to Change Blood Composition Directly or Through Liver, or Associated with Rapid Sedimentation.

Patient	Reaction	Time	Diagnosis
15	2½+	1 hr.	Colloid goiter
5	1½+	30 min.	Pernicious anemia
34	2+	30 min.	Pernicious anemia
39	2+	1 hr.	Renal tuberculosis
33	2+	30 min.	Thyroid adenoma and liver disease

Table VII — Normal Blood Findings but Positive Tendency Toward Precipitation Reaction.

Patient	Reaction	Time	Diagnosis
62	2½+	1 hr.	Hernia
76	2½+	30 min.	Colles' fracture
27	2½+	30 min.	Hemorrhoids
96	2½+	1 hr.	Diabetes
60	2½+	1 hr.	Gall stones?
25	2½+	1 hr.	Carotenemia
105	2½+	30 min.	Thyroid cyst
24	3+	2 hr.	Conjunctivitis
63	3+	3 hr.	Hernia
11	3+	2 hr.	Corneal cuts

Table VII can be reproduced among our cases so far as diagnoses are concerned, but with weaker gelations.

CONCLUSIONS

Of the maladies studied none could be found with which marked gelation of the patients' sera by alcohol consistently occurred. Parallelism between degree of gelation of serum and blood cell dyscrasia, serum protein, specific gravity or globulin fraction could not be established for practical clinical value.

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