13681

Agglutinogens in Fetal Erythrocytes.

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While statements in the older literature made it appear questionable whether the individual blood group is always developed in the newborn, there is now no doubt that with proper technic the agglutinogens A and B in the red cells can always be detected. That the same applies to the factors M and N is evident from the fact that in many thousands of tests performed for legal purposes no individual has been found whose cells contained neither M nor N, nor a case where the blood types of mother and newborn were incompatible with the laws of heredity as established by Landsteiner and Levine.

Little, however, is known concerning how early in fetal life all the agglutinogens can be detected by ordinary agglutination tests. Moureau[1] demonstrated the factors M and N in very young fetuses. Hyman[2] found M and N demonstrable in 3 fetuses but failed to obtain either M or N agglutination with the cells of a fourth, 3 months old, whose cells exhibited the agglutinogen B. She left the question open whether agglutinogens had disintegrated before expulsion of the fetus or whether they had not yet developed at that time. Recently, she reported on 4 premature newborns, 2 born at 7 and 2 at 8 months.[3]

It seemed worth while examining a somewhat larger series of fetuses to determine whether or not their agglutinogens are detectable with sera and testing fluids as they are used in transfusion work and in legal tests. The result would give further weight to the acknowledged fact that determinations of blood group and blood type in young infants are dependable. Doubt is occasionally still being cast upon this fact by lay opponents to the legal applications of blood tests, which unfortunately still do not enjoy quite general recognition.[4] In addition, by including the Rh factor in the investigation, information could be obtained on the value of tests performed

1 Moureau, P., *Rev. belg. des Scienc. Méd.*, 1935, **7**, 540.

2 Hyman, H. S., *Abstr. Doct. Diss.*, No. 21, The Ohio State University Press, 1937.

3 Hyman-Parker, H. S., *J. Immun.*, 1942, **43**, 1.

4 Schatkin, S. B., *J. Crim. Law and Criminol.*, 1941, **32**, 458.

with fetal blood for investigations on isoimmunization as a cause of habitual abortion according to Levine.[5]

Materials and Technic. A series of 19 premature fetuses was examined in the order in which they came to the pathological examination, only those showing gross evidence of maceration being omitted. The heart was tapped and a suspension of the blood in physiologic saline solution (about 1% cells) was prepared and examined the same day with the centrifuge method. In some cases examination of parents was possible. Various human A and B sera and M and N testing fluids were used, which gave positive agglutinations with the corresponding cells in dilution 1:8. A small amount of human anti-Rh serum was available through the courtesy of Dr. Philip Levine. For the Rh tests the test tubes were incubated for one hour at 37°C before centrifugation.

Results. As may be seen from Table I, the fetuses varied in length between 7 and 50 cm, the average being 28.6 cm. The distribution of agglutinogens was independent of the length of the fetuses, and did not grossly deviate from the percentages in the population. No fetus without either M or N was encountered, and no combination parent M, fetus N or *vice versa* occurred. The Rh factor was demonstrable in 4 out of 5 fetuses. This confirms the

TABLE I.
Blood Group and Blood Type of Fetuses and Parents. Presence or Absence of Rh Factor (Tested in No. 15-19 Only).

Fetus				
No.	Length	Agglutinogens	Mother	Father
1	21 cm	O MN	O M	
2	7 cm	O MN	B M	
3	13 cm	A M	A M	
4	47 cm	O MN		
5	23 cm	A M		
6	13 cm	O M	O MN	O MN
7	30 cm	A MN	A MN	A MN
8	50 cm	A M		
9	42 cm	A N		
10	27 cm	A MN		
11	19 cm	O N		
12	26 cm	B M		
13	30 cm	A N		
14	33 cm	B N	A MN	
15	41 cm	AB M Rh+	A MN Rh+	
16	42 cm	A M Rh+	O MN Rh+	
17	39 cm	A MN Rh—	A MN Rh—	
18	17 cm	O N Rh+	A N Rh+	
19	21 cm	B MN Rh+	A MN Rh—	B N Rh+

[5] Levine, P., Burnham, L., Katzin, E. M., and Vogel, P., *Am. J. Obst. and Gyn.*, 1941, **42**, 925.

indirect evidence that the Rh factor is present early in fetal life as derived from Levine's work.

Summary and Conclusions. Agglutination tests with the heart's blood of 19 fetuses show that with ordinary technic, *i. e.*, using sera and testing fluids with agglutinin titers of at least 1:8 and not too strong cell suspensions, agglutinations for A, B, M, N, and Rh can be obtained. This indicates that the agglutinogens are developed long before birth in sufficient strength for reliable examination.