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Bactericidal capacity of plasma and granulocytes against Escherichia coli in the small-for-dates newborn

by

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Infections due to Gram-negative bacteria in newborns and especially small-for-dates newborns sometimes run a dramatic course and have a high mortality rate.

The bactericidal effect of plasma and granulocytes was determined by the method of Balch et al [1] in 27 small-for-dates term newborns and 19 normal term newborns. The number of killed bacteria was practically the same in the mixture of granulocytes and plasma in both groups. On the other hand, a threefold decrease of the bactericidal effect of plasma was observed when it was applied alone, without granulocytes. This may indicate that the defect is more in the plasma than in the granulocytes, and is probably due to the failure of class IgM antibodies to cross the placental barrier.

Studies concerning the role of leucocytes and plasma factors in the antibacterial mechanisms of the newborn have yielded conflicting data [4, 5, 9, 10]. A decreased protective capacity against Staphylococcus aureus of the plasma and granulocytes of small-for-dates newborns in comparison to normal newborn infants has been shown previously [11]. Besides, newborn infants are known to have a poor defence mechanism operating with antibodies of own origin against Gram-negative bacteria [3, 6, 10]. Therefore, we have examined the bactericidal capacity of plasma and granulocytes against Escherichia coli in small-for-dates newborns.

Material and Method

Twenty-seven small-for-dates newborns and 19 normal newborns born at term were investigated.

Phagocytic cells were removed from a gravity sedimented heparinized whole blood sample containing dextran. Escherichia coli O_{18} was obtained from 20-hour broth cultures. The bactericidal capacity of plasma and granulocytes was determined according to Balch et al [1]. The incubation mixture (final ratio of bacteria per phagocyte) was shaken gently in a bath at 37° for 90 minutes to allow phagocytosis to occur, then the tubes were centrifuged at 600 rpm for 10 minutes. Distilled water was added to lyse the cells and then transferred onto the plates. The number of viable bacteria was determined by colony

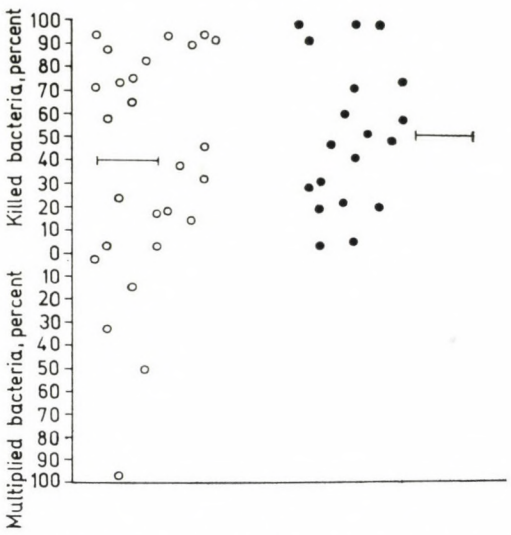

FIG. 1. Bactericidal capacity against Escherichia coli O 18 of a suspension of plasma and granulocytes; normal newborn infants; small-for-date newborns

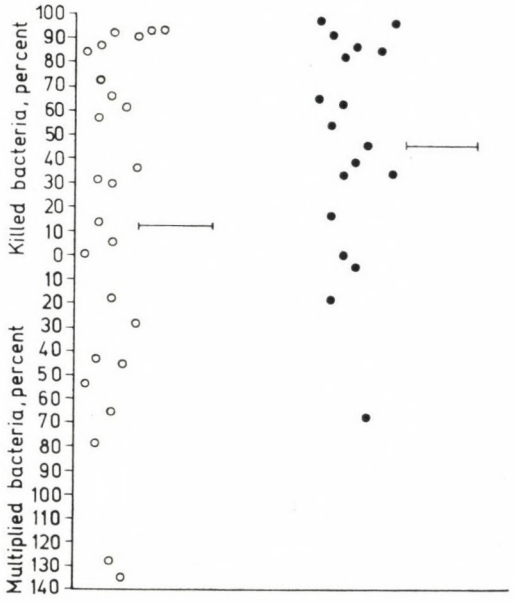

FIG. 2. Bactericidal capacity of plasma against Escherichia coli O 18 in normal newborn infants and small-for-date newborns

counts after an incubation overnight. The supernatant was used for determination of the bactericidal capacity of plasma.

Results

Figure 1 shows the bactericidal capacity of plasma and granulocytes calculated as the number of killed bacteria. The mean value for the dystrophic group was 39.7%, and for the control group 51.2%. The difference was not significant statistically ($0.30 < p < 0.40$). In both groups the killed bacteria showed practically the same range of values, from 3.1% to 99.9%. In the small-for-dates group, in 5 cases multiplying bacteria were observed, ranging from 2.4% to 98% over the initial values.

Figure 2 illustrates the bactericidal effect of plasma against E. coli. It was more than threefold in the control group (46.8%) than in the dystrophic infants (12.9%). The difference was highly significant ($p < 0.001$). The lowest and highest values (1.3% and 93.5% respectively) were nearly the same in both groups. The observed differences of the mean values were due to the multiplying of bacteria in 9 cases in the small-for-dates newborns and in 3 cases in the control group.

Discussion

It was remarkable to find a higher than the initial number of bacteria in the plasma in so many small-for-dates newborns while the bactericidal capacity of plasma and granulocytes was nearly the same in both groups. This indicates that the main defect was in the plasma and not in the granulocytes.

The antibodies belonging to the class IgM or 19S are not able to cross the placental barrier [2, 6, 11, 14]. This immunoglobulin is responsible for the opsonization of Gram-negative bacteria [3, 13]. The relative paucity of IgM present in the normal newborn is generally held to be responsible for their susceptibility to Gram-negative infections [6, 11]. It seems that in some cases the level of this immunoglobulin is normal but its opsonic activity is decreased. The increased susceptibility to Gram-negative infection may thus be due to the defective function of granulocytes since we also found a decreased phagocytic index, a low number of phagocyting granulocytes with a diminished number of peripheral granulocytes.

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