

Consistent with other reports (Manroe et al., 1979; Frazier et al., 1982; Chirico et al., 1999), the absolute neutrophil count in umbilical cord blood increased significantly in all neonatal groups compared with adults and reached the highest values in neonates delivered either vaginally or by emergency cesarean section. The direct cause of the increased number of circulating neutrophils is impairment of neutrophil adherence, the key mechanism of inflammatory response. The central role in the adherence of activated neutrophils is played by a complex of adhesive glycoproteins (CD11/CD18) called leukocytic integrins.

According to most reports (Speer and Johnston, 1992), neonatal neutrophils display impaired adherence when compared with those from adults. This impaired adherence results from reduced expression of CD11/CD18, which is associated with decreased numbers of secondary and tertiary granules in neonatal neutrophils. The integrins are synthesized and stored in these granules (Anderson et al., 1990; Jones et al., 1990; Torok et al., 1993; Reddy et al., 1998). However, it should be stressed that some authors have reported that the markers of neutrophil adherence in neonates approximate those in adults (Fontan et al., 1979; Bektas et al., 1990).

The results of the present study indicate that the method of delivery significantly affects the biologic functions of neonatal neutrophils. Neutrophil adherence was the highest in neonates born by elective cesarean section, approximating the values observed in adults, whereas it decreased significantly in neonates born either vaginally or by emergency cesarean section when compared with adults. One can suppose that the decreased neutrophil adherence in neonates exposed to the stress of labor results from the action of catecholamines and steroid hormones that are released because of perinatal stress. Corticosteroids and epinephrine diminish neutrophil adherence, leading to pseudoneutrophilia as a result of a transient shift of the marginal pool of neutrophils to the circulating pool in the central blood stream (Hrycek and Kalina, 1993; Chirico et al., 1999). Although the group of neonates born by emergency cesarean section (group C) was small, the authors decided to include it in the study in order to indicate the heterogeneity of the population of neonates born by cesarean section. Moreover, despite its low number (which is reflected in the statistical analysis of the results), the presence of group C emphasizes the role of labor stress but not of the delivery method.

The most frequently cited comparative studies of adult and neonatal neutrophils focused on the ability of neutrophils to engulf and kill bacteria, which was investigated using a large variety of techniques. The authors described numerous extra- and intracellular factors that impaired neonatal neutrophil phagocytosis; however, some studies showed no significant changes (Wilson, 1990; Speer and Johnston, 1992). Most of the authors

believe that, in optimal conditions, adults and neonates exhibit comparable levels of neutrophil phagocytic activity (Bektas et al., 1990; Falconer et al., 1995).

The present study has shown that the method of delivery significantly affects the phagocytic activity of neutrophils from umbilical cord blood. It is likely that the level of neutrophil phagocytic activity in neonates born by elective cesarean section equals the level at the end of fetal life, while the decreased neutrophil phagocytic activity in neonates exposed to labor-related stress is probably due to the inhibitory effect of corticosteroids.

Disturbances of oxygen metabolism impair the bactericidal activity of neutrophils, and therefore the methods that evaluate this metabolism are particularly important from the clinical point of view.

In this study, the NBT reduction test used to assess the metabolic activity of neutrophils revealed that unstimulated neonatal neutrophils showed a higher rate of oxygen metabolism compared with adult neutrophils, and that the method of delivery significantly affected this metabolism. Spontaneous NBT reduction was significantly lower in neonates born either vaginally or by emergency cesarean section when compared with those born by elective cesarean section, indicating that labor-related stress inhibits some redox pathways in neutrophils. These changes are thought to be caused by stress-related hormones such as catecholamines and cortisol, which affect neutrophil oxygen metabolism, and the net effect seems to result from the stimulatory action of catecholamines and the inhibitory action of cortisol on neutrophils. These findings are in agreement with other reports (Frazier et al., 1982; Wilson, 1990; Speer and Johnston, 1992).

It should be stressed that neonatal and adult neutrophils showed no significant differences in latex-stimulated NBT reduction, which indicates that they display similar levels of functional capacity.

In conclusion, this comparative study of defensive functions of neonatal and adult neutrophils points out that the conflicting results of neonatal neutrophil studies may result not only from the different methods used but also from the fact that the eligibility criteria used in these studies did not include the method of delivery.

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