Morphological Changes in Eosinophils Are Reliable Markers of the Severity of an Acute Asthma Exacerbation in Children


PURPOSE OF THE STUDY. The goal of this study was to determine if morphologic changes in blood eosinophils can be used for early identification of the severity of an acute asthma exacerbation in children.

STUDY POPULATION. Children were selected sequentially in an emergency care unit or asthma outpatient clinic. They comprised a group of 15 healthy children (5 girls and 10 boys; ages 4–14 years) without asthma or a personal or familial history of allergy, a group of 15 asthmatic children with variable disease severity (3 girls and 12 boys; ages 2–12 years) seen at a symptom-free period, and a group of 40 children with acute asthma exacerbations (14 girls and 26 boys; ages 2–13 years). There were no statistically significant differences in age or gender among the 3 groups examined.

METHODS. One milliliter of blood was collected from the subjects without anticoagulant, and 40 μL was placed directly on each slide field. Cells were allowed to adhere and were stained; a morphologic assessment was then conducted by evaluating 200 eosinophils by using microscopy (in duplicate for each subject). Microscopic fields were randomly selected, and the slides were identified only at the end of the evaluation. Morphologic changes were compared by using the Mann-Whitney test, and correlation between the severity of the asthma exacerbation and the percent changed eosinophils was tested with Spearman’s correlation.

RESULTS. The proportion of activated eosinophils was higher in asthmatic symptom-free children compared with the control group and was highest in those with acute asthma exacerbation. Significant morphologic changes were noted in several criteria: emissions of multiple pseudopods, presence of cytoplasmic vacuoles, spreading, and presence of a cluster of free eosinophil granules ($P < .001$). In addition, mild/moderate exacerbations could be distinguished from severe exacerbations ($P < .0001$) by using all of the aforementioned criteria except for the clusters of free eosinophil granules. Considering the extreme values as cut-offs for the respective sample distribution, the minimum percentages of eosinophils that indicated a risk of a severe acute exacerbation were $\geq 14\%$ for those emitting a single pseudopod and $8\%$ for multiple pseudopods, $17\%$ for cytoplasmic vacuoles, $28\%$ for eosinophils releasing a large quantity of granules, and $66\%$ for spread eosinophils. Sensitivity and specificity were highest for spread of eosinophils ($100\%$ and $96\%$, respectively).

CONCLUSIONS. The results of this study show that quantifying morphologic changes in eosinophils is a feasible and reliable way to identify the severity of an asthma exacerbation and may therefore prove useful in the clinical management of patients.

REVIEWER COMMENTS. This study represents a novel approach to utilizing observed changes in eosinophil morphology to assist in clinical evaluation. It does require technical skill but only a small blood sample that would be practical in many settings. Additional prospective studies would be helpful to confirm the utility of this approach.
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