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Clinical significance of basophil leucocytes in bronchial asthma*

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Abstract

Changes of basophil leucocyte counts of the peripheral blood in bronchial asthma were investigated mainly by our improved method of KOVACS (4). The results are as follows. 1) The basophils in bronchial asthma generally show a higher count than in healthy controls. 2) During the interval of repeated asthmatic attacks the basophil count is higher than in the asymptomatic period. 3) Particularly in an episode of asthmatic attack, the basophils increase immediately before the attack and decrease to the normal level or lower after the attack has begun. 4) During asthmatic attacks it may be possible to expect another attack, if the basophil count again tends to increase from the previous low count. 5) This counting method of basophils is easy enough for the routine examination like calculation of peripheral leucocytes. 6) Observation of the changes of peripheral basophils appears to be a useful laboratory aid for the diagnosis and therapeutic evaluation of bronchial asthma, making possible an early detection of the next attack. A discussion is given of the behavior of the basophils in bronchial asthma.

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CLINICAL SIGNIFICANCE OF BASOPHIL LEUCOCYTES IN BRONCHIAL ASTHMA

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It has been considered that the peripheral basophil leucocyte has little clinical significance. However, we have suspected that basophil leucocytes may play an important role in bronchial asthma since they contain histamine (1, 2) and heparin-like substance (3) as do tissue mast cells.

Through observations of basophils during an episode of asthmatic attack, we have come to understand that their examination is useful for the diagnosis and therapeutic evaluation since they well reflect the asthmatic state. This paper deals with our counting methods and results obtained.

MATERIALS AND METHODS

The subjects of this study consisted of 64 healthy controls, 89 patients with bronchial asthma and 7 patients with urticaria, totalling 160 cases. The staining method for counting basophils is mainly that of KOVACS (4) improved by us and SHELLEY's neutral red method (5) was used in part. This improved method is easy to perform and gives an excellent stability. The procedure of this technic is shown below.

STAINING SOLUTION

1. 0.05% toluidine blue solution 11 ml
 toluidine blue (Merck).....0.05 g } mixed and added distilled water
 1.8% sodium chloride.....50 ml } up to 100 ml
 96% ethylalcohol22 ml }
 2. 0.03% light green (Merck) solution 0.8 ml
 3. Saturated solution of saponin (Saponin white, Merck)
 in 50% ethylalcohol 0.5 ml
 4. 1/15 M phosphate buffer (ph 6.4) 5 ml
- 1—4 solutions are mixed and used for staining

STAINING AND COUNTING METHODS

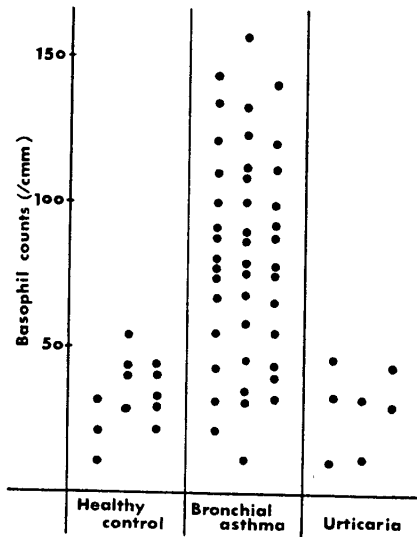
1. Aspirate peripheral blood and above fluid in a proportion of one to 10 in a standard leucocyte pipette.

2. Shake gently for one minute.
3. Count by chamber of Fuchs-Rosenthal in a high power magnification (10×40).
4. Basophil leucocytes stain in a cerise colour (eosinophil leucocytes stain emerald green).

RESULTS

1. The basophils counted by Shelley's method

The basophil leucocyte counted by SHELLEY'S neutral red method (5) was 11—56/ml in healthy controls, while in patients with bronchial asthma it generally showed an increase to the range of 13—156/ml. On the other hand, it tended to decrease in patients with urticaria and after steroid administration (Fig. 1).



Absolute basophil counts in peripheral blood in allergic diseases (neutral red staining)

Fig. 1 Absolute basophil counts in peripheral blood in allergic diseases (neutral red staining)

Furthermore, in patients with repeated asthmatic attacks the count was generally higher than during the asymptomatic stage.

2. The basophils counted by our method

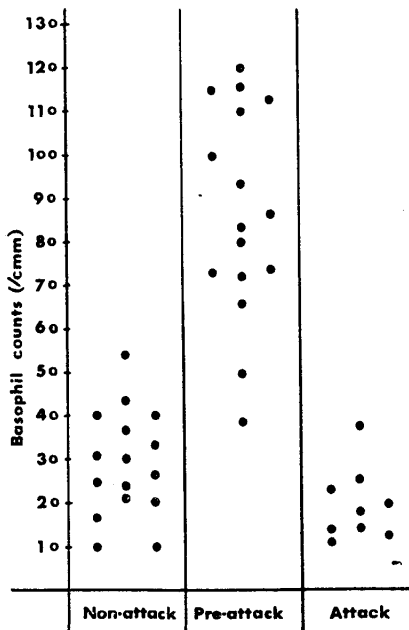
As our staining method above mentioned is very easy, it is particularly suited to observe the basophils in a course of asthmatic attack. Basophils when counted by our method averaged 38 ± 22 /cmm in normal persons. It was found that in an episode of asthmatic attack the basophils by our

toluidine blue method increased immediately before the attack and decreased to or below the normal level during the attack. These changes of basophils in an attack of bronchial asthma showed a regular pattern when examined repeatedly in asthmatic attacks of the same patients. Namely, this tendency was persistent through the stages before, during and after the attacks. During asthmatic episodes it was possible to predict a next attack when the basophil count again tended to increase from the previous low count. And the state of high basophil leucocyte count in bronchial asthma seemed to be a preasthmatic attack stage. (Figs. 2, 3)

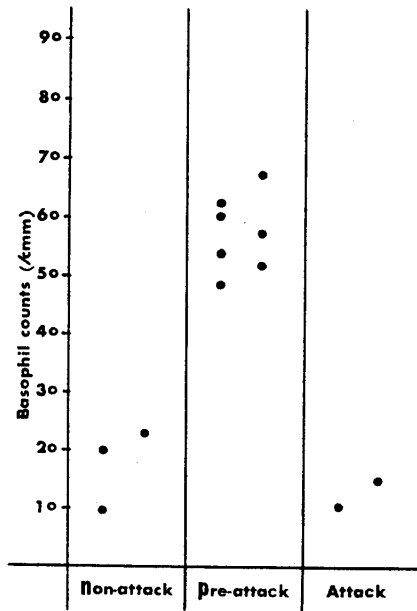
Cases showing changes of basophil counts in asthmatic attacks are presented below.

Case 1. 27-year-old female; The basophil count in the asymptomatic stage showed a low count as in healthy controls and increased with the approach of an asthmatic attack, but decreased at the same time when the attack had begun. Thereafter the patient gained a remission by intravenous administration of aminophyllin and maintained an asymptomatic condition with a low count of basophils (Fig. 4).

Case 2. 51-year-old male; This case showed a similar changes of basophils as in Case 1 with respect to asthmatic attack but after that the



Absolute basophil counts in asthmatic attack
Fig. 2 Absolute basophil counts in asthmatic attack



Absolute basophil counts in asthmatic attacks of the same patient

Fig. 3 Absolute basophil counts in asthmatic attacks of the same patient

Changes of basophil counts in a case of bronchial asthma
Case 1 27-year-old female

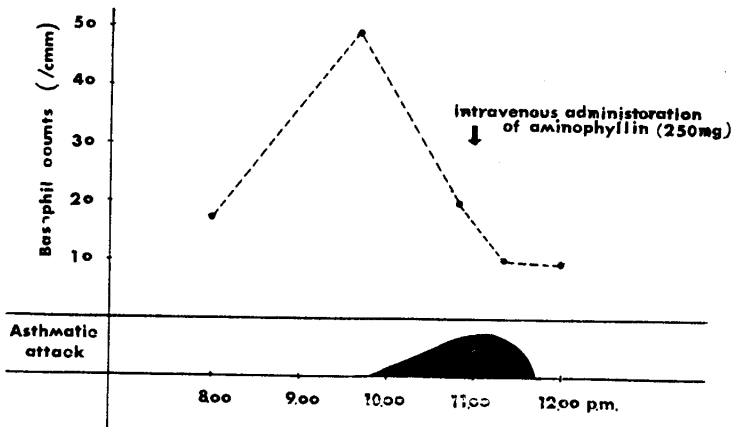


Fig. 4 Changes of basophil counts in a case of bronchial asthma (Case 1)

basophils of this patient increased again up to the count before the attack although he obtained a transient remission by intravenous administration of aminophyllin. This basophil rise was followed by a next attack. (Fig. 5)

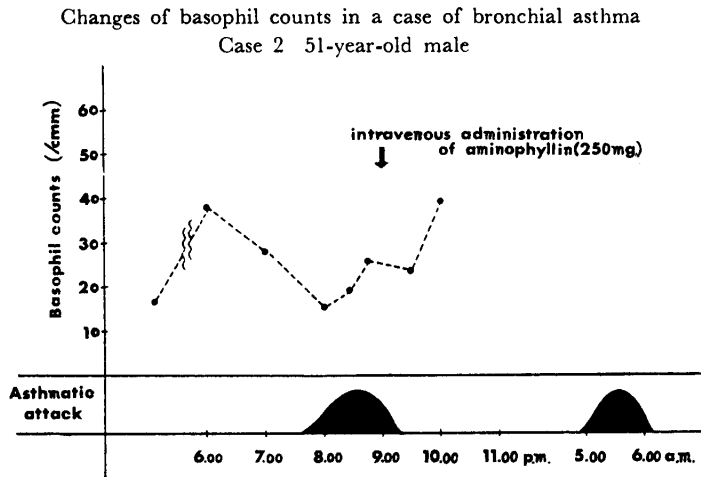


Fig. 5 Changes of basophil counts in a case of bronchial asthma (Case 2)

DISCUSSION

The function of basophil leucocytes is important in relation to anaphylaxis (6), but it is not clear whether they play a role as histamine source. However, it has been noticed that basophils decrease in an anaphylactic shock, and they are connected with immediate type of allergic reaction. Particular observation of basophils in bronchial asthma has not been reported. We have studied changes of basophils in bronchial asthma in detail. The summarized results are as follows. Basophils in bronchial asthma are generally higher than in healthy controls. During the interval of repeated asthmatic attacks the basophil count is higher than in the asymptomatic period. In detailed examination the basophils increase immediately before the attack and decrease to the normal level or lower after the attack has begun. It is very interesting that this tendency is always repeated in each attack of the same patient. These findings are expected for the next asthmatic attack, and are useful for the diagnosis and observation of the therapeutic course. It is known that the basophils are related to thyroid and adrenocortical functions. And then the changes of basophil count have been studied in an allergic reaction such as urticaria. A causal relation between basophils and immediate type of allergic reaction is unknown so that it is necessary that the role of histamine and heparin as chemical mediator is elucidated. And this may offer a very interesting problem for the solution of etiology of bronchial asthma. At present we are extending examinations on the function of basophil leucocytes. Our staining method above mentioned is very easy, and it is possible

to make in detail basophil counts as a routine examination.

SUMMARY

Changes of basophil leucocyte counts of the peripheral blood in bronchial asthma were investigated mainly by our improved method of KOVACS (4). The results are as follows.

- 1) The basophils in bronchial asthma generally show a higher count than in healthy controls.
- 2) During the interval of repeated asthmatic attacks the basophil count is higher than in the asymptomatic period.
- 3) Particularly in an episode of asthmatic attack, the basophils increase immediately before the attack and decrease to the normal level or lower after the attack has begun.
- 4) During asthmatic attacks it may be possible to expect another attack, if the basophil count again tends to increase from the previous low count.
- 5) This counting method of basophils is easy enough for the routine examination like calculation of peripheral leucocytes.
- 6) Observation of the changes of peripheral basophils appears to be a useful laboratory aid for the diagnosis and therapeutic evaluation of bronchial asthma, making possible an early detection of the next attack.

A discussion is given of the behavior of the basophils in bronchial asthma.

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