Reference Values for Immature Granulocytes in Healthy Blood Donors Generated on the Sysmex XE-2100 Automated Hematology Analyser

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An increase in immature granulocytes (IG) in peripheral blood is of great importance for the diagnosis of hematological malignancies. Furthermore, it may indicate systemic inflammation. IGs are usually quantified by visual microscopy; however, recent studies have evaluated automated IG count on the DIFF channel and IG detection on the IMI channel of the Sysmex XE-2100 automated hematology analyser.

The aim of the present study was to generate reference values for these parameters. Men and women showed comparable reference intervals for the IG counts; the 5th percentile was zero and the 95th percentile was 0.03×10^9/ L for both men and women. For the IG count in percent (%IG) the 5th percentile was zero and the 95th percentile was 0.5% for men and 0.4% for women. The count of myelocytes in the IMI channel in the study population resulted in a 5th percentile of zero and a 95th percentile of 0.03×10^9/ L for both men and women.

The clinical value of these automated measurements has to be elucidated in further clinical studies.

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Key Words Immature Granulocytes, IG Count, Immature Information, IMI, Reference Intervals

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INTRODUCTION

An increase in immature granulocytes (IG) in peripheral blood is of great importance for the diagnosis of hematological malignancies. Furthermore, it may indicate systemic inflammation. Thus, automated IG counting may function as a screening test for infectious diseases and myeloid disorders, resulting in earlier diagnosis and intervention.

Recent studies have evaluated the automated IG count on the DIFF channel[1)] and IG detection by the IMI channel [2)], but reference values for these two parameters have not been established until now.

The aim of the present study was to define reference values for the IG count on the DIFF channel and IG detection on the IMI channel of the Sysmex XE-2100 automated hematology analyser.

MATERIALS AND METHODS

Blood specimen selection and processing

156 healthy blood donors (80 men and 76 women: mean age 38 years [range 19 - 69 years]) from the Institute of Transfusion Medicine, University Hospital Leipzig, Germany, were enrolled in this study. Blood specimens were collected into 2.8 mL K_3EDTA Monovettes (Sarstedt, Germany) and processed within 4 hours on the Sysmex XE-2100. Instrument performance was monitored using quality control materials supplied by the manufacturer.

All blood donors were assessed according to German legal requirements[3)]. This allowed to detect influencing and interfering events which might affect the rate of IG production including diet, physical activity, smoking, alcohol consumption and consumption of drugs or pharmaceuticals including oral contraceptives. Volunteers were also questioned about history of allergy, recent surgery, recent transfusion, bacterial infection and any other co-existing disease. Donors with C-reactive protein (CRP) levels > 5 mg/L were excluded from the study.

XE-2100 IG count

The IG count includes mainly metamyelocytes and myelocytes and is obtained from the DIFF channel by fluorescence flow cytometry. The combination of side scatter and fluorescence intensity of the nucleated cells characterizes each cell detected. The standard XE-2100 offers the IG count as a research parameter, however, upgrading with the XE-IG Master software is necessary for reporting this parameter [4)].

Immature Information (IMI) channel measurement

The IMI (Immature Information) channel detects immature myeloid cells, including bands, IGs and blasts. The reaction principle of this channel is based on differences in membrane composition between mature and immature cells that are exploited by channel specific reagents resulting in a scattergram plotting radio frequency (RF y-axis) against direct current (DC x-axis). This channel determines the total number of myeloid precursor cells[2].

RESULTS

Measurement of IG count and IMI count on Sysmex XE-2100

A total of 156 samples was analyzed on the XE-2100 in the CBC+ DIFF mode. Results of the IG count are shown in ***Fig. 1***: 26 blood donors showed a zero count; 12 had a count of 0.01×10^9/L; 78 a count of 0.02×10^9/ L; 22 of 0.03×10^9/ L; 11 of 0.04×10^9/ L; 5 of 0.05×10^9/ L; and 2 of 0.06×10^9/ L.

Men and women showed comparable values for IGs with the highest value of 0.03×10^9/ L for men and 0.06×10^9/ L for women (***Figs. 2*** and ***3***). No age dependency for the IG counts was detectable (***Fig. 4***). The 5th percentile was zero and the 95th percentile was 0.03×10^9/L for both men and women. For the IG count in percent (%IG) the 5th percentile was zero and the 95th percentile was 0.5% for men, 0.4% for women and 0.4% if the data for men and women were combined (data not shown).

The count of immature myelocytes in the IMI channel in this study population resulted in a 5th percentile of zero and a 95th percentile of 0.03×10^9/L for both men and women (data not shown).

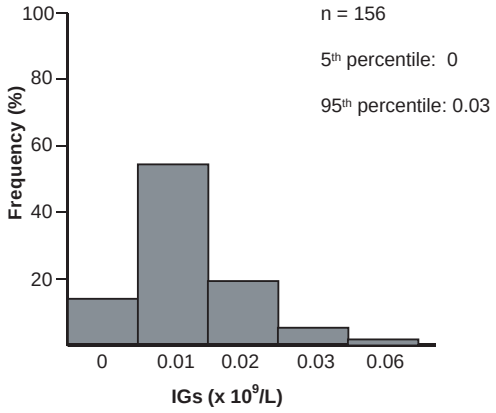

Fig. 1 *Measurement of IG counts in healthy blood donors*
The frequency of various concentrations is given in per cent.

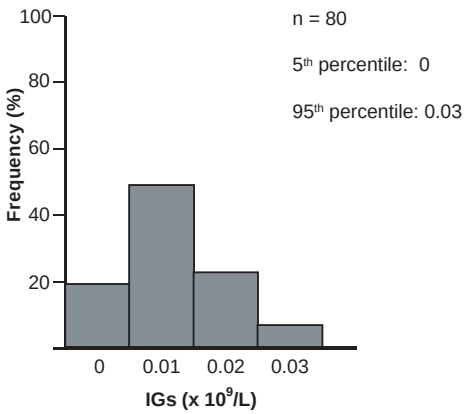

Fig. 2 *Measurement of IG counts in healthy men*
The frequency of various concentrations is given in per cent.

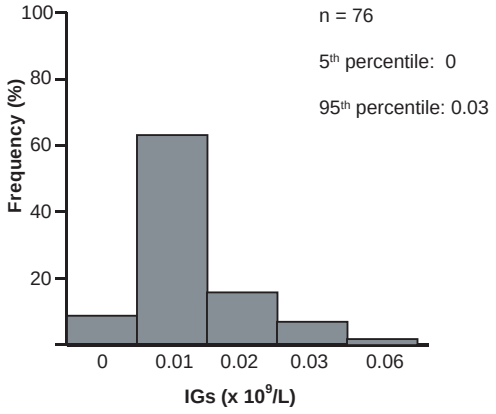

Fig. 3 *Measurement of IG counts in healthy women*
The frequency of various concentrations is given in per cent.

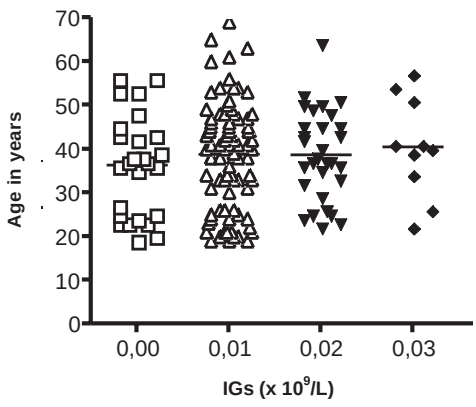

Fig. 4 *Age dependency of IG counts in healthy blood donors (n = 156).*

DISCUSSION

The aim of this study was to generate reference values for (1) the IG count and (2) IG detection by the IMI channel, analyzed by the Sysmex XE-2100 automated hematology analyser.
The automated analysis of IGs by IG count or IMI detection may be helpful in screening or monitoring leukaemoid reactions, such as severe and chronic infections, inflammation and tissue necrosis, neoplasia and myeloproliferative disorders. Some investigators recommend the IG values produced by the Sysmex XE-2100 as screening information about the infection status of the patient[4]. Results from patients with IG flags were compared with the counts of myeloid precursors (promyelocytes, myelocytes, metamyelocytes) determined microscopically. It has been shown that IG counts on the Sysmex analyser were systematically lower than the manual counts but that both methods correlate acceptably [5].
A recent study attributes high sensitivity to the IMI channel for the detection of immature cells in pregnant women[6]. Ansari-Lari, et al. state that > 3 % IGs, measured by Sysmex XE-2100, predict sepsis with > 90% specificity[7].
We analyzed IGs in 156 healthy blood donors by using IG count and IMI channel. We showed gender and age independent values.
Studies will be necessary to evaluate the application of automated IG measurements as screening assays for infectious diseases. However, reference values, generated in this study, should help to classify increased values of IGs.

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