

# Neutrophil Immunofluorescence by Doughnut Cells or Ring

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## CLINICAL IMAGE

The presence of ring-shaped nuclei neutrophils or doughnut cells (Figure 1) is well known in rats and mousesgranulopoiesis, and it was later described in humans. Ring and/or hyposegmented neutrophils are already well-known findings in leukemia patients, [1] megaloblastic anemia and myeloproliferative diseases [2,3]. An occasional occurrence is also present in patients with myelodysplastic syndrome (MDS) or chronic granulocytic leukemia (CGL). Besides there are still reports on infectious mononucleosis, Chagas disease, [4] and lymphoproliferative disorders (multiple myeloma and monoclonal gammopathy of undetermined significance) or even in healthy individuals. [5,6] Thus, this peculiar morphological presentation can be considered a nonspecific finding of several hematological diseases. Hence, we present not only the hematoxylin and eosin stain representation but a unique point of view (by immunofluorescence) of a ring-shaped nuclei neutrophil in a years old male patient with multiple myeloma suspicion.

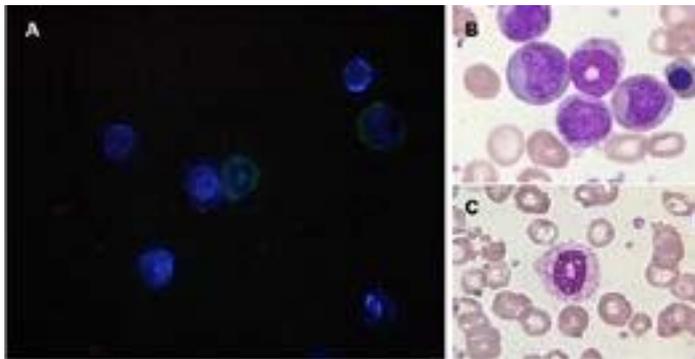


Figure 1: Flow Diagram.

## TRANSPARENCY

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### Adherence to national and international regulations

Not applicable.

## Authors' contributions

All authors read and approved the final manuscript.

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None.

## Availability of data and materials

All data generated or analyzed during this study are included in this published article.

## Ethics approval and consent to participate

Written informed consent was obtained from the patient for participation in the study.

## Consent for publication

The authors declare that they have no competing interests.

## Competing interests

The authors declare that they have no competing interests.

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