



## Neutrophil faggot cells and inv(16): not such a fortuitous association?

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Dear Editor,

A 36-year-old previously healthy man presented with fever, malaise, and bruising. A full blood count test showed a hemoglobin concentration of 98 g/L, platelet count  $42 \times 10^9/L$ , and leucocyte count  $22 \times 10^9/L$  with 40% blast cells and 6% neutrophils [14% with a few or multiple cytoplasmic Auer rods (Fig. 1a–c)]. No coagulation abnormalities were present.

A bone marrow aspirate revealed 48% blasts, 41.5% granulocytes, and 4% eosinophils. Blasts had promonocytoid (28%) or undifferentiated (18%) morphology and showed granular positivity with myeloperoxidase (97%) but negativity with alpha-naphthyl acetate esterase. Eosinophils occasionally contained pre-eosinophilic granulation and showed weak positivity with periodic acid-Schiff or chloroacetate esterase stains.

Dysplasia was present in 96% of the cells in the granulocytic lineage: pseudo-Pelger-Huet anomaly, agranular cytoplasm or presence of Auer rods, from metamyelocytes to mature neutrophils, predominated in the latter. Interestingly, bundles of Auer rods (faggot cells) were seen up to 10% in mature neutrophils (Fig. 1d–f), while only 1 or 2 Auer rods were observed in less than 0.5% of the atypical promonocytoid cells (Fig. 2a–d).

Flow cytometry showed that blasts were positive for CD34, HLA-DR, CD123, cyMPO, CD13, CD33, and CD117, with 12.5% positive for CD64 and CD4. Cytogenetic analysis found an inv(16) and, in 4/40 metaphases, a hyperdiploidy of about 52 chromosomes was observed. Fluorescence in situ hybridization (Fig. 3) and molecular studies confirmed inv(16) and *CBFB-MYH11* rearrangement, respectively and discarded *PML-RARA* rearrangement. Next-generation sequencing showed a *KIT* p.Asp816Val mutation. The final diagnosis was acute myeloid leukemia (AML) with inv(16); *CBFB-MYH11*. The patient received chemotherapy according to the Pethema protocol, achieving a complete remission after induction, but with persistently positive *CBFB-MYH11*.

The presence of 1–2 Auer rods is usually seen in myeloid blasts yet rarely in mature neutrophils, being exceptional in the monocytic lineage [1]. It is even more unusual that they are numerous, in bundles, such as those described in the faggot cells.

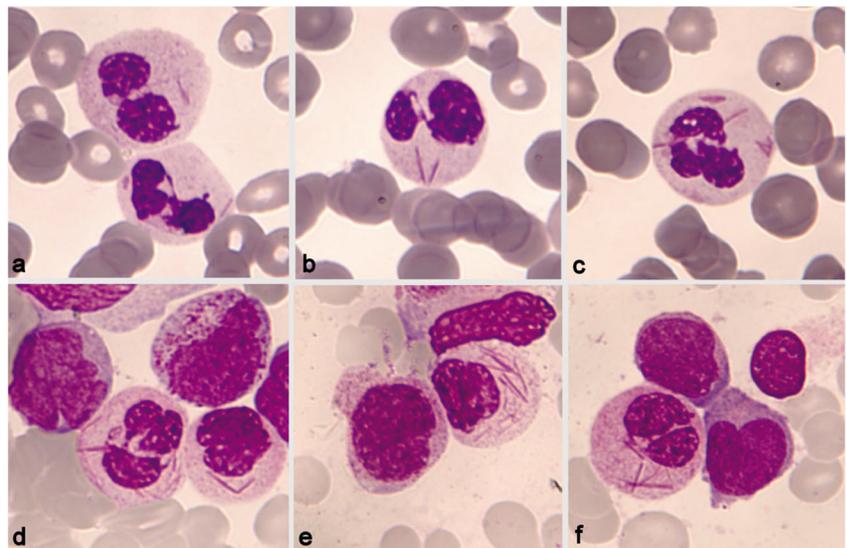
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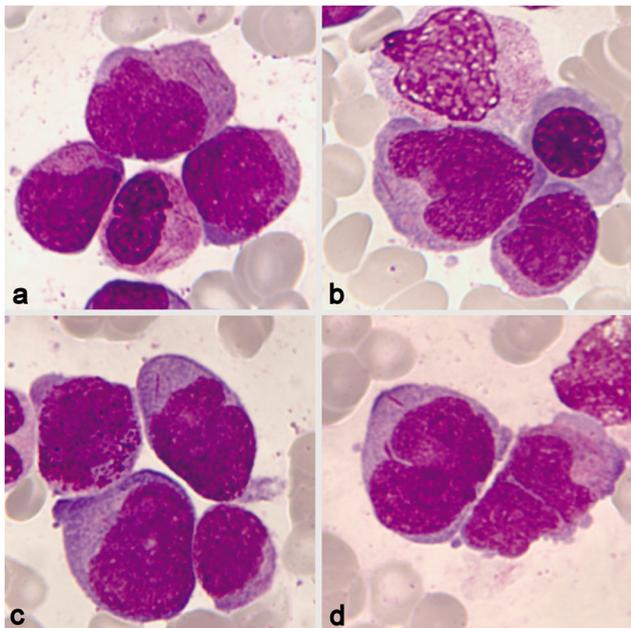
**Fig. 1** May-Grünwald-Giemsa stain,  $\times 1000$ . **a–c** Peripheral blood smear show faggot cells in neutrophils. **d–f** Bone marrow aspirate shows faggot cells in maturing granulocytes



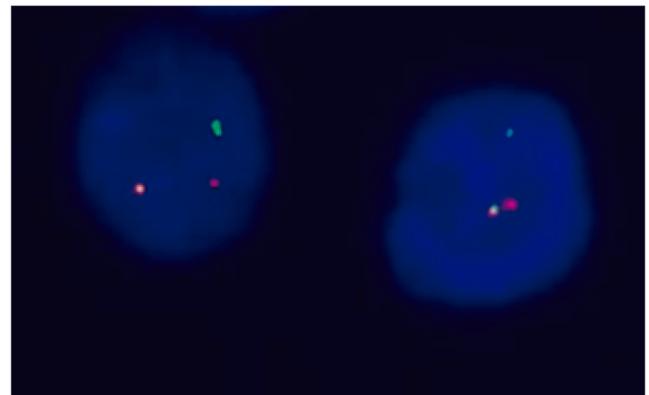
Faggot cells usually correspond to leukemic promyelocytes. They are rarely observed in myeloid blasts and in the final stages of granulopoiesis (metamyelocyte to mature neutrophil). They have only been described punctually in AML with t(8; 21) (in mature neutrophils) [2], acute

leukemia of mixed phenotype (in mature neutrophils) [3], AML with complex karyotype and amplification of *MYC* (in blasts and maturing neutrophils) [4], AML without maturation and trisomy 4 (in mature neutrophils and metamyelocytes) [5].

In the literature reviewed, only one case of concordant faggot cells with mature neutrophils and band forms in an AML with inv(16) has been described, as a therapy-related AML [6], while additionally, in this case, some Auer rods were observed in malignant cells of monocytic lineage. This association may not be fortuitous.



**Fig. 2** May-Grünwald-Giemsa stain,  $\times 1000$ . **a–d** Bone marrow aspirate shows the presence of 1–2 Auer rods in atypical promonocytoid forms



**Fig. 3** Interphase fluorescence in situ hybridization with a *CBFβ* break apart rearrangement probe. Two nuclei showing red and green signal split indicating a *CBFβ* rearrangement

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** This article does not contain any studies with human participants performed by any of the authors.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

## References

1. Kanoh T, Hashimoto S, Usui T et al (1986) Auer rods in mature granulocytes and monocytes. *Tohoku J Exp Med* 148:99–102
2. Kallel C, Makni F, Bouzidi H, Hdiji S, Elloumi M, Souissi T, Ellouz F (2005) Myelodysplastic syndrome / acute myeloid leukemia with t(8;21) and bundle of Auer rods in neutrophils: an unusual hemopathy. *Ann Biol Clin* 63:429–432
3. Dmitrienko S, Vercauteren S (2012) Auer rods in mature granulocytes of a patient with mixed lineage leukemia. *Blood* 119:4348
4. Guérin E, Mahon FX, Lippert E (2008) Bundles of Auer rods in blast cells and mature neutrophils in a non-promyelocytic acute myeloblastic leukaemia. *Br J Haematol* 141:749
5. Ohnishi H, Yoshino H, Yoneyama R, Ishii M, Watanabe T, Bessho F (2008) Faggot formation in mature neutrophils and metamyelocytes in acute myeloid leukemia without maturation. *Pediatr Hematol Oncol* 25:165–170
6. Jerez A, Osma M, Amigo M et al (2010) Faggot cells in an HIV-positive patient with inv(16)/therapy-related acute myeloid leukaemia. *Br J Haematol* 150:646