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Short Communication

Auer rods: Diagnostic and prognostic significance

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Auer rods are rod shaped crystalline inclusions, formed of azurophilic granules named after John Auer although were first recognised by Thomas Mc Crae. Based on the electron microscopic finding way back in 1977, it was concluded that the formation of Auer rods is due to defects in the formation, aggregation, and concentration of the peroxidase granules in the leukemic blasts. Auer rods have varied morphological features Most common form being described as needle shaped with pointed ends, but could be of comma shape, diamond shape, rectangular, cork-screw forms, and rare granular Auer bodies also seen.¹ Bundles of Auer rods aggregate to form Faggot cell that is, pathognomonic of AML-M₃. Phi bodies may mimic Auer rods, but they are catalase containing granules. Pseudo-Auer rods reported in plasma cells in few cases of plasma cell dyscrasias.^{2,3} Only 50 % of myeloid malignancies exhibit Auer rods within the cytoplasm of blast cells.^{1,4} Though mostly they are seen in myeloblasts but can be present in any stage of maturation of myeloid lineage down to mature neutrophils. Virtually Auer rods are considered diagnostic of AML, but they are also seen in blast crisis of CML and have diagnostic value in a specific type of MDS called refractory anaemia with excess blasts – 2 (RAEB-2) and chronic myelomonocytic leukemia-2 (CMML -2).

Auer rods in Acute Myeloid Leukemias (AML)

1. Auer rods seen in 50 to 60% of acute myeloid leukemias, mostly in neoplastic myeloid blasts.²
2. Auer rods in mature neutrophils are extremely rare but described in acute PML, AML t(8;21), AML with maturation and acute leukemias of ambiguous lineage.⁵ Their presence in neutrophils is suggestive of nucleo-cytoplasmic asynchrony where the nuclear maturation has occurred however cytoplasmic granule content is similar to immature myeloid cells.
3. In FAB classification M₂ subtype of AML shows numerous blast cells with Auer rods (about-70%), where as faggots seen in M₃ subtype. Auer rods variably present in M₄ subtype, rarely in M₁ subtype and usually absent in M₀ & M₅ subtypes.³
4. Auer rods are generally absent in secondary AMLs.⁶
5. Presence of Auer rods in AMLs, signifies good prognosis specially in M₁-M₄ subtypes.² Excellent response to chemotherapy mostly ATRA-sensitive(All-trans retinoic acid) with high remission rate and long survival, reflects a specific MPO genotype.⁷ Two genes here thought to be involved are RUNX1 at 21q22 & ETO at 8q22 which form a fusion protein.
6. Auer rods also determines treatment end point in AML. The term complete remission generally refers to one of the morphologic criteria i.e. absence of Auer rods in blasts. They usually not need any alternate/additional therapy. Even if such patients are

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in remission by all other criterias, at all show Auer rods in blasts, in due course of a few months they will show florid relapse.^{2,7}

7. Electron microscopy shows different 3 dimensional crystal structures in different subtypes of AMLs would of considerable diagnostic/prognostic importance.⁸
8. Studies also show different MPO genotypes, which might have related to diagnosis and therapy.⁷

Auer rods in myelodysplastic/ myeloproliferative diseases

Review of literatures, suggests that Auer rods signify an aggressive biology in myelodysplastic and myeloproliferative diseases and blast dysmaturation in CML.⁷

1. Refractory anemia with excess of blasts is further divided into two types 1&2. The latter category (RAEB-2) includes cases with blasts having Auer rods regardless of blast count and/or with 10 to19% blasts in bone marrow and/or 5-19% blasts in peripheral blood. These cases associated with increase rate of progression to AML and have a worse prognosis.^{2,9}
2. CMML is no longer classified by WHO as an MDS, but rather as a myelodysplastic / myeloproliferative disease. Nevertheless the WHO subdivides CMML into types 1&2, according to a scheme nearly identical to that used for RAEB as mentioned above. Thus Auer rods play an important role in diagnosis and prognosis^{2,9}
3. Their presence in chronic myeloid leukemia (CML) is very rare. Few reports have been described in blastic phase of CML.⁶

Auer rods are best known as lineage specific markers of myeloid differentiation and has great value in the settings of acute leukemias for diagnosis, therapy and prognosis. Though more than 100 years have passed away, but the biology of Auer rods appears to be still in infantile stage. Further works needed to refine and confirm many aspects. However, we must spend enough time in searching such beautiful rods in myeloid lineage leukemias, for the benefit

of patients.

Conflict of Interest

The authors declare that there is no conflict of interest.

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