Case History for BMD-09 – BMD-13

This bone marrow aspirate is from a 54-year-old man status post-kidney transplant with persistent severe anemia. Laboratory data include: WBC = 2.9 x 10^9/L; RBC = 2.15 x 10^{12}/L; HGB = 6.7 g/dL; HCT = 19.0%; MCV = 88 fL; and PLT = 172 x 10^9/L. Serum parvovirus PCR is positive. (Erythroid aplasia. Scattered large pronormoblasts containing viral nuclear inclusions.)

Please click on the hyperlink below to view the DigitalScope images for this case. Click on the "i" icon for each region of interest (challenge) to view the text that is found in the Participant Summary Report (PSR).
http://www.digitalscope.org/LinkHandler.axd?LinkId=6ae4ce9c-54c2-4c11-a263-e41f1dea416f

To access the online Hematology Glossary, please click the hyperlink below:
http://www.cap.org/ShowProperty?nodePath=/UCMCon/Contribution%20Folders/WebContent/pdf/hematology-glossary.pdf

Summary of Participant Survey Results

The following is a statistical summary of all results submitted by participating labs. These are provided to allow participants to see their responses in the context of their peers. These results may identify findings or topics for further education or review. Survey results are not intended to represent the correct or desired responses for proficiency testing purposes and the SD and CV should not be interpreted as acceptable reporting limits. Participants are encouraged to review discrepant results with their medical director.

Bone Marrow Differential – %

	NO. LABS	MEAN	S.D.	C.V.*	Median	Low Value	High Value
Blasts	265	1.35	1.21	89.1	1.0	0.0	5.3
Promyelocytes	265	2.19	1.51	68.8	2.0	0.0	7.0
Myelocytes	275	10.08	4.53	45.0	10.0	1.0	24.0
Metamyelocytes	274	8.89	4.42	49.7	8.1	0.0	21.0
Band/Segmented Neutrophils	277	43.24	8.47	19.6	43.4	17.7	68.0
Eosinophils (all stages)	274	6.53	2.57	39.3	6.5	0.0	13.8
Basophils	263	0.71	0.59	83.7	0.8	0.0	2.0
Monocytes	266	1.99	1.66	83.3	2.0	0.0	7.0
Lymphocytes	277	18.22	5.93	32.6	18.8	1.0	36.0
Plasma cells (normal and abnormal)	264	0.81	0.57	69.4	1.0	0.0	2.3
Erythroid precursors (all stages)	272	4.53	3.28	72.5	4.0	0.0	16.6
Other	162	0.08	0.26	*	0.0	0.0	1.3
Myeloid : Erythroid ratio	263	25.97	21.24	81.8	19.0	0.0	89.4

BMD-08

* When low results are reported on an analyte, a high coefficient of variation (CV) may result. When the mean value is very low the C.V. may be exaggerated.

Other cells not listed:	Total (N=12)	%
Histiocytes/macrophages	6	50.0
Pronormoblast with parvovirus infection	3	25.0
Megakaryocytes	2	16.7
Mast Cell	1	8.3

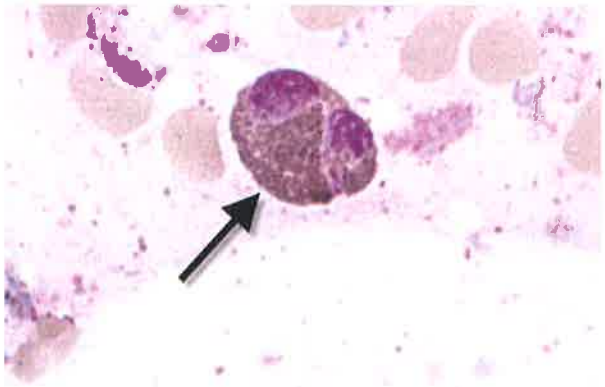
BMD-08

Committee Comments on Bone Marrow Differential and Aspirate

The bone marrow aspirate smear contains cellular particles. There is a stark paucity of erythroid precursors with markedly decreased maturation. Scattered proerythroblasts are present and appear markedly enlarged with visible intranuclear inclusions. Granulocytes are present in normal numbers and demonstrate the usual spectrum of maturing cells. Some scattered small lymphocytes, plasma cells and eosinophils are also seen. Blasts do not appear increased. Megakaryocytes are normal in number and morphology.

Cell Identification

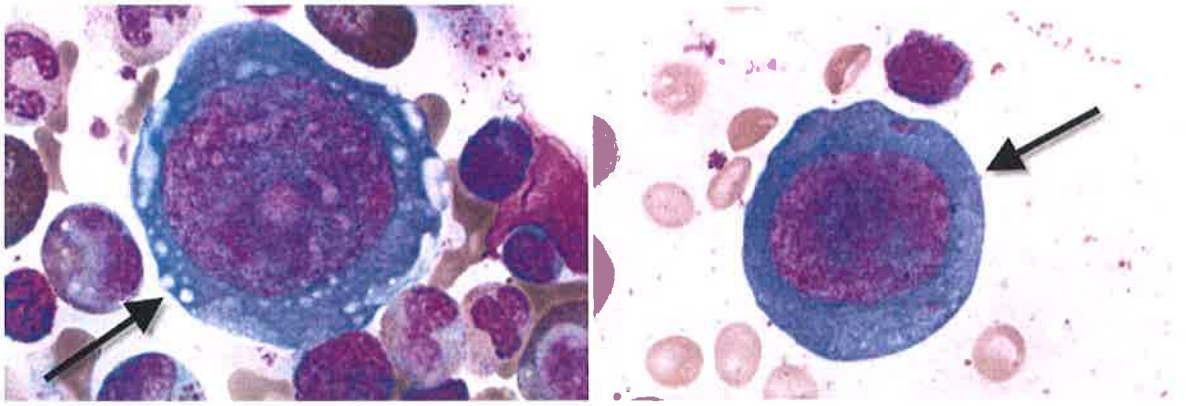
BMD-09



Identification	Participants No.	Participants %	Evaluation
Eosinophil, any stage	274	96.5	Educational
Eosinophil, any stage with atypical/basophilic granulation	9	3.2	Educational
Neutrophil, toxic (to include toxic granulation and/or Döhle bodies, and/or toxic vacuolization)	1	0.3	Educational

The arrowed cell is an eosinophil, as correctly identified by 96.5% of the participants. The eosinophil is a myeloid cell characterized by coarse, orange-red granules of uniform size and is similar to a neutrophil in diameter (10 to 15 µm). Normally, the nucleus of a mature eosinophil demonstrates condensed chromatin and nuclear segmentation with two or three nuclear lobes.

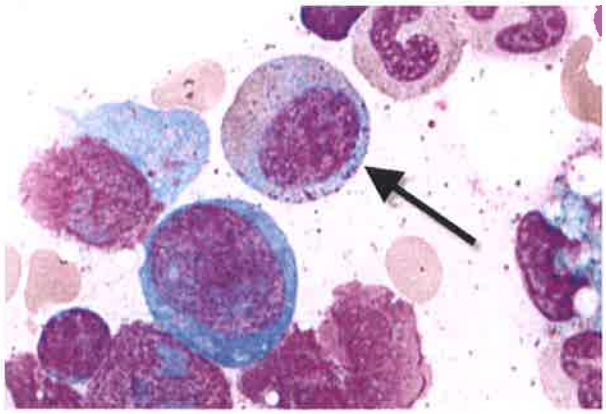
BMD-10



Identification	Participants No.	Participants %	Evaluation
Erythrocyte precursor with changes of parvovirus infection	247	87.0	Educational
Erythrocyte precursor, abnormal/dysplastic nuclear features (includes pronormoblast, basophilic, polychromatophilic, and orthochromic normoblasts)	14	5.0	Educational
Erythrocyte precursor, normal (includes pronormoblast, basophilic, polychromatophilic, and orthochromic normoblasts)	10	3.5	Educational
Erythrocyte precursor with megaloblastic changes/maturation	3	1.1	Educational
Erythrocyte precursor with vacuolated cytoplasm	3	1.1	Educational
Megakaryocyte or precursor, abnormal	3	1.1	Educational
Neutrophil, metamyelocyte	1	0.3	Educational
Malignant lymphoid cell (other than blast)	1	0.3	Educational
Megakaryocyte or precursor, normal	1	0.3	Educational
Blast cell (includes lymphoblast)	1	0.3	Educational

The arrowed cell is an erythrocyte with parvovirus, as correctly identified by 87.0% of the participants. Parvovirus B19 may result in depression of erythropoiesis through infection of bone marrow progenitor cells. In bone marrow aspirate smears, patients affected by parvovirus B19 infection characteristically show extremely large erythroid precursor cells with distinct intranuclear inclusions. The diameter of these abnormal cells may exceed 50 µm. The cytoplasm is moderately abundant and stains deep blue while the nucleus is round with dispersed chromatin. Note that there is very little maturation in the erythroid lineage beyond the proerythroblast (normoblast) stage.

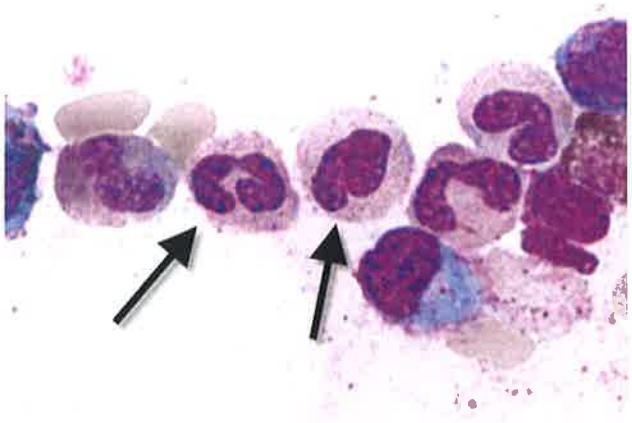
BMD-11



Identification	Participants No.	Participants %	Evaluation
Neutrophil, myelocyte	264	93.0	Educational
Neutrophil, metamyelocyte	10	3.6	Educational
Neutrophil, promyelocyte	8	2.8	Educational
Eosinophil, any stage with atypical/basophilic granulation	1	0.3	Educational
Neutrophil, promyelocyte, abnormal with/without Auer rod(s)	1	0.3	Educational

The arrowed cell is a neutrophil, myelocyte, as correctly identified by 93.0% of the participants. Myelocytes are maturing myeloid cells that show evidence of granulocyte maturation. They are preceded in maturational stage by the promyelocyte and succeeded by metamyelocytes. Myelocytes measure approximately 15 µm in diameter and show moderate pale-gray cytoplasm with secondary granulation. The nucleus is round to oval with relatively coarse chromatin and an inconspicuous nucleolus.

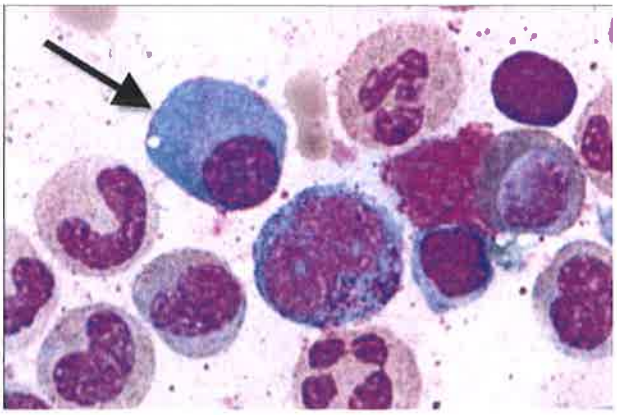
BMD-12



Identification	Participants No.	%	Evaluation
Neutrophil, segmented or band	273	96.1	Educational
Neutrophil with dysplastic nucleus and/or hypogranular cytoplasm	6	2.2	Educational
Neutrophil, metamyelocyte	2	0.7	Educational
Neutrophil with Pelger-Huët nucleus (acquired or congenital)	2	0.7	Educational
Neutrophil, toxic (to include toxic granulation and/or Döhle bodies, and/or toxic vacuolization)	1	0.3	Educational

The arrowed cell is a neutrophil, segmented or band, as correctly identified by 96.1% of the participants. Segmented neutrophils are the mature granulocyte and are prominent in normal bone marrow aspirates. Neutrophils range in diameter from 10 to 15µm, with moderate amounts of pale pink cytoplasm containing fine, eosinophilic granules. The nucleus usually has three or four segments (lobes) connected by a thin filament that contains no internal chromatin, giving it the appearance of a solid, thread-like dark line. Band neutrophils are slightly less mature with a deeply indented or 'U-shaped' nucleus that often resembles a horseshoe.

BMD-13



Identification	Participants No.	Participants %	Evaluation
Plasma cell (to include morphologically mature, abnormal, and with inclusion, eg, Dutcher body, Russell body, etc)	281	99.1	Educational
Erythrocyte precursor, normal (includes pronormoblast, basophilic, polychromatophilic, and orthochromic normoblasts)	1	0.3	Educational
Erythrocyte precursor, abnormal/dysplastic nuclear features (includes pronormoblast, basophilic, polychromatophilic, and orthochromic normoblasts)	1	0.3	Educational
Osteoblast	1	0.3	Educational

The arrowed cell is a plasma cell, as correctly identified by 99.1% of the participants. Plasma cells are terminally differentiated antibody producing B-lymphocytes ranging from 10 to 20 µm in diameter. They represent a normal constituent of the bone marrow typically accounting for less than 5% of total cellularity. The cytoplasm of plasma cells contains immunoglobulin and appears blue-gray or basophilic. The nucleus is eccentrically placed and there is often a visible perinuclear hof or pale zone corresponding to the cell's Golgi apparatus. Chromatin is condensed with a 'clock-face' appearance. The nucleus is round with dispersed chromatin. Note that there is very little maturation in the erythroid lineage beyond the proerythroblast (normoblast) stage.