Cytological Bone Marrow Cell Differential Counts and Morphological Findings in the Common Marmoset (Callithrix jacchus)

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Introduction

Cytological bone marrow evaluation is performed in **nonclinical toxicological studies** to identify potential effects of tested compounds on hematopoiesis.

The common **marmoset (Callithrix jacchus)** is a **nonhuman primate** (NHP) species used in biomedical research for over 30 years. Due to its **small size** (adult 200-600g, average height 20-30 cm) and the current limited supply of other NHP species such as the Cynomolgus monkey **(Macaca fascicularis)**, the number of marmosets used in toxicological studies is expected to increase.

Materials and Methods

Bone marrow smears were prepared from 26 healthy control marmosets (13 males & 13 females, 2-4 years old) **within 2-5 minutes after euthanasia** (isoflurane anesthesia followed by exsanguination) in a r**oom exempt from any formalin vapor.**

Precisely, immediately following euthanasia, one femur was isolated, and the attached muscles were trimmed from the periosteal surface. After l**ongitudinal incision of the proximal femur**, hematopoietically active (red) bone marrow was exposed. A small drop of bovine serum albumin (BSA) was placed at the end of a glass slide. Using a 23G needle, **bone marrow was gently transferred on a glass side and mixed with BSA**. Finally, the material was spread uniformly on the glass side and allowed to air dry. Two bone marrow smears from one proximal femur were prepared for each animal and stained with May- Grünwald-Giemsa stain using an automated stainer (Aerospray®).

Smears were evaluated microscopically for overall **quality**. An **approximative 400-cell complete differential cell count and morphological assessment were performed.**

For each sex, **myeloid to erythroid (M:E) ratios and the percentage of each individual cell types, total granulocytic cells, total erythroid cells, total lymphocytes related to total bone marrow cells were calculated.**

Results

High-quality smears

All smears obtained by the collection procedure yielded **high-quality** smears with high cellularity and **adequate cellular preservation**. Proliferation and maturation pools of all hematopoietic cell lines could be evaluated.

Quantitative assessment

- M:E ratios: 0.61:1.0 to 1.77:1.0
- Percentages of total granulocytic cells: 30.7% to 58.3%
- Percentages of total erythroid cells: 32.1% to 58.3%
- Percentages of lymphocytes: 4.8 to 22.4%

Morphological findings

• Granulocytic series:
Notable morphologic findings consisted of rare **large to giant neutrophilic metamyelocytes and band neutrophils and very rare ring-shaped nuclei.**

• Erythroid series:
Notable morphologic findings consisted of **nuclear blebbing or lobulation with a variable number of shapes and binucleated metarubricytes**. Mitotic figures were commonly seen in the erythroid series.

• Megakaryocytic series:
Megakaryocytes were typically mature. Rarely, megakaryocytes with non fused nuclei and mature cytoplasm and rarely, **emperipolesis** involving segmented neutrophils, was observed. Rare **proplatelets** were identified.

• Lymphocytic series:
Lymphocytes were commonly **small and mature**. Rare large lymphoblasts were identified.

• Monocytic series:
Rare mature monocytes were seen.

• Plasma cells:
Rare Plasma cells and very rare **Flame cells** and **Mott cells** were observed.

• Nonhematopoietic elements:
Infrequently, osteoblasts in small aggregates, hemosiderin-laden macrophages and nurse cells were seen.

Quantitative and morphological findings similar to the Cynomolgus Monkey

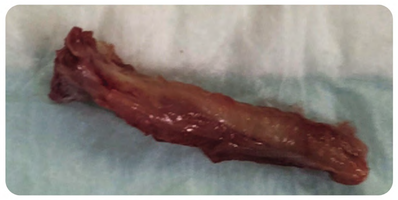
(Macaca fascicularis)

The common marmoset *(Callithrix jacchus)*

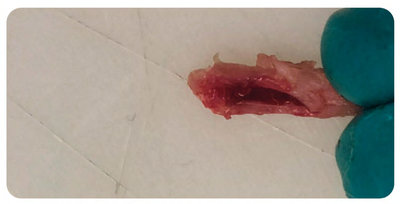
A nonhuman primate (NHP) species
New world Monkey

Aim of the study

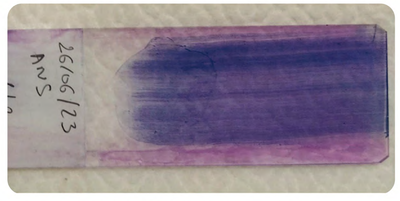
The purpose of this study was to **describe bone marrow cell differential counts and morphological findings from healthy marmosets.**



1. Isolation of one femur

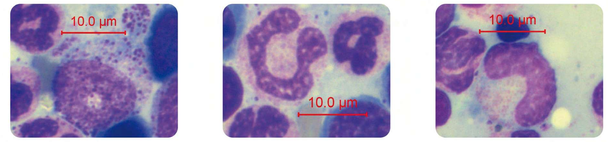


2. Longitudinal incision of the proximal femur



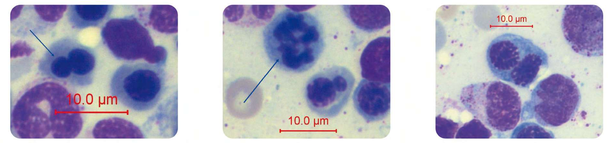
3. MGG stained bone marrow smear

Granulocytic series



Ring-shaped nucleus | Giant form | Giant metamyelocyte

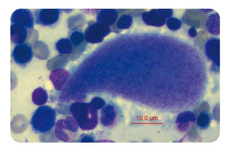
Erythroid series



Nuclear blebbing | Mitotic figure | Binucleation

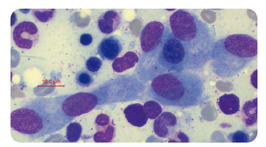
Megakaryocytic series

Megakaryocyte



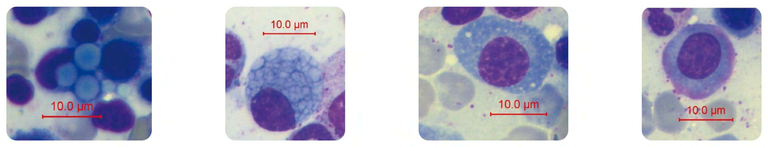
Proplatelet

Others



Osteoblasts

Lymphocytic series



Russell bodies | Mott cell | Plasma cell | Flame cell

Conclusion

Bone marrow smears can be easily prepared immediately following euthanasia in the common marmoset.

The proximal femur yielded smears of adequate quality for cytological examination.
Quantitative and qualitative assessment of bone marrow smears of healthy animals showed similar results to the Cynomolgus Monkey.

These results demonstrate technical and scientific appropriateness of cytological bone marrow evaluation in the common marmoset and provide preliminary data regarding background morphological findings.

References

- Cytological bone marrow cell differential counts and morphologic findings in healthy Cynomolgus Monkeys (Macaca fascicularis) from Nonclinical Toxicology Studies. Carter C et al., Toxicol Pathol. 2017 Feb;45(2):267-274.

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- Cytological examination and cellular composition of bone marrow in healthy, adult, Cynomolgus Monkeys (Macaca fascicularis). Provencher Bolliger A. and Fontaine M. Comp Haemat Inter. 1998;8:183-190.