# Platelets

## Interpretive Summary

**Description:** Platelets are involved in clot formation and stabilization (primary hemostasis).

### Decreased Platelets

#### Common Causes

- Artifact (most common cause)
  - Platelet clumps (especially cats)
  - Clots in specimen tube
- Decreased platelet production (bone marrow suppression)
  - Drugs
    - Chemotherapeutic agents
- Increased platelet consumption/destruction
  - Immune mediated (typically relatively severe; platelet counts below 50,000 /µL)
    - Primary (idiopathic) immune-mediated thrombocytopenia (IMT)
    - Secondary IMT
      - Infectious
      - Neoplasia
      - Systemic immune-mediated disease
        - Systemic lupus erythematosus (SLE)
        - Evan's syndrome (IMT and IMHA)
  - Non-immune mediated (typically mild to moderately decreased platelets)
    - Blood loss, acute and severe
    - Platelet activation and consumption
      - Localized intravascular coagulation (eg. hemangiosarcoma, thrombosis)
      - Disseminated intravascular coagulation (DIC)
- Idiopathic/multifactorial
  - Infectious
    - Rickettsial (*Anaplasma* spp*, Ehrlichia* spp.)
    - Viral (canine parvovirus, feline panleukopenia, FeLV, FIV, canine distemper, equine infectious anemia)
    - Protozoal (*Babesia* spp, *Cytauxzoon felis, Leishmania* spp, *Theileria* spp)
    - Parasitic *(Angiostrongylus vasorum)*
    - Bacterial (Leptospirosis
    - Fungal (Histoplasmosis)
  - Neoplasia

#### Uncommon Causes

- Sequestration (rarely causes clinically relevant decrease)
- Decreased platelet production (bone marrow suppression)
  - Immune-mediated (targeting megakaryocytes)
  - Drugs/Toxins
    - Estrogen (endogenous/exogenous)
    - Phenylbutazone (dogs and horses)
    - Trimethoprim-sulfadiazine and trimethoprim-sulfonamide
    - Griseofulvin (cats)
    - Idiosyncratic
  - Irradiation (extensive/whole body)
  - Bone marrow disease/myelophthisis
    - Bone marrow neoplasia
    - Myelofibrosis

        - Osteopetrosis
        - Myelonecrosis
    - Megakaryocytic leukemia
- Increased platelet consumption/destruction
    - Neonatal alloimmune thrombocytopenia
    - Post-transfusion purpura
    - Envenomation (e.g. snake bites) without DIC
    - Vasculitis/endocarditis
- Idiopathic/multifactorial
    - Breed related low platelets
        - Macrothrombocytopenia (giant platelet disorder) of Cavalier King Charles Spaniels/other breeds
        - Greyhounds
    - Endotoxemia
    - Hypophosphatemia
    - Anaphylaxis

**Related Findings**

- Artifact
    - Freshly prepared blood smear shows platelet clumps
- Decreased production of platelets
    - CBC shows abnormalities in other cell lines
        - Anemia, leukopenia
    - Abnormal cytology/histopathology on bone marrow aspirates
- Increased consumption of platelets
    - Evidence of systemic immune mediated disease (Note: Not seen with primary IMT)
        - Positive Coombs test
        - Positive antinuclear antibody (ANA) test
    - Abnormal coagulation profile
    - Positive blood or urine culture (systemic sepsis/bacteremia/endocarditis)
    - Abnormal thoracic and abdominal imaging
        - Mass/lymphadenopathy
        - Evidence of dirofilariasis or angiostrongylosis
    - Abnormal cytology/histopathology on organs, masses, lymph nodes
- Idiopathic/multifactorial
    - Infectious
        - Positive serological testing/PCR for various infectious diseases
        - Positive fecal Baermann/ blood tests (*Angiostrongylus vasorum)*
    - Neoplasia
        - Abnormal thoracic and abdominal imaging
            - Mass/lymphadenopathy
        - Abnormal cytology/histopathology on organs, masses, lymph nodes

**Increased Platelets**

**Common Causes**

- Increased production
    - Inflammation
        - Infection
        - Immune-mediated
        - Surgery
        - Trauma
    - Non- hematopoietic neoplasia
    - Iron deficiency
        - Chronic low grade blood loss
    - Rebound
        - Recovery from thrombocytopenia
        - Following significant anemia (secondary effect of erythropoietin)

    - Increased cortisol (mechanism unknown)
        - Cushing's disease
        - Exogenous steroids
        - Stress

**Uncommon Causes**

- Hemic neoplasia (clonal thrombocytosis)
    - Primary (essential) thrombocytosis
    - Chronic myeloproliferative disease
        - Polycythemia vera
        - Primary erythrocytosis
        - Chronic myeloid leukemia
    - Acute megakaryoblastic leukemia
    - Myelodysplastic syndrome (occasionally)
- Reactive thrombocytosis (secondary, nonclonal)
- Redistribution
    - Exercise
    - Epinepherine
- Increased production
    - Chemotherapy (vincristine, vinblastine)
    - Post-splenectomy

**Related Findings**

- Inflammation
    - Abnormal CBC
        - Neutrophilia +/- band neutrophilia
        - Monocytosis
    - Increased globulins
- Iron deficiency
    - Anemia
        - Red cell microcytosis (decreased MCV)
        - Decreased MCH, MCHC
        - Regenerative or nonregenerative
    - Low serum proteins (due to blood loss)
    - Positive fecal occult blood (with gastrointestinal blood loss)
    - Positive fecal ova and parasites
    - Decreased total body iron stores
        - Decreased serum iron, ferritin, total iron binding capacity (TIBC)
    - Bone marrow aspiration reveals low iron stores
- Rebound
    - Regenerative anemia
    - Large/shift platelets
- Corticosteroid induced
    - Abnormal urine cortisol:creatinine ratio, low dose dexamethasone suppression test, ACTH stimulation test

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## Additional Information

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**Physiology**

- Platelets are small cytoplasmic fragments of megakaryocytes. Megakaryocytes are derived from pluripotent stem cells in the bone marrow.

- Platelet production requires presence of adequate megakaryocytes in the bone marrow (megakaryopoiesis) and normal formation and delivery of platelets to the circulation (thrombopoiesis).
- Megakaryopoiesis and thrombopoiesis are primarily mediated by thrombopoietin. This hormone is derived from hepatocytes, renal tubular epithelium and stromal bone marrow cells. Thrombopoietin is cleared by platelets and megakaryocytes. Erythropoietin plays a lesser role in platelet production.
- Platelet alpha granules store proteins involved in hemostasis and vessel repair.
- Dense granules in platelets contain $Ca^{2+}$, $Mg^{2+}$, ADP, ATP and serotonin which are also secreted with appropriate stimuli.
- The main function of platelets is in primary hemostasis. They are involved in formation of the hemostatic plug (clot).
- In addition to vascular damage repair and formation of hemostatic plugs, platelets participate in inflammation and wound healing.

**Diagnostic Methodology**

- There are multiple methods for quantifying platelets, but since activation (and clumping) can occur during collection or storage, blood films made from fresh samples should also be evaluated whenever possible.
- Platelet clumping (pseudothrombocytopenia) is the most common cause of low platelet counts because clumps may be counted as individual platelets. Even small clumps on a smear make the platelet count and estimate inaccurate. Platelet clumping is very common in cats, but can occur in all species.

**References**


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