Approach To The Patient With Splenomegaly

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Splenomegaly

- The spleen is the largest lymphatic organ in the body and is sometimes approached clinically as though it were **a very large lymph node.**
- It participates in the **primary immune response.** maturation of T & B lymphocytes
- It functions as a filter for the blood and is responsible for **removing senescent red blood cells** from the circulation, as well as blood cells and other cells coated with immunoglobulins. during the intrauterine life → synthesis of RBCs & WBCs

extramedullary hematopoiesis if there is B.M dysfunction
① yolk sac ② liver ③ spleen ④ B.M

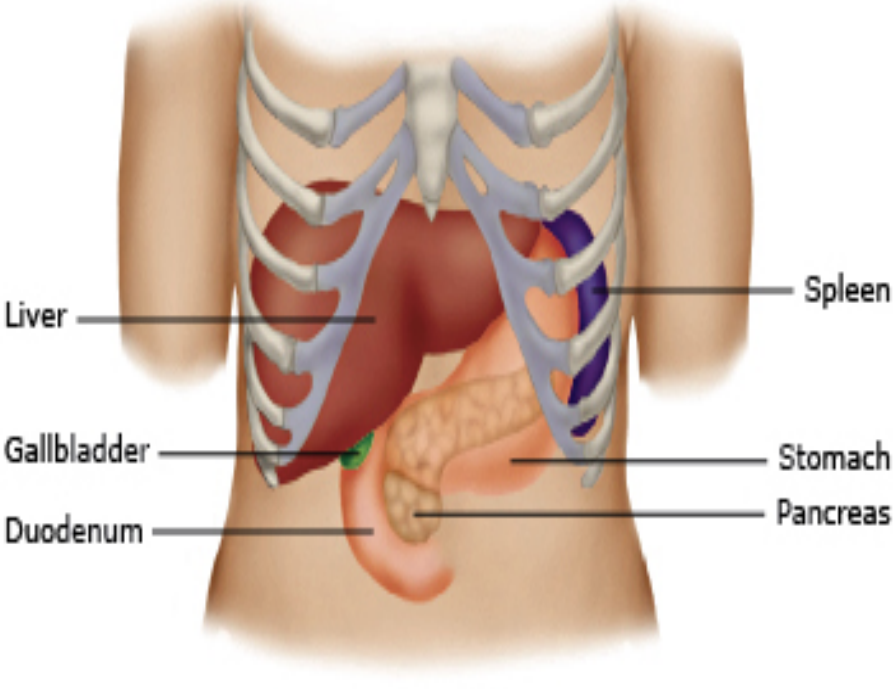
Properties Of The Normal Spleen

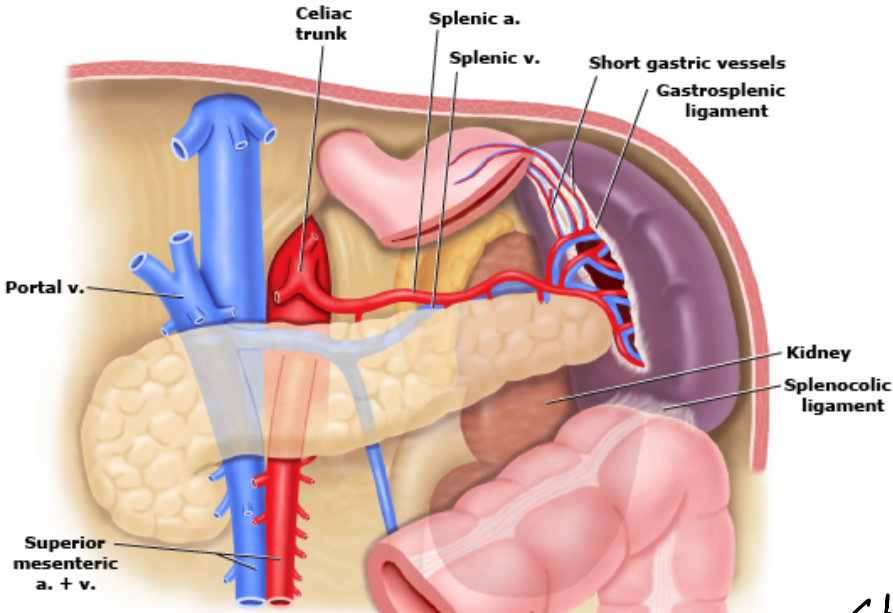
- **Location** retroperitoneal organ

The spleen lies within the peritoneal cavity in the posterior portion of the left upper quadrant, below the diaphragm and adjacent to the lower ribs (9 through 11), the stomach, the splenic flexure of the colon, and left kidney , with its hilum in close approximation to the tail of the pancreas

crossed by rib 10th

* normally spleen isn't palpable (palpable spleen should enlarged to 3 times normal)
Left hypochondrium ← lower pole of spleen ← inspiration


Liver
Gallbladder
Duodenum
Spleen
Stomach
Pancreas



B'S ⇒ celiac trunk → celiac A → splenic A → 6 branches

Drainage ⇒ splenic vein + SMV } → portal vein

Size

Radiologists → length > 12cm → splenomegaly

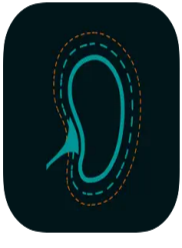
↳ according to it 25% of normal US patients will have splenomegaly

← But

- **The size of the spleen correlates with a person's height, weight, and sex; it is slightly larger in taller and heavier individuals and in men than women.**
- **The median spleen length is 10.9 cm with a mean volume of 166 cm3**
- **The upper limits of normal for the tallest females and males were approximately 12.3 and 14.5 cm (4.8 and 5.7 inches), respectively.**
- **Upper limit of normal of 12 cm, is commonly used in many radiology departments**

App Store Preview

Open the Mac App Store to buy and download apps.



SplenoCalc 4+

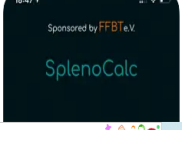
Ingo Peter Soehngen

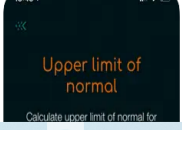
Designed for iPhone

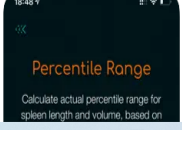
★★★★★ 1.8 • 5 Ratings

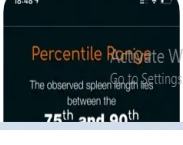
Free

iPhone Screenshots

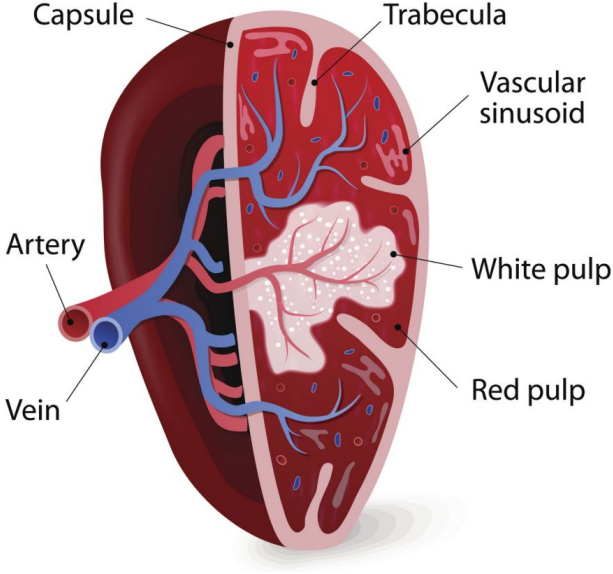








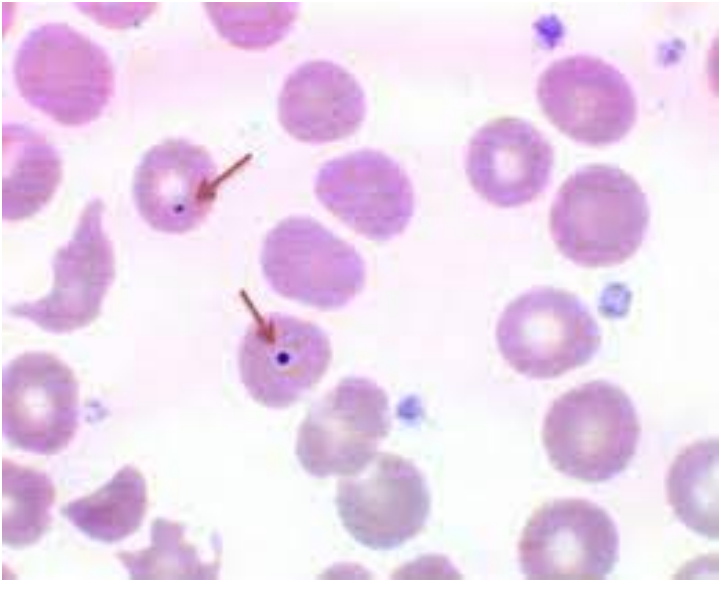
SPLEEN ANATOMY



Anatomy

- The splenic **red pulp** occupies more than half the volume of the spleen and is the site where senescent red cells are identified and destroyed and red blood cell inclusions are removed by a process known as **pitting**. Sequestration of RBCs → splenomegaly ↳ the most cause
- In the absence of splenic function, basophilic inclusions known as **Howell-Jolly bodies** are seen in circulating red blood cells. Asplenic or not functional spleen

remenants of DNA inside the RBCs



- **Howell-Jolly bodies**

Hyperplasia of immune system → splenomegaly
↳ Autoinflammatory disease, infections, Rhomatoid, SLE

- **The white pulp of the spleen contains macrophages, B lymphocytes, and T lymphocytes; participates in the recognition of microorganisms and foreign proteins; and is involved in the primary immune response.**

Terminology

- **Splenomegaly – Increased spleen size.**
- **Typically defined as an enlarged spleen if :**
  1. **Weighing > 250 g and with**
  2. **Maximal craniocaudal dimension of 13 cm by computed tomography (CT) or US**
  3. **Palpable on physical exam.**

pathophysiology

Mechanisms of splenomegaly

- Increase sequestration of abnormal RBCs
- Conditions associated with immune hyperplasia
- Conditions associated with extramedullary hematopoiesis
- Conditions involving malignant infiltration into the spleen
- Conditions involving benign mass infiltration
- Conditions involving abnormal intracellular or extracellular deposition
- Causes associated with passive congestion

Malignant infiltration

Fluid malignancy (Hematological malignancy)

↓

lymphomas, leukemias, Hodgkin & Non Hodgkin, Multiple myloma

→ solid malignancies → Melanoma, Sarcoma

Benign infiltration — fibroma, meningoma, benign cyst lymphangioma

extra or intra deposition (infiltrative splenic disorders)

↳ Amyloidosis, sacroidosis
Glycogen storge disease
Gaucher syndrome

↳ destruction on Portal vein, Splenic vein, Budd chiari S
Lives Cirrhosis, Right heart failure
(Congested Splenomegaly)

- **Asplenia – Absence of the spleen or absent splenic function (also called functional asplenia or autosplenectomy).**
- **This may be caused by surgical splenectomy (traumatic or atraumatic) or a condition such as sickle cell disease (SCD) in which splenic infarction early in life causes loss of splenic function.**

↳ or trait or with thalasemia

How to know if the Spleen is not functional
↳ Howell jelly bodies

- **Hyposplenia – Also called hyposplenism; refers to reduced splenic function.**
- **Milder forms of SCD such as hemoglobin SC disease or sickle-beta+ thalassemia may cause hyposplenia.**
- **An autoimmune disorder in which T or B lymphocyte function is impaired may affect antibody production and/or cell-mediated immunity without impacting other functions.**

- **Hypersplenism** – Splenic sequestration and/or destruction of blood cells (red blood cells [RBCs], white blood cells [WBCs], and platelets) extensive enough to cause one or more cytopenias.
- **Splenosis** – Seeding of the abdominal cavity with splenic cells that can occur during surgery or trauma.
- **Accessory spleen** – A separate region of splenic tissue in the abdomen, present in approximately 15 percent of individuals.

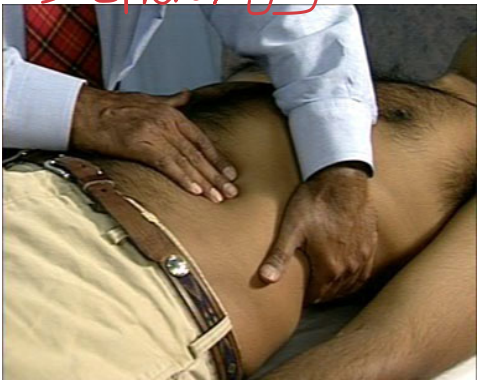
How To Examine The Spleen

- **The normal spleen is not usually palpable because it is located beneath the rib cage in the left upper abdomen.** left hypochondrium
- **A spleen becomes palpable when it is enlarged more than 3 times**
- **Deep palpation , bimanual palpation or hoking palpation can be used for detection of splenomegaly** → for thin people
- **Percussion of Traubs area or Castell's spot**
- **Bedside US**

Traubs area boundaries ⇒ 6th rib
Left mid axillary line
Left costal margin

Normally the sound heard → resonance

dullness on full inspiration → Splenomegaly



Monomanual

Binanual

Castell's spot → Lt ant axillary line → lowest ICS
→ percussion here with dullness → splenomegaly

Most Sensitive test for splenomegaly → imaging (CT, MRI, PET scan)

Causes of Splenomegaly

↳ same as lymphadenopathy

- **Infection**
- **Bacterial (e.g., endocarditis, brucellosis, syphilis, typhoid, pyogenic abscess)** Salmonella
- **Mycobacterial (e.g., tuberculosis)**
- **Fungal (e.g., histoplasmosis, toxoplasmosis)**
- **Parasitic (e.g., malaria, leishmaniasis)** ↳ Kala azar
- **Rickettsial (e.g., RMSF)**
- **Viral (e.g., EBV, CMV, HIV, hepatitis** A, B, C

Mononucleosis

Benign disorders of the immune system

- **Rheumatoid arthritis with Felty's syndrome,**
- **Systemic lupus erythematosus** → 1/3 patients with SLE have lymphadenopathy with splenomegaly
- **Drug reactions such as to phenytoin**
- **Serum sickness**
  ↳ hypersensitivity

Malignant disorders

- **Acute or chronic myeloid or lymphoid leukemia,**
- **Non -Hodgkin's lymphoma,**
- **Hodgkin's disease,**
- **Waldenström's macroglobulinemia,**
- **Malignant histiocytosis**
- **Other malignancies (e.g., melanoma, sarcoma)**

Multiple myloma

Benign infiltration

- **Hamartoma**
- **Hemangioma**
- **Fibroma**
- **Splenic cyst**
- **Lymphangioma**

Splenic fibroma

Others …

- **Congestive splenomegaly**
- **Portal hypertension secondary to liver disease**
- **splenic or portal vein thrombosis**
- **Splenic artery aneurysm**
- **Budd-chiari syndrome**
- **Rt side heart failure**
- **Cavernous transformation of the portal vein**

ITP (Idiopathic thrombocytopenic purpura)

- **Hematologic disorders** (e.g., autoimmune hemolytic anemia, hereditary spherocytosis, thalassemia major, hemoglobinopathies, elliptocytosis, extramedullary hematopoiesis)

cold warm hot

- **Storage diseases** (e.g., Gaucher's disease, amyloidosis, Niemann-pick diserase)

sacroidosis

- **Endocrinopathies** (e.g., hyperthyroidism)

↳ splenomegaly & lymphadenopathy

Huge Splenomegaly

Massively enlarged spleen

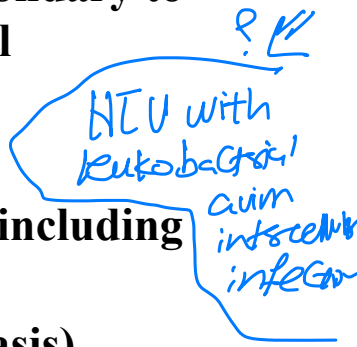
- **A spleen enlarged such that its lower pole is within the pelvis, or which has crossed the midline into the right lower or right upper abdominal quadrants is considered to be massively enlarged.**
- **Also defined as spleen at 8 cm below costal margin**

Mild Splenomegaly ≥ 3 cm below costal margin
Sever ⇒ 3-8 cm
Huge ⇒ > 8cm
" or cross the midline

thalassemia major

Causes of massive splenomegaly

- Chronic myeloid leukemia CML
- Myelofibrosis, primary or secondary to polycythemia vera or essential thrombocytosis
- Gaucher disease
- Lymphoma, usually indolent, including hairy cell leukemia
- Kala-azar (visceral leishmaniasis)
- Hyperreactive malarial splenomegaly syndrome, also called tropical splenomegaly syndrome



Evaluation Of splenomegaly

- **The evaluation of splenomegaly depends on the patient's clinical status and the reason that splenomegaly was identified.**
- **This may range from immediate bone marrow aspiration and biopsy (and other testing) in an acutely ill individual with massive splenomegaly and abnormalities on the peripheral blood smear to observation without an extensive workup in an otherwise asymptomatic healthy individual with incidentally discovered mild splenomegaly on an imaging study.**

History

- **Symptoms attributable to splenomegaly (eg, early satiety, abdominal fullness or distention, pain referred to the chest or left shoulder).**
- **Pharyngitis, especially in a young adult, suggests infectious mononucleosis.**
- **Individuals with B symptoms or weight loss may have a malignancy (eg, lymphoma, myeloproliferative neoplasm, metastatic solid tumor).**
- **Travel history**
- **Family history**

- At most cases the present of splenomegaly just associated with infections or inflammatory condition

- But if history & physical exam prove a serious condition underlying this splenomegaly

  ex: sever weight loss
  sever lymphadenopathy with huge splenomegaly
  sever anemia & sever thrombocytopenia

→ in this cases → do further evaluation

Diagnosis depend on → History
→ physical exam
→ Lab investigation

Symptoms of splenomegaly → Pain at Lt side (يحس انه شيء ثقيل)
→ early satiety (spleen push stomach)

- Those with significant alcohol intake or nonalcoholic **fatty liver disease** (NAFLD) may have **hepatic fibrosis or cirrhosis.**
- Those who reside in **endemic areas** may be at risk for pathogens listed before.
- Symptoms of anemia (without LUQ or acute or subacute febrile illness), further investigations may point to **autoimmune hemolytic anemia, acute lymphocytic leukemia**, or acute monocytic leukemia

fatigue - blurred vision, headache

for malignancy (Aplastic anemia infiltration of B.M

↳ Subcapsular hematoma

- **H/O trauma**
- **H/O drug intake (phenytoin , oxaliplatin , GM-CSF)**
- **H/O abnormal bleeding : ITP**

↳ Cause lymphadenopathy & splenomegaly

↳ ecchymosis , petechiae, purpura
hematuria , melena

* May have thrombocytopenia , aplastic anemia
leukemia & B.M infiltration
* liver cirrhosis

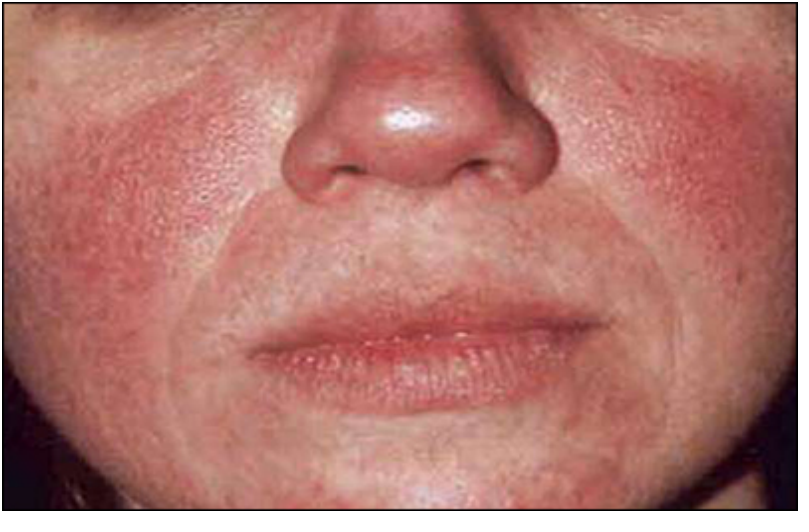
Physical examination

Not seen in thalasemia or sickle cell anemia, Liver cirrhosis cyst fibroma, portal vein thrombosis

- **Fever may be seen with infection or hematologic malignancy.** B symptoms
- **Splenic tenderness suggests the possibility of infarction, rupture, or acute infection.** inflammatory spleen → tender malignent spleen ⇒ Mostly Non
- **Ascites or peripheral edema may be seen if there is severe liver disease and/or vascular obstruction.** Cirrhosis
- **A ruddy complexion may be seen in PV.**

↳ polycythemia vera (myeloproliferative disease)

PV



- **A ruddy complexion**

- **The size of the spleen may be somewhat helpful in suggesting certain diagnoses but by itself does not have very high sensitivity or specificity.**
- **A massively enlarged spleen that crosses the midline or extends into the pelvis is often cited as a characteristic finding in myeloproliferative neoplasms, lymphoma, HCL, transfusion-dependent thalassemia, Gaucher disease, or tropical splenomegaly syndrome.**

Huge Spleen

liver cirrhosis, benign conditions → No HSM
amyloidosis - Sarcoidosis - EBV. Gush disease
HSM SLE → cell cause HSM

- **Hepatomegaly or LAPs**
- **Jaundice**
- **Bleeding (ecchymosis , bruising)**
- **Stigmata of RA / SLE**
- **Cardiac murmurs**

Rt Sided HF
tricuspid regurge
or stenosis

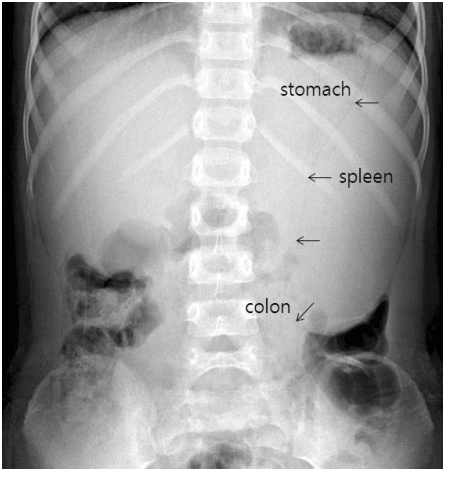
- joint → Rheumatoid arthritis
- lymph nodes

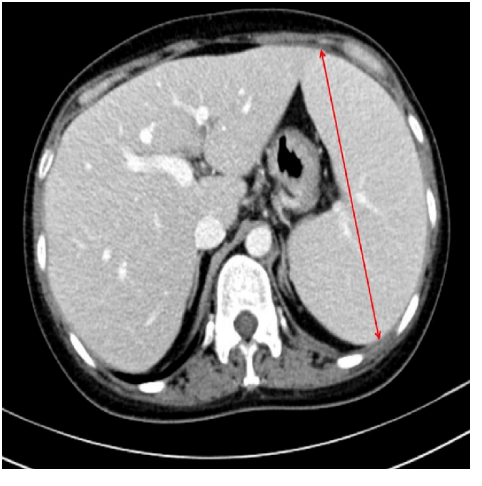
Laboratory Evaluation

- **Laboratory studies are frequently valuable in assessing splenic function.**
- **The spleen can be imaged with ultrasonography, CT, traditional radionuclide scans, and PET**

Splenic imaging for size estimation

- **Ultrasound — The spleen is considered to be normal in size if its length is <13 cm or its thickness is ≤5 cm on ultrasound examination.**
- **CT scanning — The spleen is enlarged if its length is >10 cm**
- **Plain film —It is considered enlarged if it is >6 cm wide or >13.6 cm long, or if (length x width) is >75 cm2.**


stomach
spleen
colon



myelofibrosis / aplastic anemia

Laboratory tests

- **CBC and peripheral smear**
- **Neutropenia, anemia, and/or thrombocytopenia : termed "hypersplenism.**
- **Neutrophilia suggest the presence of infection or malignancy.**
- **On occasion, invading organisms may be seen on the peripheral smear : babesiosis malaria**

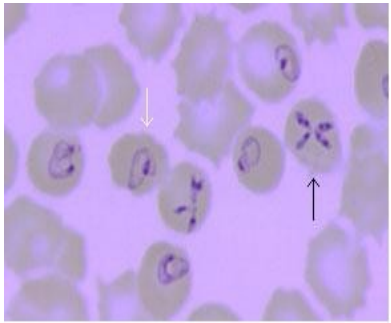
BM disorder & infiltration

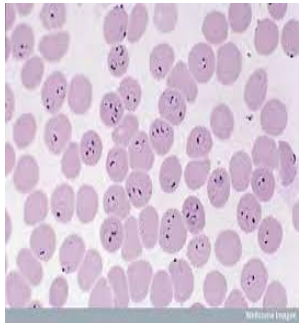
↑Hb in PV

↑Platelets in essential thrombocythemia

anemia in thalassemia or sickle cell

Blood film → see malaria, inclusions





Babesiosis

Malaria

⇒ Maltese cross
↳ seen in babesiosis
Pt with fever, anemia, jaundice
Blood film shows Maltese cross inclusions
↳ seen in nephrotic syndrome (lipid in urine)

- **Bacterial sepsis : toxic granulation, vacuoles, and Dohle bodies in neutrophils**
- **The presence of increased numbers of abnormal cells in the peripheral blood suggests the presence of a hematologic malignancy.**
- **The presence of hypochromic, microcytic red cells, along with target cells and basophilic stippling, in an iron-replete child suggests the diagnosis of thalassemia**

- **Teardrop cells – Myelofibrosis or thalassemia**
- **Spherocytes – AIHA or hereditary spherocytosis.**
- **A leukemic blast cell containing Auer rods immediately indicates the diagnosis of acute myeloid leukemia**

Other Initial Testing

- **Liver function tests are often helpful in determining the contribution of liver disease; however, mild elevations are nonspecific and may be a result of infection or hepatic involvement by another disorder.**
- **HIV testing may be appropriate if no other cause of splenomegaly is immediately apparent.** HIV serology

in endocarditis & ECO

- **Blood cultures are obtained if infection is suspected**
- **Chest radiography may be useful, as pleural effusion may accompany a splenic abscess or other infectious disease.**

- **LDH** } leukemia
- **Uric acid**
- **Rheumatological tests** Rheumatoid factor
- **Serological tests for infectious causes**
- **Gaucher disease is identified or excluded using a glucocerebrosidase assay on peripheral blood leukocytes.**

Spleen or Liver biopsy

- Antinuclear antibody (ANA) → for SLE
- Hb electrophoresis

- **For those with suspected malignancy or infiltrative disease involving the spleen, the spleen is rarely the appropriate organ/tissue to biopsy due to its vascularity; bone marrow aspirate and biopsy is appropriate in most cases of suspected hematologic malignancy.**
- **Other alternatives include lymph node biopsy or testing of peripheral blood using flow cytometry**

Additional approaches

- **CT examination of the chest and abdomen should be performed to evaluate the patient for disseminated or intra-abdominal malignancy, such as hepatoma or lymphoma, advanced liver disease, or portal hypertension.**

Diagnostic splenectomy

- The resected spleen may reveal a localized splenic tumor, cyst(s), inflammatory pseudotumor, hamartoma, amyloid, vascular anomaly, infection, sarcoidosis, or other rare condition
- In a series of 122 "diagnostic" splenectomies the most common pathologic diagnoses were:
- Lymphoma/leukemia — 57 percent
- Metastatic carcinoma/sarcoma — 11 percent

9% cyst & pseudocyst 7% benign & malignant neoplasia

Disorders Of Splenic Function

- **Hypersplenism — Hypersplenism refers TO :**

1. **Splenomegaly**
2. **Anemia , leukopenia, and/or thrombocytopenia**
3. **Compensatory bone marrow hyperplasia**
4. **Improvement after splenectomy (if performed)**

- **Typically, the cytopenias are relatively mild and transfusions are rarely indicated**

- **Management of hypersplenism is usually supportive, with treatment of the underlying cause and avoidance of interventions that could further worsen hepatic or splenic function.**
- **For individuals with significant splenomegaly, avoiding high-impact activities and reducing the risk of falls may be indicated.**
- **Splenic artery embolization or splenectomy**

Asplenia Or Hyposplenia

- **Absent or reduced splenic function (asplenia and hyposplenia, respectively) can be due to anatomic absence of the spleen (eg, following splenectomy) or an underlying disorder associated with splenic infarction or infiltration.**

Causes of asplenia and hyposplenism

Iatrogenic	▪ Splenic artery embolization ▪ Splenic irradiation ▪ Total or partial splenectomy
Hepatic diseases	▪ Alcoholic liver disease ▪ Chronic viral hepatitis ▪ Cirrhosis and portal hypertension ▪ Primary biliary cirrhosis
Hematologic diseases	▪ Acute leukemia ▪ Chronic lymphocytic leukemia ▪ Hematopoietic stem cell transplantation (particularly if associated graft versus host disease) ▪ Lymphoma ▪ Mastocytosis ▪ Myeloproliferative neoplasm ▪ Sickle cell disease (eg, HbSS, HbSC, HbS-beta thalassemia) ▪ Thalassemia
Vascular impairment	▪ Celiac artery thrombosis ▪ Splenic artery thrombosis ▪ Splenic vein thrombosis
Gastrointestinal diseases	▪ Celiac disease ▪ Inflammatory bowel disease ▪ Whipple's disease

Autoimmune diseases	▪ Antiphospholipid antibody syndrome ▪ Goodpasture's syndrome ▪ Granulomatosis with polyangiitis ▪ Hashimoto's thyroiditis ▪ Polyarteritis nodosa ▪ Rheumatoid arthritis ▪ Sjogren's syndrome ▪ Systemic lupus erythematosus
Infectious diseases	▪ HIV/AIDS
Infiltrative diseases	▪ Amyloidosis ▪ Sarcoidosis
Congenital syndromes	▪ Autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED) syndrome ▪ Hypoparathyroidism syndrome ▪ Isolated congenital hyposplenia ▪ Ivemark's syndrome ▪ Normal neonatal state (particularly if birth is premature) ▪ Other congenital or familial syndromes ▪ Stormorken's syndrome

- **Absent or reduced splenic function may be suspected in individuals with conditions known to affect the spleen or if characteristic red blood cell (RBC) findings such as Howell-Jolly bodies, RBC pits, or nucleated RBCs (NRBCs) are on the blood smear**

- **The major implication for management of documented or suspected splenic impairment is the increased risk of infection, which includes encapsulated organisms and other pathogens that would normally be cleared by the filtering function of the spleen or by the cell-mediated immune response**
- **Important aspects of treatment and prevention of infection in these individuals include:**
- **Treatment of infection**
- **Immunizations and prophylactic antibiotics**

Thank you