



Spleen

Dr. Raed Tayyem, FRCS

Consultant Bariatric, Upper GI, and General Surgeon
Hashemite University

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Contents:



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- Physiology (Functions)
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Spleen Origin

- The Splenic tissue develops from condensations of mesoderm in the dorsal mesogastrium.





Anatomy

- It is the largest single mass of lymphoid tissue in the body
- Has a size of a closed fist
- Weight of normal adult spleen: 75–250 g
- It lies in the left hypochondrium between the gastric fundus and the left hemidiaphragm
- Its long axis lying along the tenth rib
- The hilum sits in the angle between the stomach and the kidney and is in contact with the tail of the pancreas

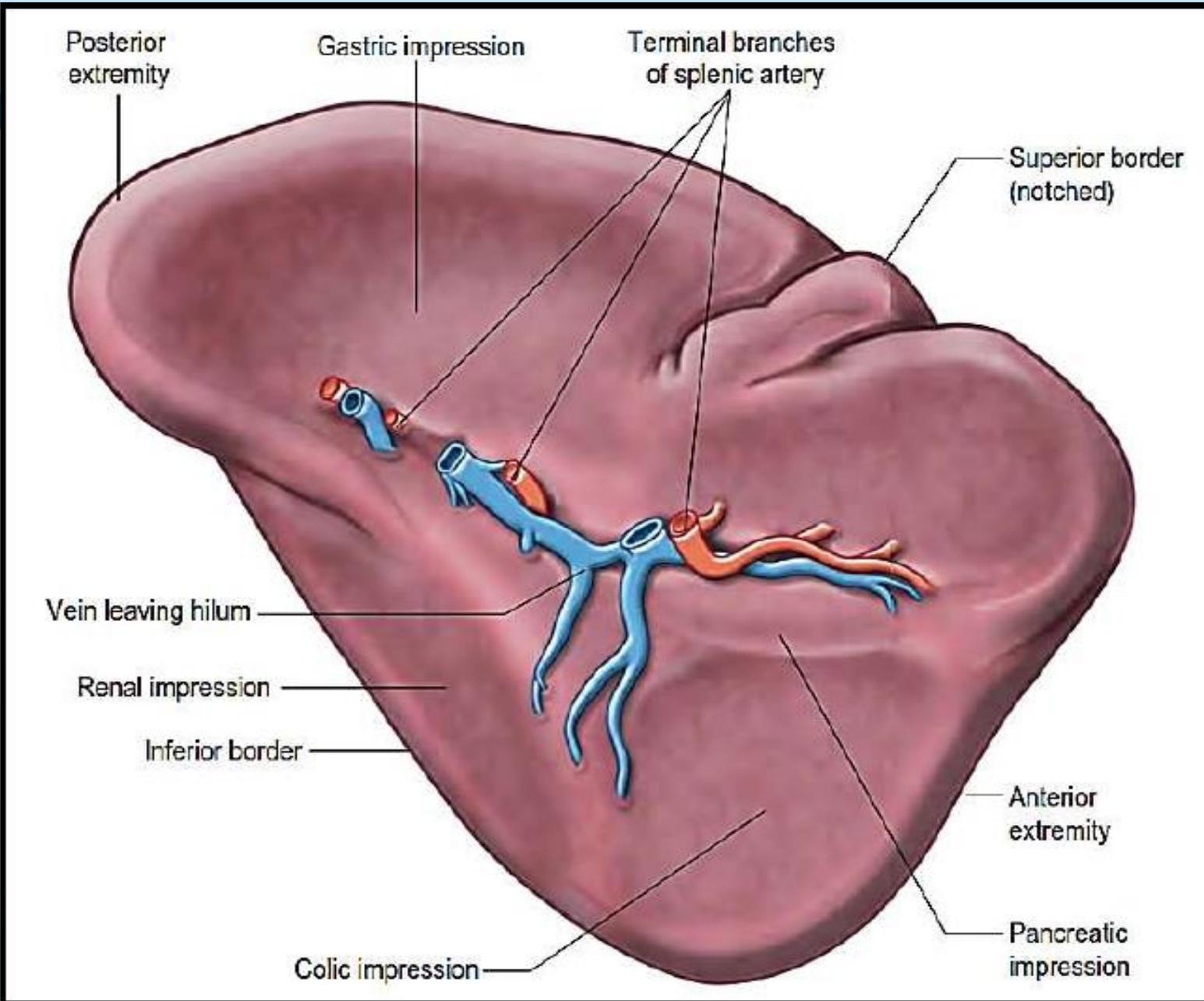


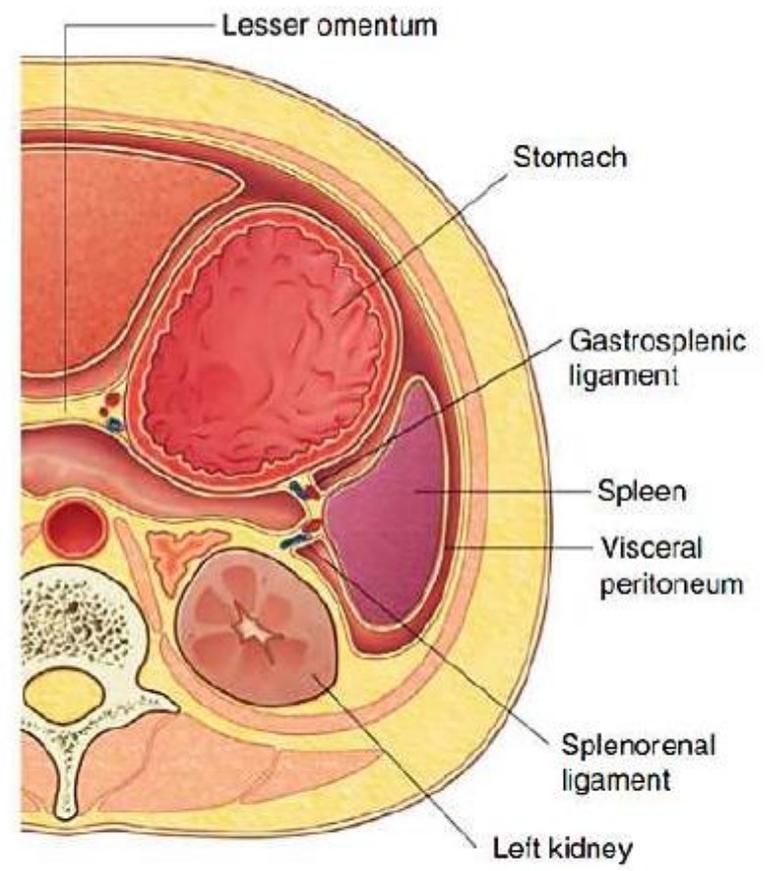
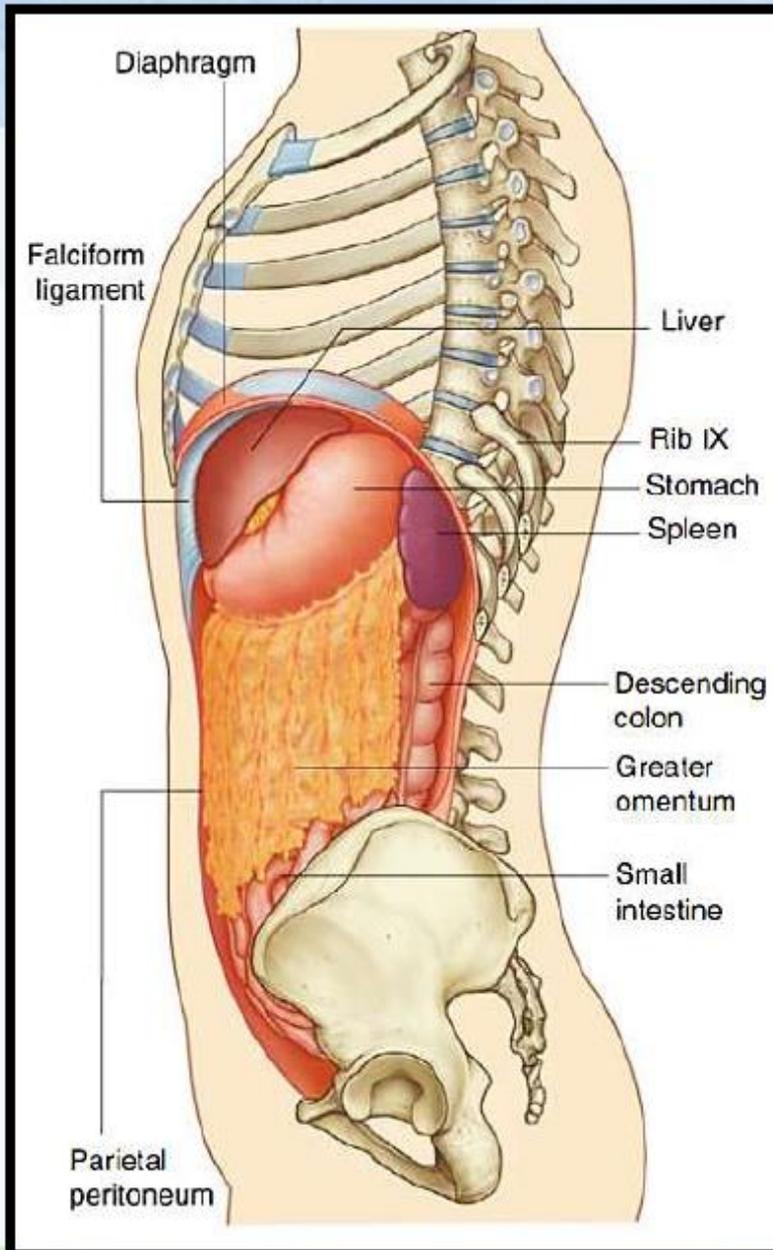
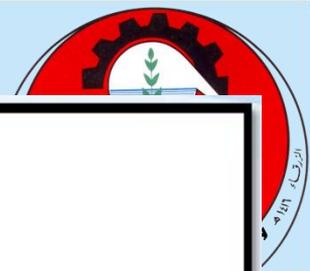


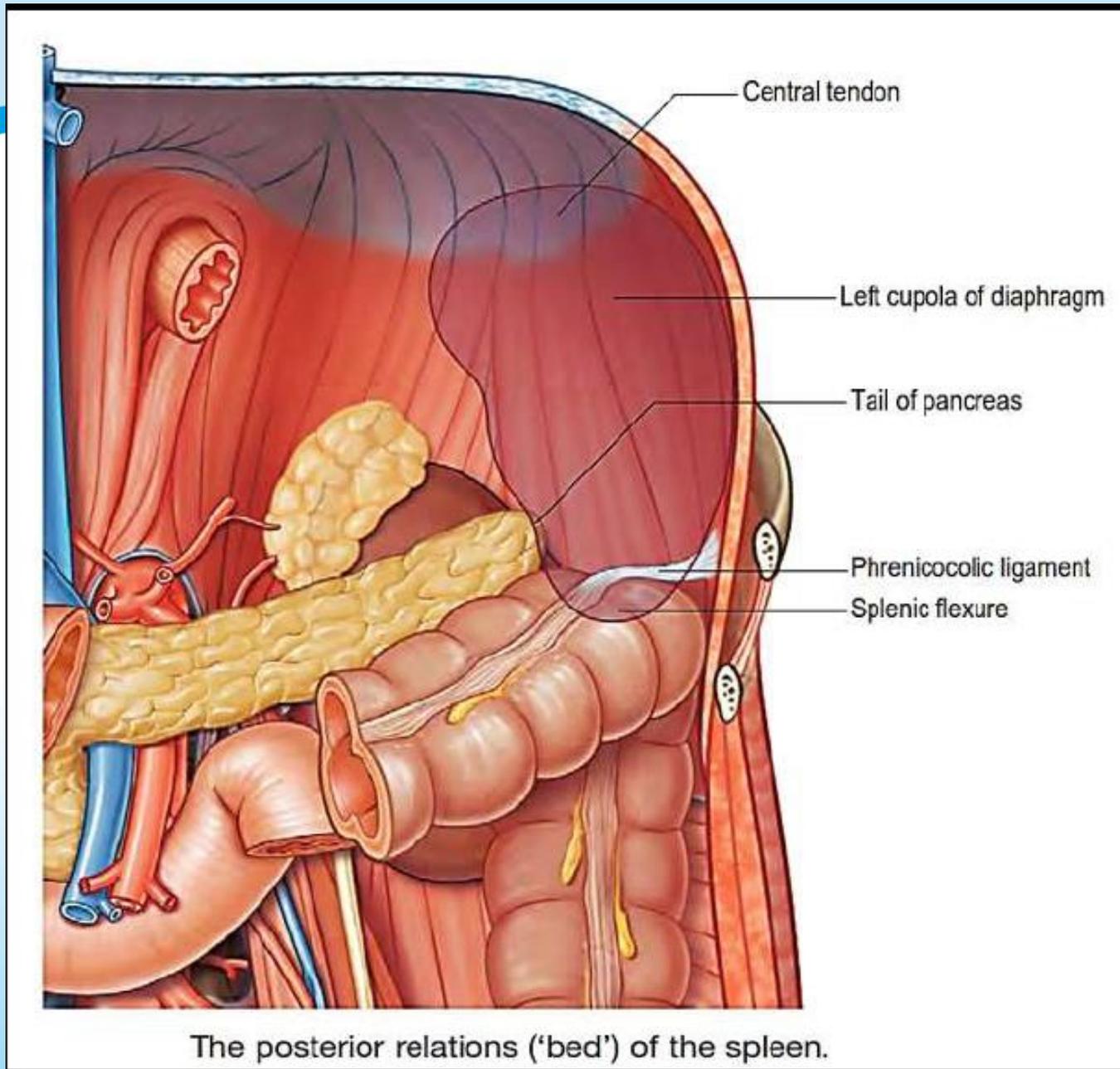
Surface anatomy

- Lower pole extends no further than the mid-axillary line.
- There is a notch on the inferolateral border, and this may be palpated when the spleen is enlarged.











Splenic ligaments

1. The gastrosplenic ligament
2. The lienorenal ligament attaches the spleen to the tail of the pancreas and the kidney
3. The Spleno colic ligament

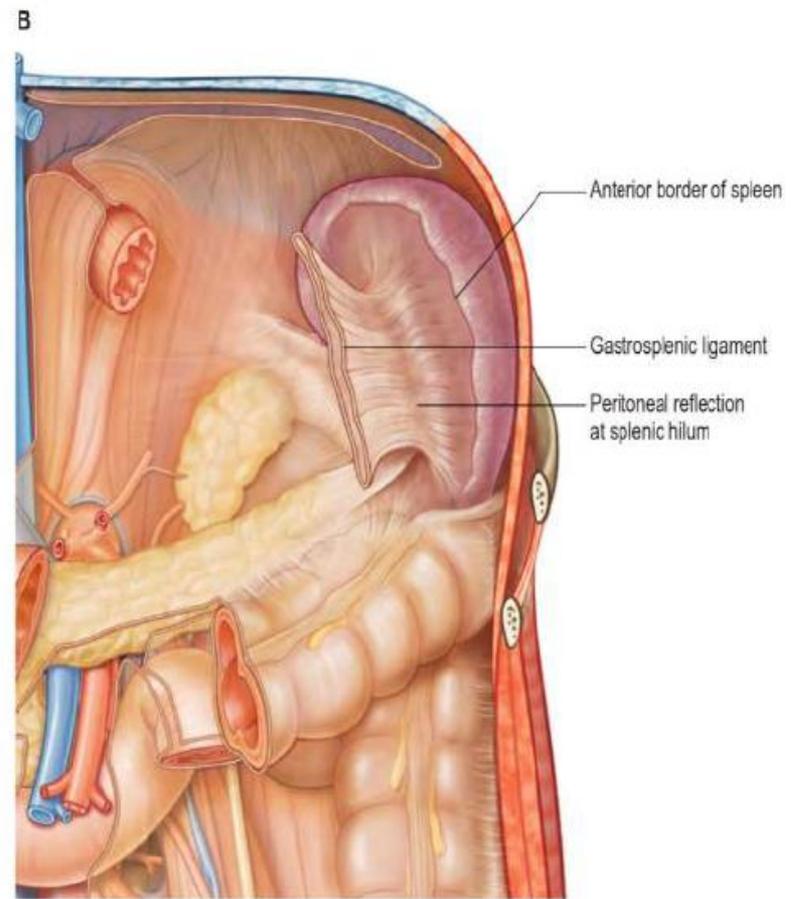
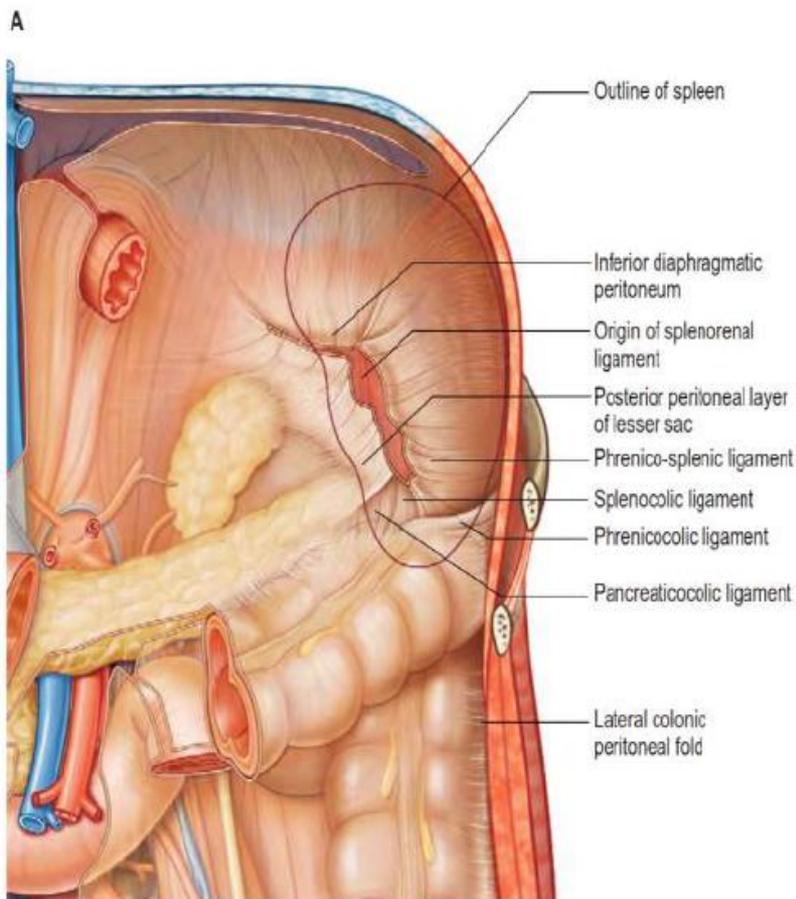




Gastrosplenic ligament

- It passes from the greater curvature of the stomach to the spleen
- It contains the vascular supply principally the main splenic artery and vein and the short gastric vessels.





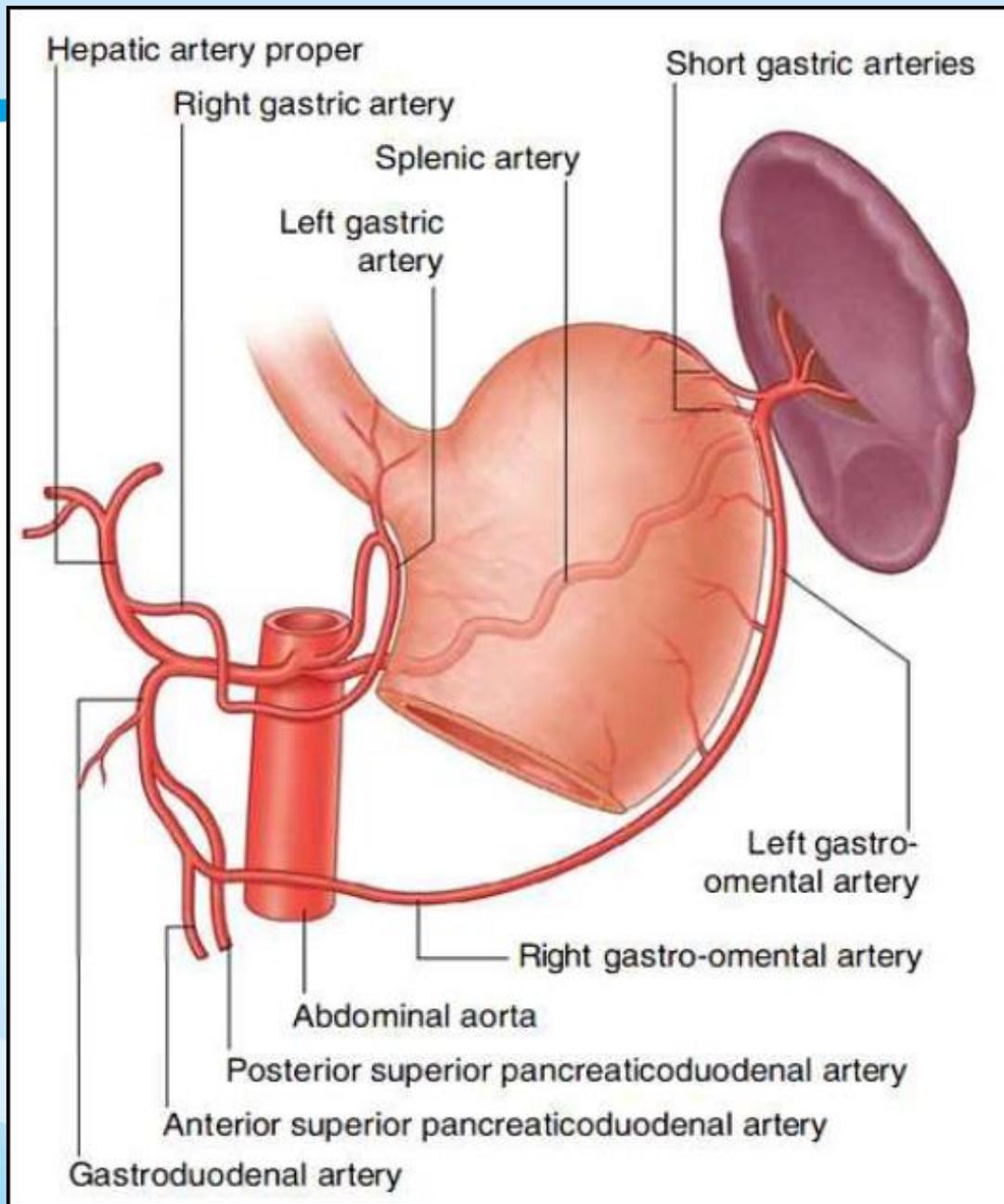
The peritoneal connections of the spleen. **A**, The posterior peritoneal connection seen as if the spleen has been removed with the folds fixed in their 'normal' positions. **B**, The anterior peritoneal connections seen with the spleen in place as if the stomach and greater omentum have been removed with the folds fixed in their 'normal' positions.



Blood Supply

- The tortuous splenic artery arises from the coeliac axis and runs along the upper border of the body and tail of the pancreas, to which it gives small branches.
- The short gastric and left gastroepiploic branches pass between the layers of the gastrosplenic ligament.
- The main splenic artery generally divides into superior and inferior branches, which, in turn, subdivide into several segmental branches.



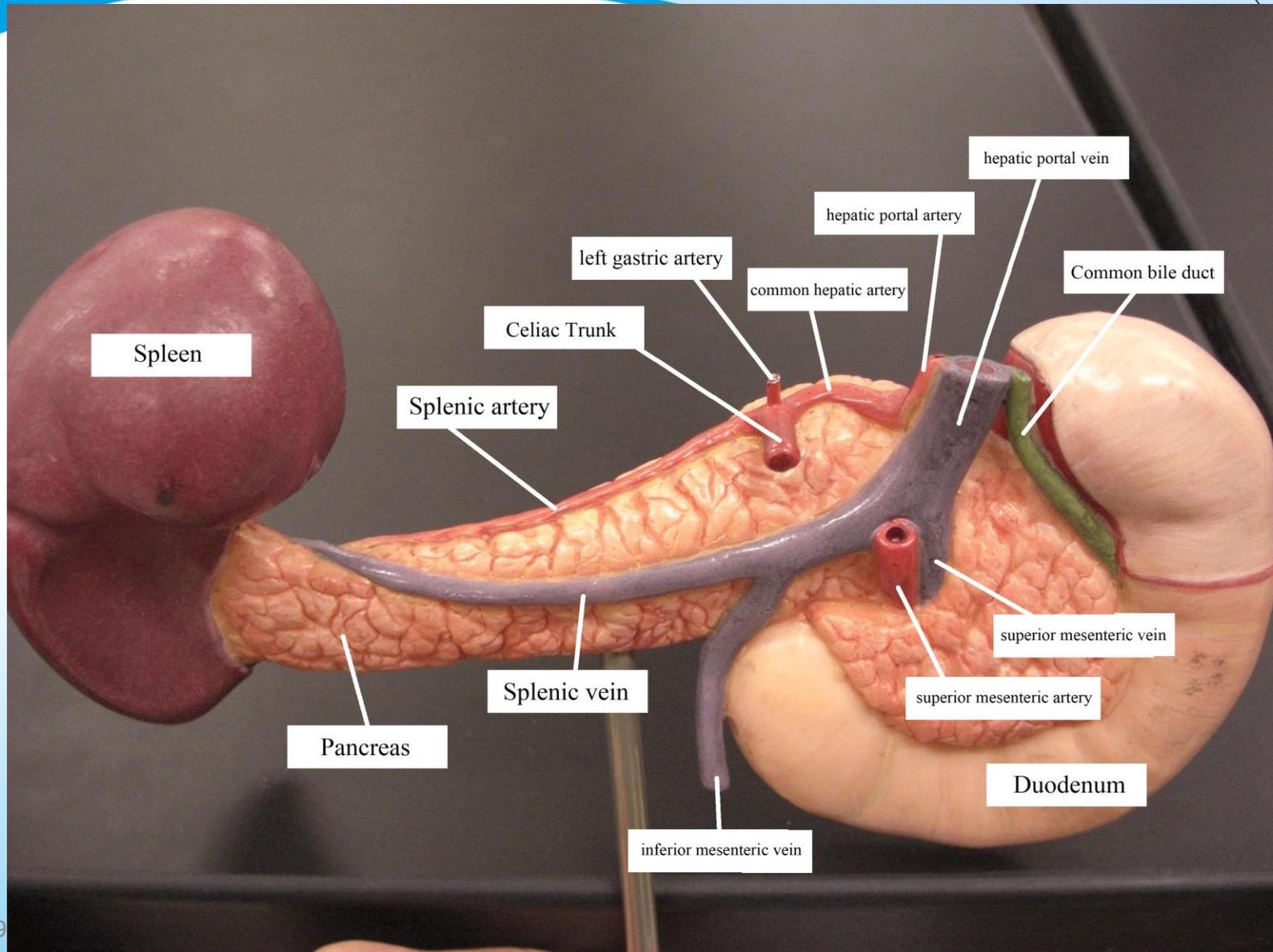




Splenic venous drainage

- The splenic vein is formed from several tributaries that drain the hilum.
- The vein runs behind the pancreas, receiving several small tributaries from the pancreas before joining the superior mesenteric vein at the neck of the pancreas to form the portal vein.







Lymphatic drainage

- The lymphatic drainage comprises efferent vessels in the white pulp that run with the arterioles and emerge from nodes at the hilum.
- These nodes and lymphatics drain via retropancreatic nodes to the coeliac nodes.





Nervous supply

- Sympathetic nerve fibres run from the coeliac plexus and innervate splenic arterial branches.

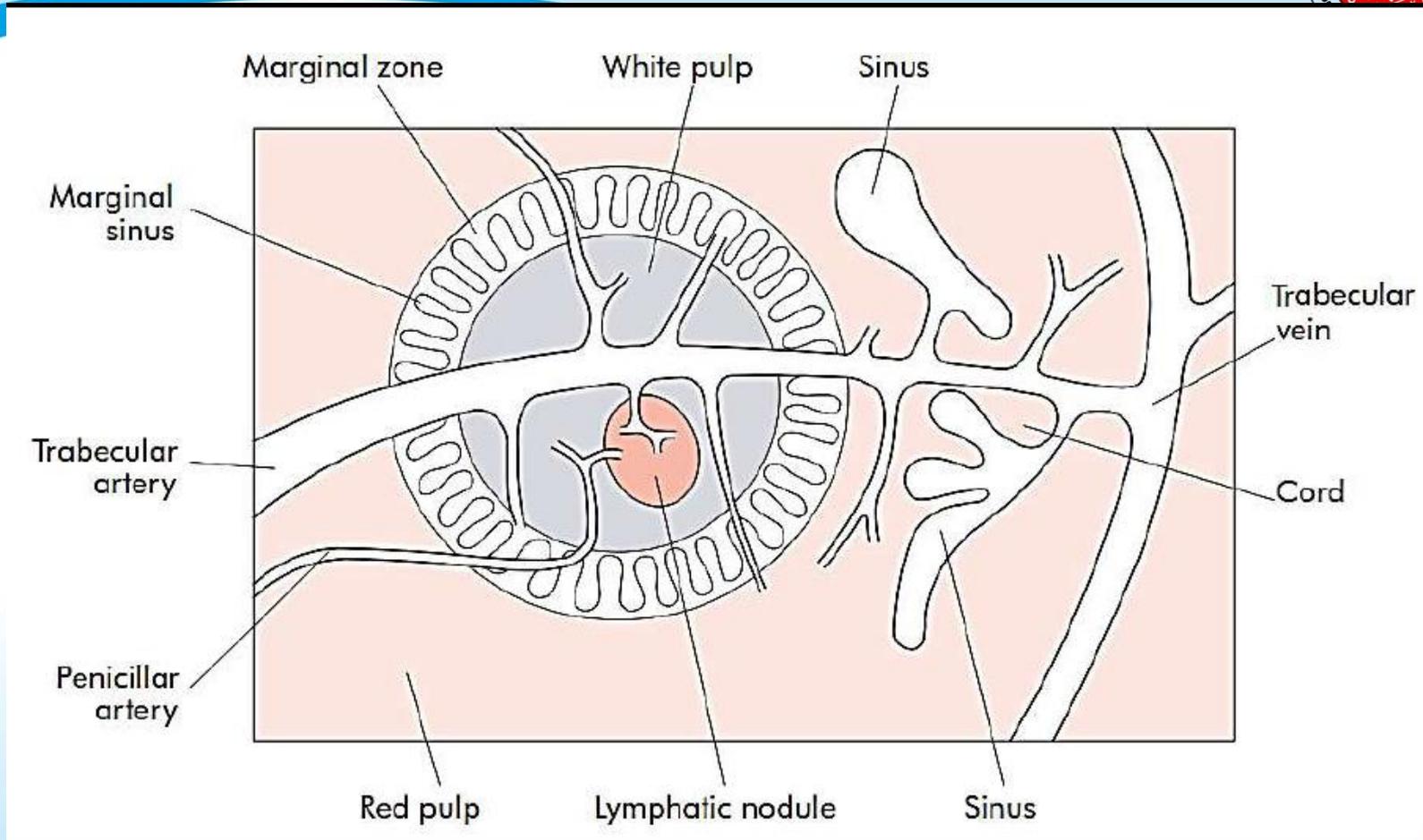




Histology

- The cut surface of the spleen consists of areas of 'red pulp'
- within which can be seen pale, ovoid nodules (about 1 mm diameter) of 'white pulp' (Malpighian bodies).
- The splenic pulp is invested by an external serous and internal fibroelastic coat which is reflected inwards at the hilum onto the vessels to form vascular sheaths.







Functions of the Spleen

- Although the spleen was previously thought to be dispensable, increasing knowledge of its function has led to a conservative approach in the management of conditions involving the spleen.
- It is now recognized that an incidental splenectomy during the course of another operative procedure increases the risk of complication and death.
- The surgeon should therefore normally endeavor to preserve the spleen to maintain the following functions:





Immune function

- The spleen processes foreign antigens and is the major site of specific immunoglobulin M (IgM) production.
- These antibodies are of B- and T-cell origin and bind to the specific receptors on the surface of macrophages and leukocytes, stimulating their phagocytic, bactericidal and tumoricidal activity.
- The non-specific opsonins, properdin and tuftsin, are synthesized.





Filter function

- Macrophages in the reticulum capture cellular and noncellular material from the blood and plasma.
- This will include the removal of effete platelets and red blood cells.
- This process takes place in the sinuses and the splenic cords by the action of the endothelial macrophages.
- Iron is removed from the degraded hemoglobin during red cell breakdown and is returned to the plasma.
- Removed non-cellular material may include bacteria and, in particular, pneumococci.





Pitting

- Particulate inclusions from red cells are removed, and the repaired red cells are returned to the circulation.
- These include Howell–Jolly and Heinz bodies, which represent nuclear remnants and precipitated hemoglobin or globin subunits, respectively.





Reservoir function

- This function in humans is less marked than in other species, but the spleen does contain approximately 8 per cent of the red cell mass.
- An enlarged spleen may contain a much larger proportion of the blood volume.





Cytopoiesis

- From the fourth month of intrauterine life, some degree of hemopoiesis occurs in the fetal spleen.
- Stimulation of the white pulp may occur following antigenic challenge, resulting in the proliferation of T and B cells and macrophages.
- This may also occur in myeloproliferative disorders, thalassaemias and chronic haemolytic anaemias.



Indications for splenectomy

Traumatic

- Rupture after blunt injury to the abdomen
- Iatrogenic injury during another procedure (particularly mobilization of the splenic flexure of the colon)

Haematological

- Immune thrombocytopenia
- Hereditary spherocytosis
- Autoimmune haemolytic anaemias
- Malaria
- Schistosomiasis
- Leishmaniasis
- Staging of haematological malignancies (e.g. Hodgkin's disease)

With other viscera

- Radical gastrectomy
- Pancreatectomy

Miscellaneous

- Treatment for gastric varices
- Treatment of splenic artery aneurysms
- Treatment of splenic cysts/tumours



Splenic Trauma



- **Spleen is the most common organ to be injured in abdominal trauma.**
- **Etiology of trauma:**
- Closed trauma: Direct, Indirect, & Spontaneous
- Open trauma: Gun-shots, Puncture, & Iatrogenic (e.g. Gastrectomy)



Classic Presentation of Rupture Spleen



- **Initial shock - Lucid interval - Internal hemorrhage**
- **STAGE OF SHOCK**
- **GENERAL:** Tachycardia, Hypotension, Hypothermia, Decreased urine output
- **LOCAL:**
- **Inspection:** Ecchymosis, Bruises, Fracture of ribs, Abdominal distention
- **Palpation:** Rigidity, Tenderness, Rebound tenderness
- **Percussion:** Shifting dullness
- **Auscultation:** Diminished intestinal sounds
- **DRE:** Fullness in retro-vesical pouch, Douglass pouch



Classification of hemorrhage

Parameter	Class			
	I	II	III	IV
Blood loss (ml)	<750	750–1500	1500–2000	>2000
Blood loss (%)	<15%	15–30%	30–40%	>40%
Pulse rate (beats/min)	<100	>100	>120	>140
Blood pressure	Normal	Decreased	Decreased	Decreased
Respiratory rate (breaths/min)	14–20	20–30	30–40	>35
Urine output (ml/hour)	>30	20–30	5–15	Negligible
CNS symptoms	Normal	Anxious	Confused	Lethargic



- **Special signs:**
- **Kehr' Sign:** Referred pain in Lt shoulder , hyperesthesia form diaphragmatic irritation
- **Balance sign:** Shifting dullness on Right side (free blood) + Fixed Dullness on Left side (clots, hematoma)
- **Cullen's sign:** (late) Bluish discoloration around the umbilicus





Risk of splenic injury

- Child
- Pathological spleen



Causes of splenomegaly

Infection

- Acute (viral)
- Subacute
- Chronic (malaria)

Immunological inflammatory disorders

- Felty syndrome (with rheumatoid arthritis and granulocytopenia)
- Systemic lupus erythematosus
- Sarcoidosis
- Amyloidosis
- Thyroiditis

Haemolytic anaemia

Immune thrombocytopenia

Portal hypertension

- Thrombosis of the portal vein
- Liver cirrhosis

Primary metastatic neoplasms

- Leukaemia (in particular, chronic lymphocytic leukaemia)
- Lymphoma/Hodgkin's disease
- Myeloproliferative syndromes
- Sarcoma

Storage diseases

- Gaucher's disease
- Niemann–Pick disease





Management of traumatic injury to the spleen

- ABC principles of the Advanced Trauma and Life Support™





Unstable patients

- Abdominal distension
- peritonitis
- hypotension despite fluid resuscitation
- require transfer to the Operating Suite for an emergency laparotomy





Haemodynamically stable

- CT is very sensitive and specific for splenic injuries
- 65–95% of adults and 87–98% of children can be treated conservatively.



Grades

	Description
Class 1	Sub-capsular hematoma
Class 2	Superficial tears
Class 3	Deep tears
Class 4	Avulsion of pole of spleen
Class 5	Complete depulping of spleen
Class 6	Injury of a vascular pedicle



Vaccinations



- Pneumococcal vaccination before surgery and repeated at intervals of five years
- *Haemophilus influenzae* and meningococcal vaccination before surgery if not previously received
- Influenza vaccinations given every year
- Giving vaccines minimum of two weeks before surgery or as soon as possible after emergency surgery



Antibiotics



- Lifelong penicillin should be offered (250–500 mg b.d.)



Complications of splenectomy



- Haemorrhage
- Gastric dilation
- Pancreatic fistula
- Subphrenic abscess
- Overwhelming post-splenectomy infection

