

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Spotlight on the Spleen Surgery

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Learning objectives

- To have an understanding of the development, anatomy & functions of the spleen.
- To understand the indications of splenectomy.
- To be able to classify the causes of splenomegaly.
- To be capable of assessing patient with hypersplenism.
- To be aware of splenic injuries & who to treat.
- To understand the principles & consequences of splenectomy.

INTRODUCTION

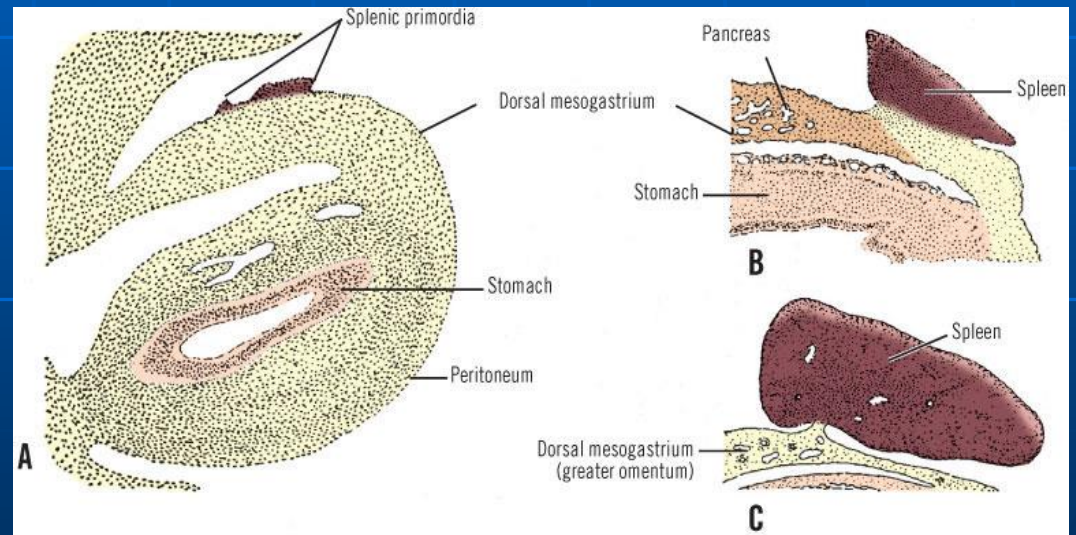


Embryogenesis of the spleen

Normal development

Normal development

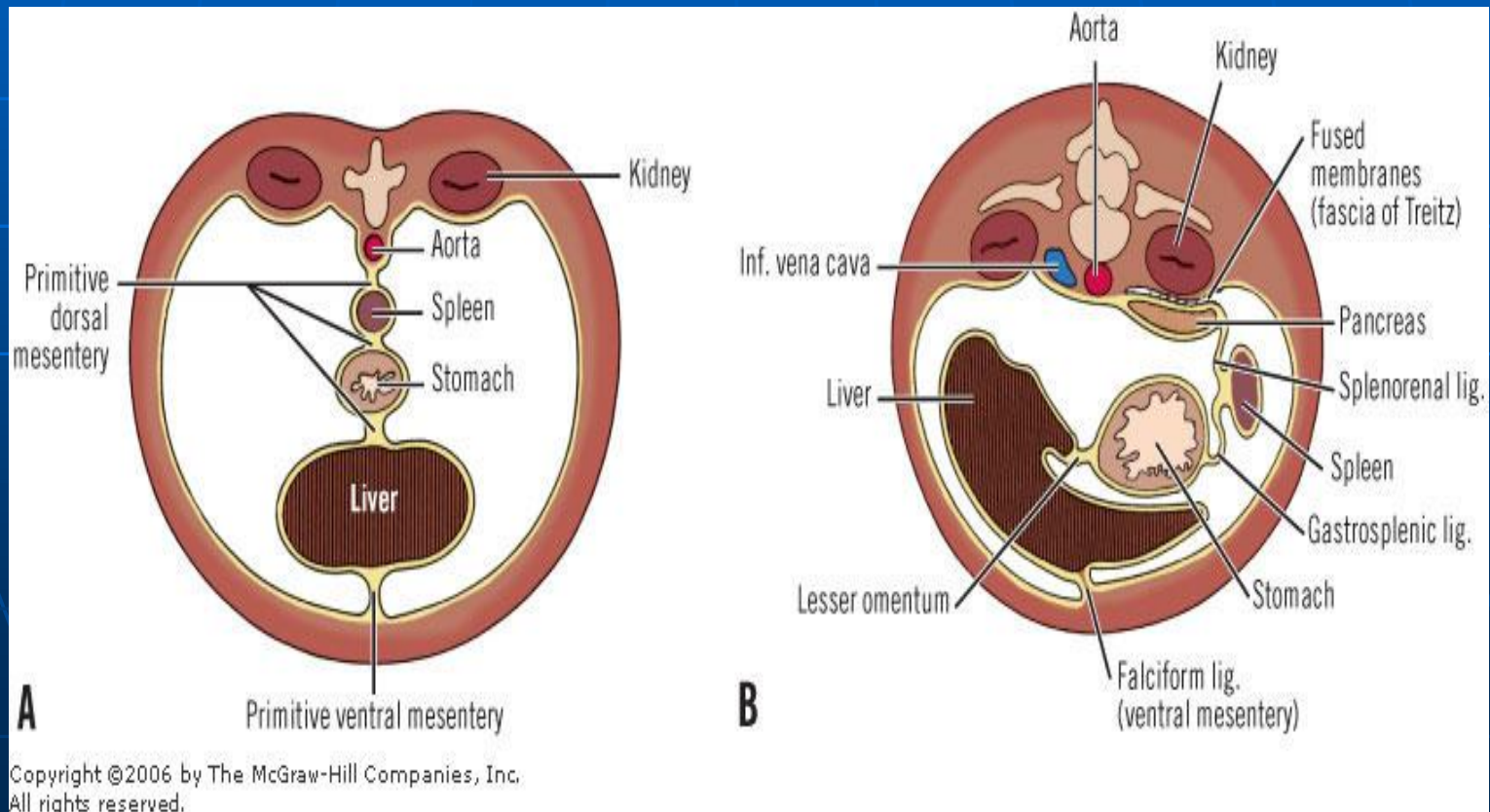
- Fetal splenic tissue develops from condensation of mesoderm in the dorsal mesogastrium around fifth week of gestation.



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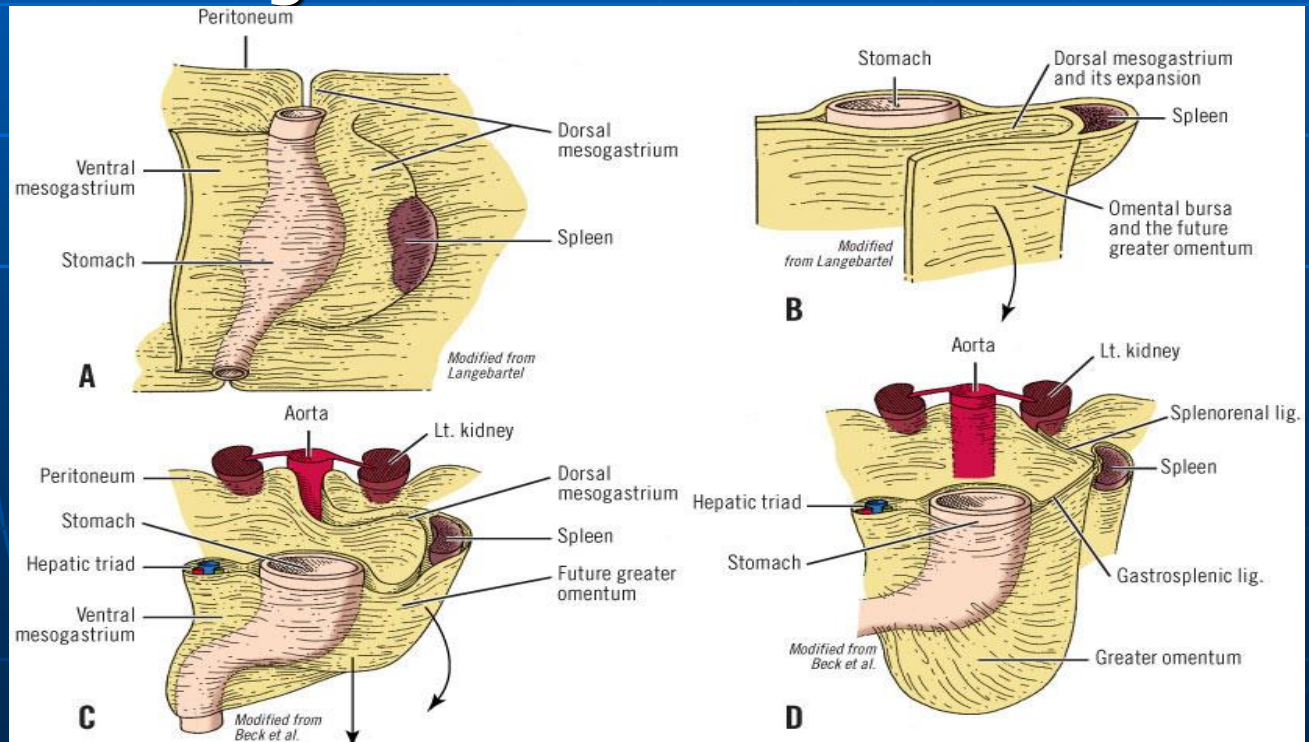
Normal development

- the spleen is located between the leaves of the dorsal mesogastrium, and occupies this location in adult life .



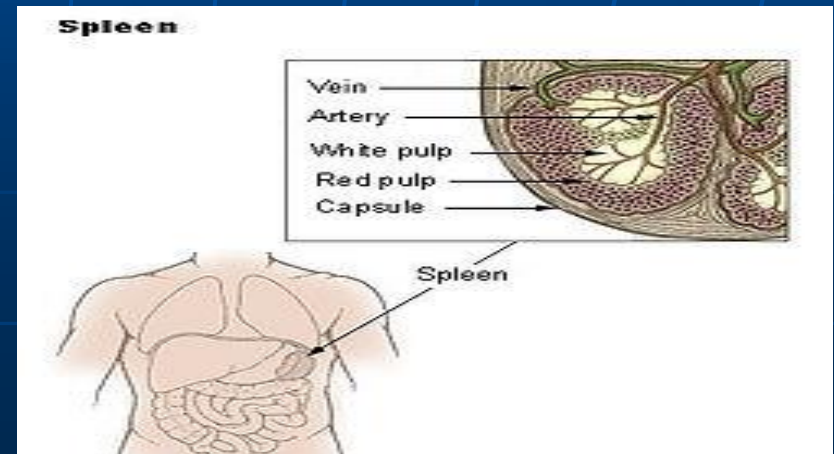
Normal development

- The left side of the dorsal mesogastrium gives rise to the splenic ligaments.
- One between the fetal splenic tissue and the stomach to form the gastro splenic ligament & the other between it & the left kidney to form the lienorenal ligament .



Normal development

- The spleen assumes its characteristic shape in the early fetal period; fetal lobulation normally disappears late in the prenatal period. .
- Splenic lobules form around the central arteries in the first weeks of the second trimester. The red pulp develops at the periphery of the lobules. The white pulp (accumulation of lymphocytes, monocytes, and macrophages) which forms around the centre.



Embryogenesis of the spleen

Congenital anomalies

Congenital anomalies

- **Asplenia**: splenic agenesis is a very rare but is present in 10% of children with congenital heart disease.
- **Polysplenia**: the normal spleen is deeply lobulated or divided into two or more parts. It is distinct from **accessory spleen**, in which the normal spleen is present but is joined by one, two, or more splenic nodules of small size that are completely separated from the main organ.
- **Wandering spleen (Splenic ectopia)**: an error in the embryologic development of the spleen's primary supporting ligaments. The ligaments may be abnormal (too long, too short, too wide, too narrow, abnormally fused) or absent.

Congenital anomalies

- **Hamartomas:**are rarely found in life & vary in size from 1 cm in diameter to masses enough to produce abdominal swelling.
- **Splenogonadal fusion:** Splenic tissue is known to fuse with male and female gonads.
- **Splenic cysts:**of embryonal rests include dermoid & mesenchymal inclusion cyst.

Accessory Spleens (Splenunculi)

- In 10% of adult.
- Multiple but rarely exceed 10.
- Most are situated near the hilum.
- Organized splenic architecture & separate arterial supply (inf.polar a.).
- Are Important during splenectomy for Haematological conditions.
- It must be differentiated from splenosis.

Splenosis

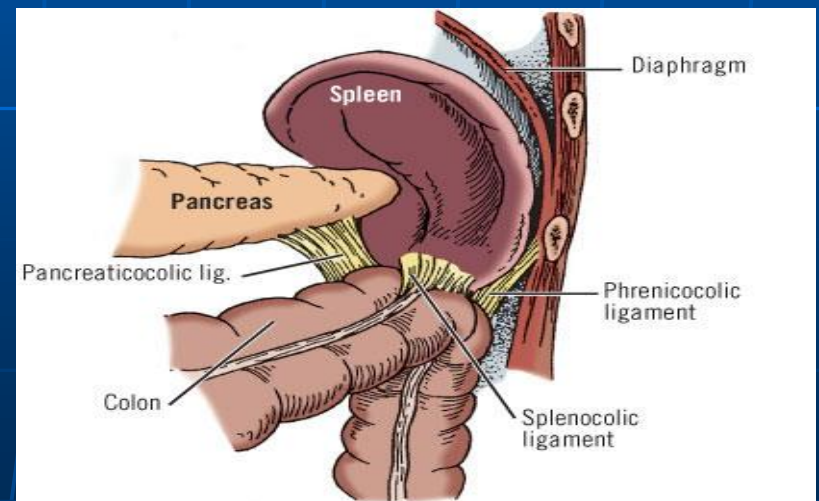
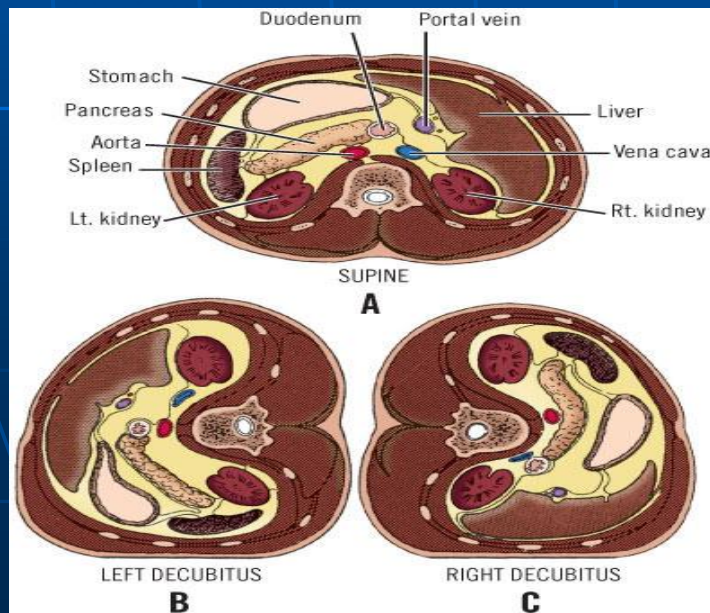
- The peritoneum of patients sustained rupture or trauma of spleen can be seeded with fragments that auto transplanted .
- Multiple more than 20.
- Have antecedent traumatic events.
- Scattered over the peritoneum.
- Do not have a co-ordinated circulation.
- Does not require treatment..

Surgical anatomy of the Spleen

Topography and relations

Topography & relation

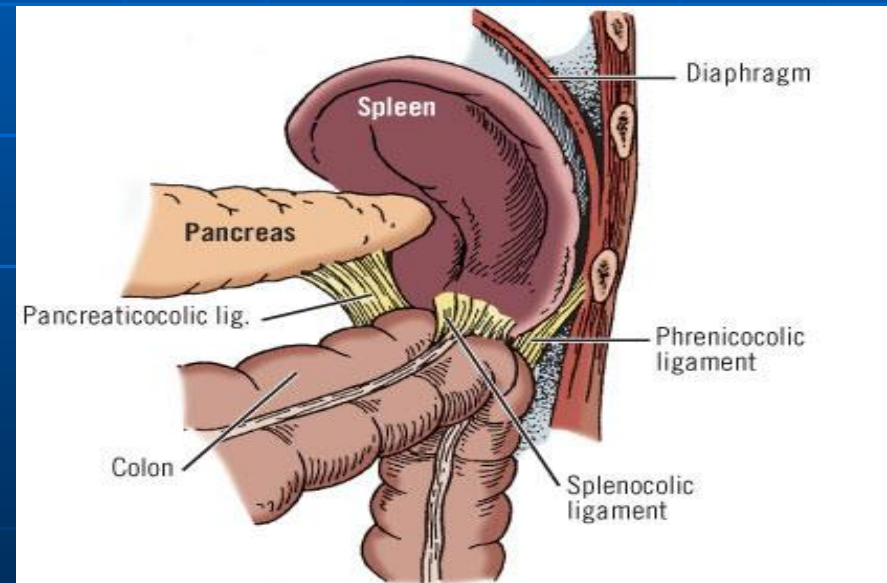
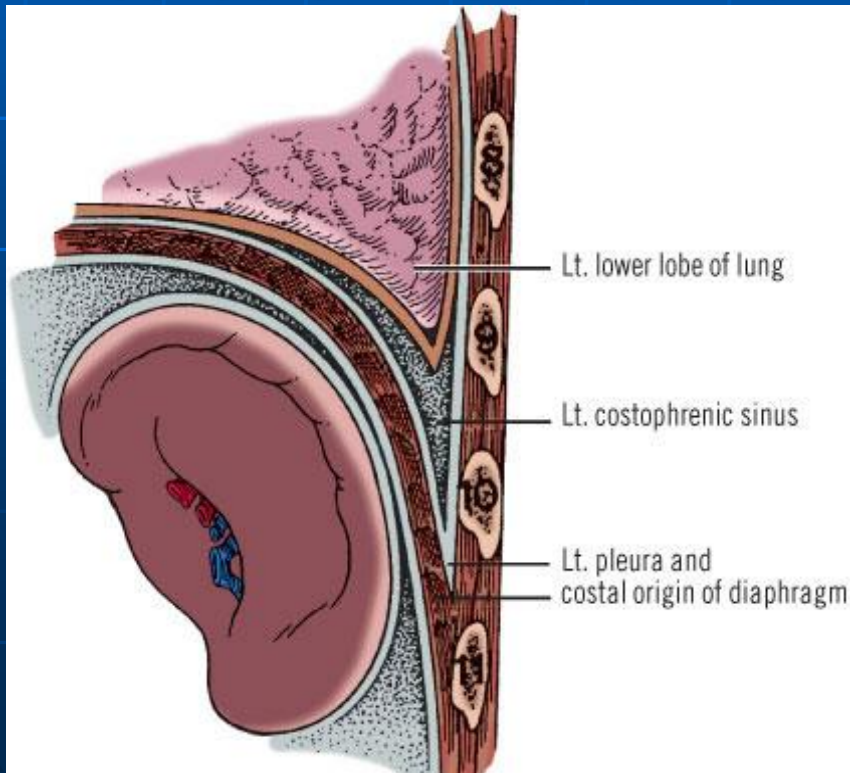
- The spleen is located in the left upper quadrant of the abdomen in a niche formed by the diaphragm above it (posterolateral). The stomach is located medially (anteromedial), the left kidney and left adrenal gland posteriorly (posteromedial), the phrenicocolic ligament below, and the chest wall (the ninth to eleventh left ribs) laterally. The tail of the pancreas in most cases is related to the splenic hilum. The spleen is concealed at the left hypochondrium .



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Topography & relation

- The spleen is oriented obliquely. Its upper end is situated some 5 cm from the dorsal midline, approximating the level of the spinous processes of the tenth and eleventh thoracic vertebrae.
- The lower end lies just behind the midaxillary line. The long axis of the organ roughly parallels the course of the tenth rib .



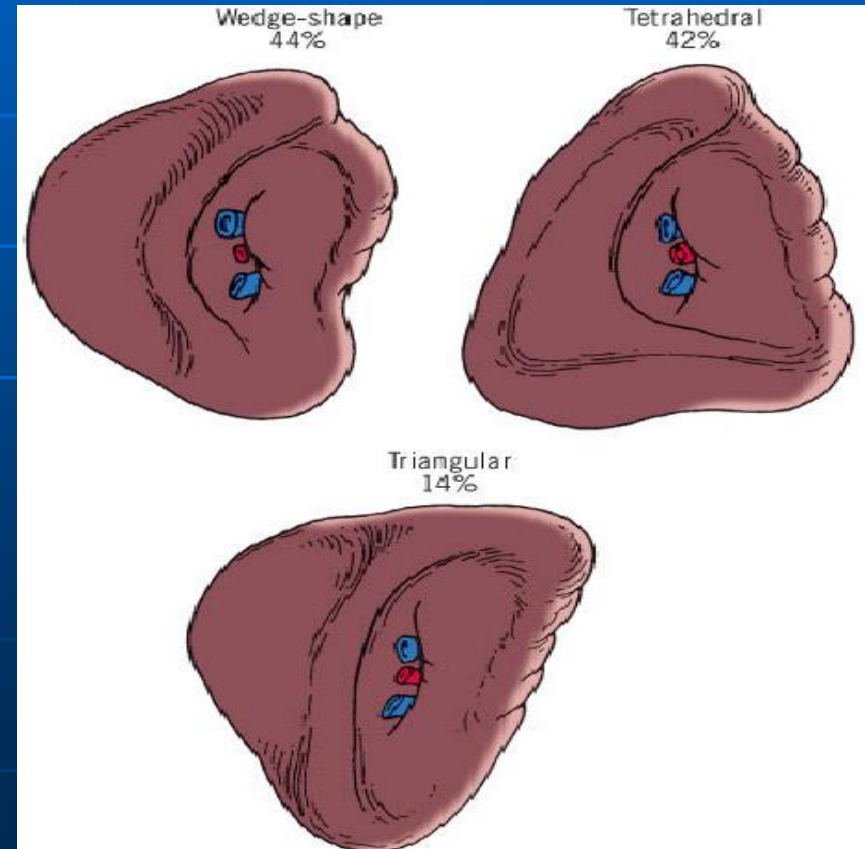
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Size of the Spleen

- The spleen can be very small or very large .
- Harris's odd numbers 1, 3, 5, 7, 9, and 11 (as reported by Last33) help one memorize certain average dimensions of the spleen :
 - The spleen measures 1 x 3 x 5 inches (2.5 x 7.5 x 12.5 cm) .
 - The spleen weighs 7 oz (220 g) .
 - The spleen relates to left ribs 9 through 11

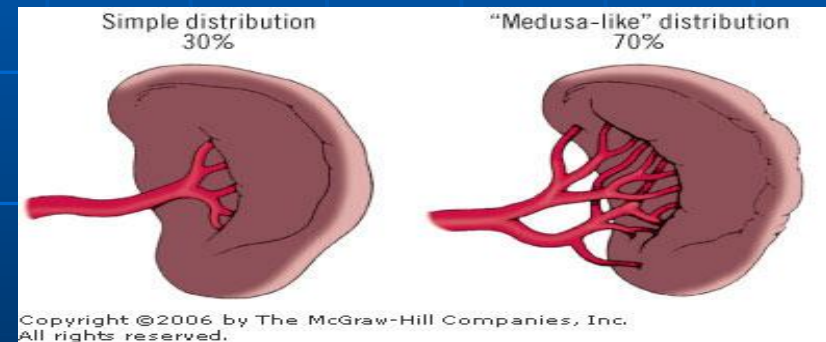
Shape of the Spleen

- the spleen has three forms. It is wedge-shaped in 44% of specimens, tetrahedral in 42%, and triangular in 14% .



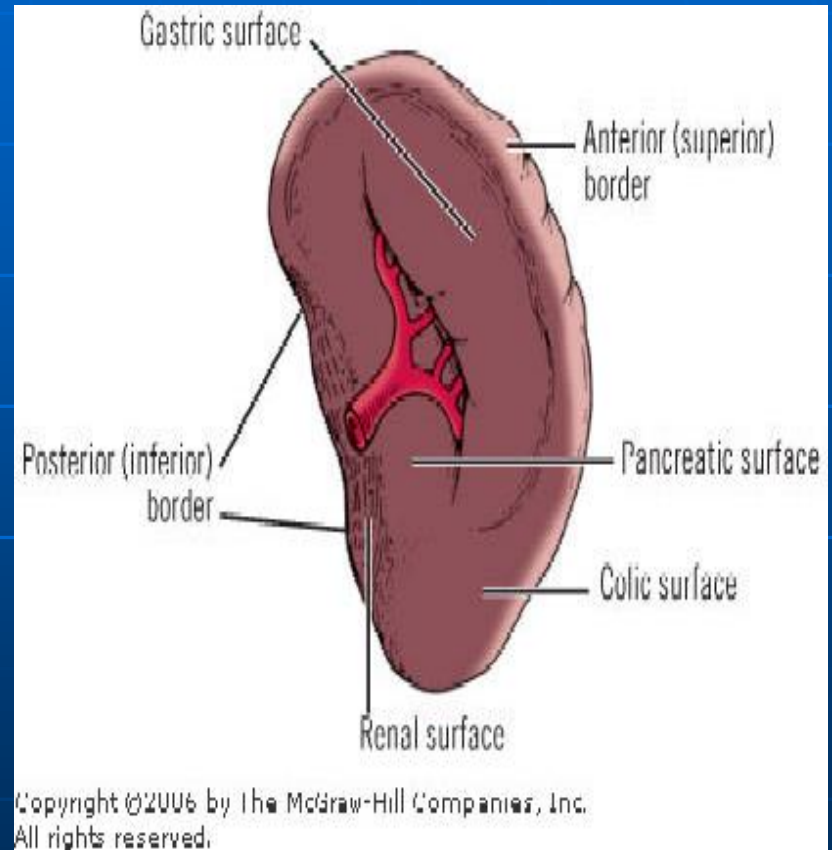
Shape of the Spleen

- two forms of the spleen. The first (30%) is a compact type of spleen with almost even borders and a narrow hilum in which the arterial branches are few and large. The second (70%) is a distributed type, with notched borders and a large hilum, in which the arterial branches are small and numerous.



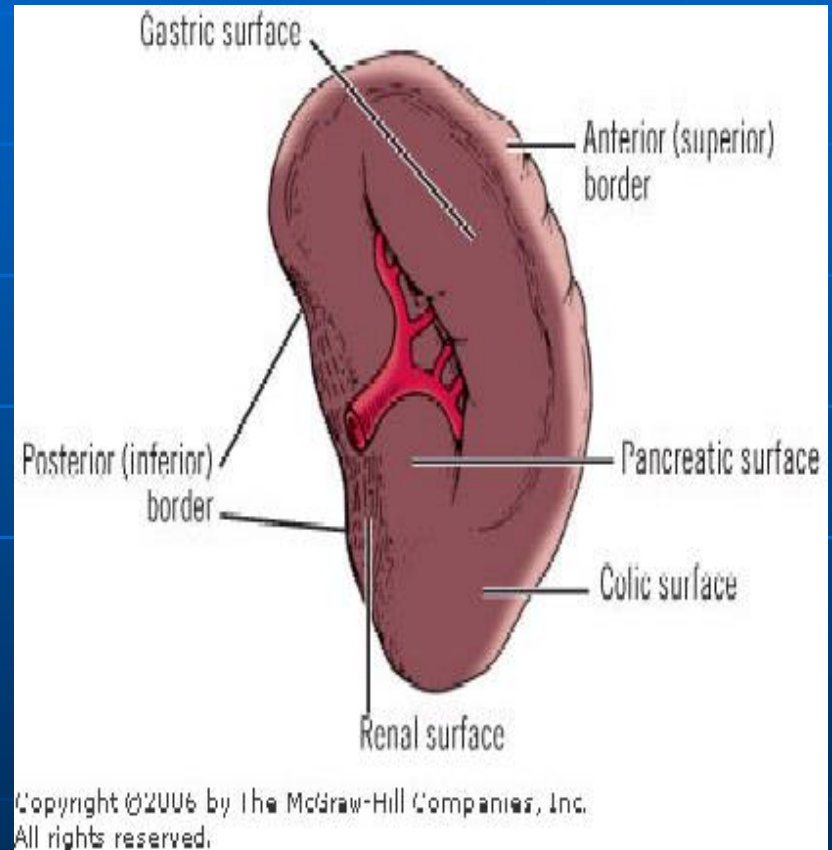
Surfaces & borders of the Spleen

- the spleen has two surfaces: parietal and visceral. The convex parietal surface is related to the diaphragm; the concave visceral surface is related to the surfaces of the stomach, kidney, colon, and tail of the pancreas .



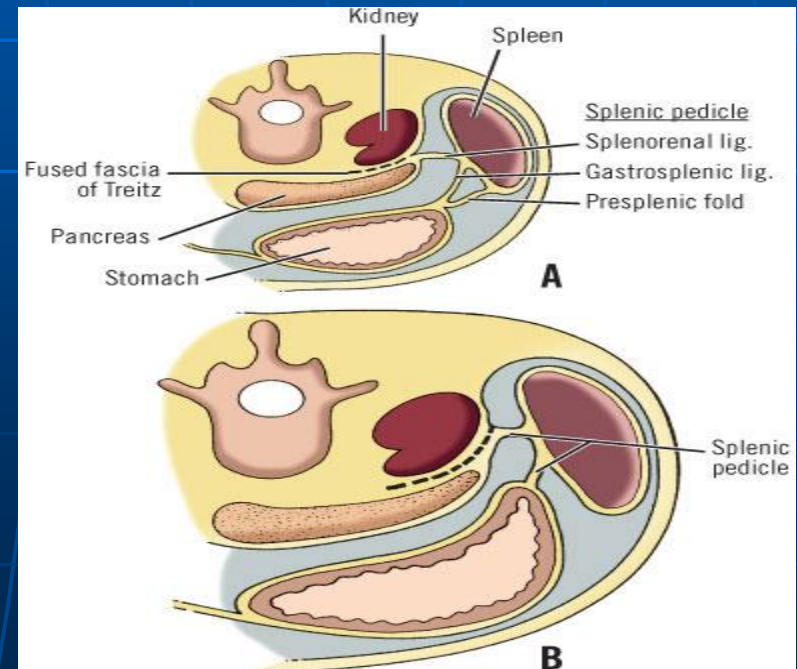
Surfaces & borders of the Spleen

- The spleen has two borders: the superior (anterior) and the inferior (posterior). The superior border separates the gastric area from the diaphragmatic area, and the inferior border separates the renal area from the diaphragmatic area..



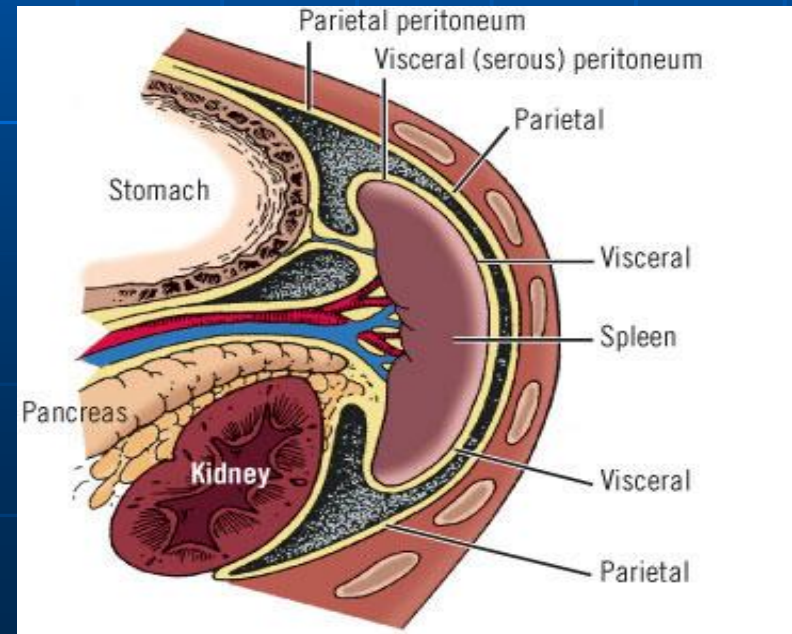
Peritoneum & ligaments of the Spleen

- The right and left layers of the greater omentum (mesogastrium) separate to enclose the spleen almost completely, except at the hilum, providing its serosal covering, or capsule. The capsule formed by the visceral peritoneum is as friable as the spleen itself and as easily injured.



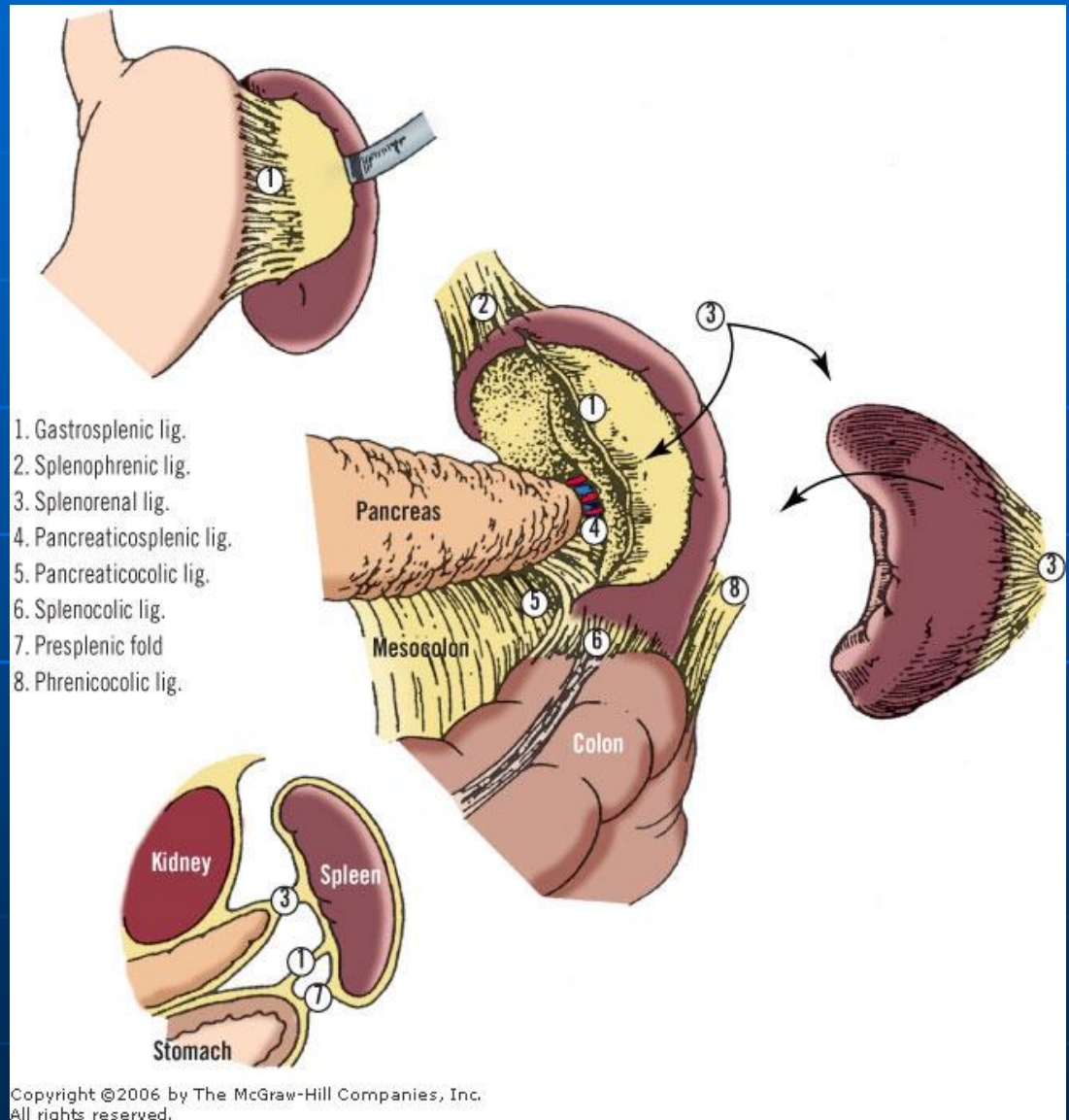
Peritoneum & ligaments of the Spleen

- The peritoneal layers that enclose and suspend the spleen form the two chief ligaments of the spleen, the gastrosplenic ligament and the splenorenal ligament. These are portions of the embryonic dorsal mesentery, or mesogastrium, the leaves of which separate to surround the spleen. These two ligaments form the splenic pedicle.



Suspensory ligaments of the Spleen

- Major splenic ligaments, are: gastrosplenic & splenorenal .
- minor splenic ligaments the names of which indicate their connections.

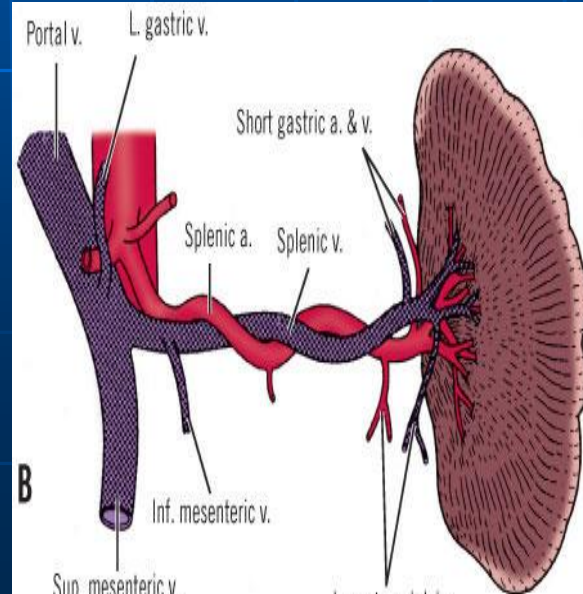
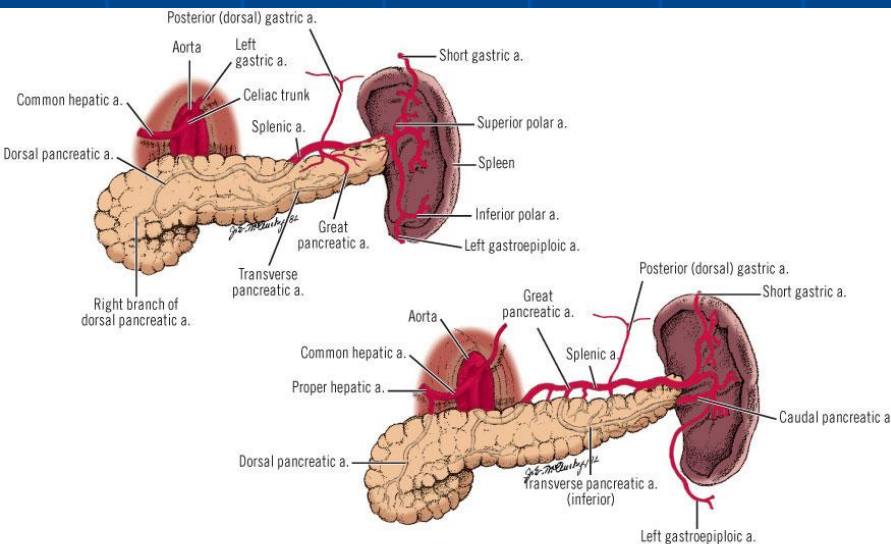


Surgical anatomy of the Spleen

Vascular system of the spleen

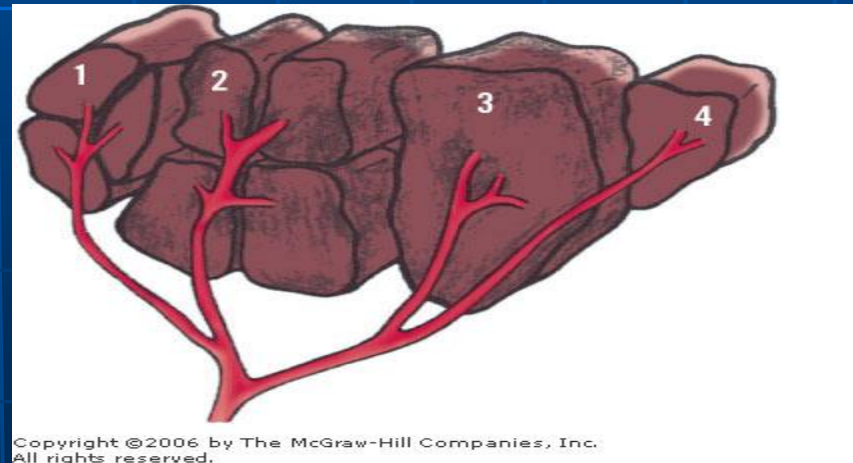
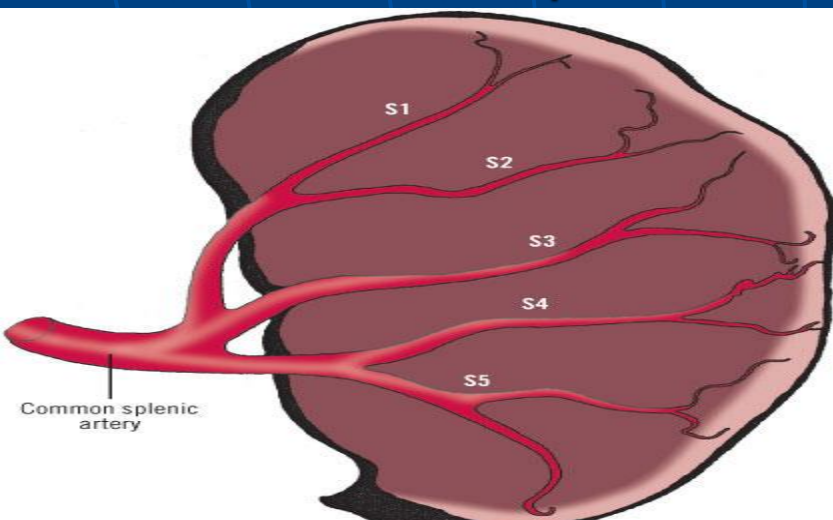
Arterial supply of the Spleen (Splenic artery)

- the splenic artery is a branch of the celiac trunk, arising together with the common hepatic and left gastric arteries .
- the splenic artery courses leftward in close relation to the upper border of the pancreas. Occasionally its course may be in front of or completely behind or within the pancreatic parenchyma.



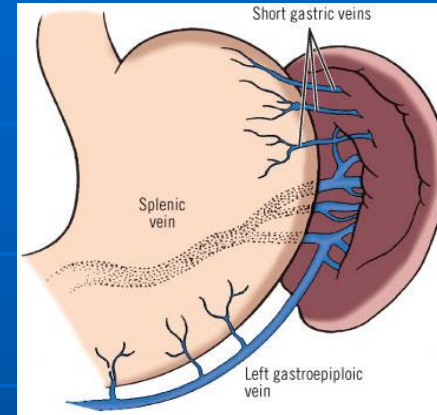
Arterial supply of the Spleen (Segmental anatomy)

- The common splenic artery divided into two terminal arteries (Superior & inferior) which occur at variable distance from spleen.
- the two terminal arteries give off the segmental arteries to the spleen, the central segmental arteries & the polar arteries.
- The splenic segments which are separated by avascular planes are arterio venous, and are four in number: two central & two polar.

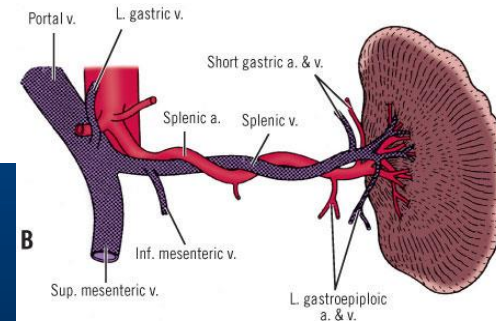


Venous drainage of the Spleen

- The venous drainage mirrors the arterial supply with the splenic vein joining the superior mesenteric vein behind the neck of the pancreas to form portal vein.
- The spleen also drain through the short gastric veins.



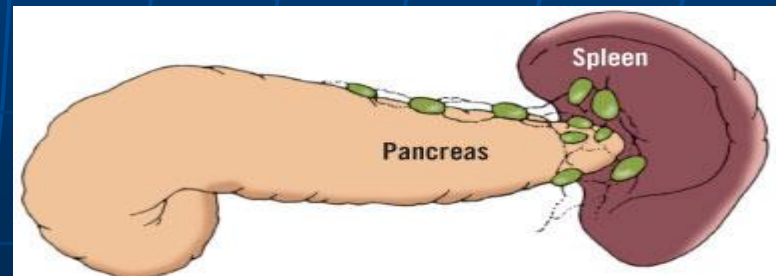
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Lymphatic drainage of the Spleen

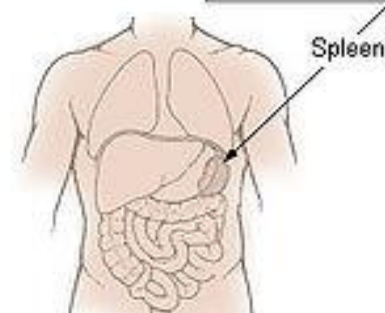
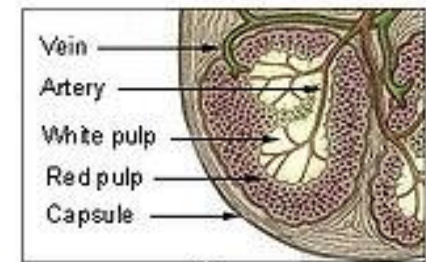
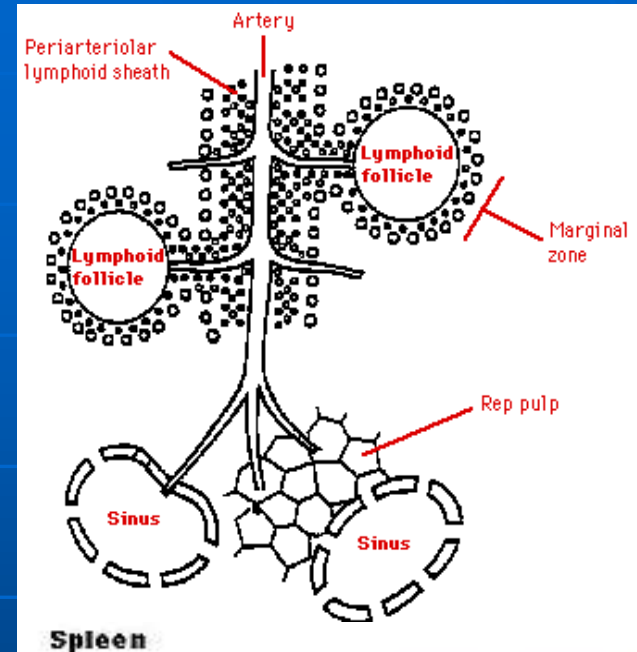
- The lymphatic vessels of the spleen arise from the splenic capsule and some of the larger splenic trabeculae .
- the splenic chain includes suprapancreatic nodes, infrapancreatic nodes, and afferent and efferent lymph vessels .
- Their primary function is that of draining the lymph of the stomach rather than that of the spleen.



Histology and Physiology of spleen

Histology of the Spleen

- The spleen comprises one quarter of the lymphoid mass of the body .
- The spleen is composed of 75-85 percent red pulp and approximately 20 percent white pulp .
- The red pulp is concerned with maturation and removal of damaged and senescent red cells, whereas the white pulp forms a major component of the cellular immune surveillance & protection of the body.



Function of the Spleen

- The spleen serves four functions:
 - 1- blood storage,
 - 2-hematopoiesis,
 - 3- filtration, and
 - 4-immunologic response .

Function of the Spleen

■ **Blood storage:**

- Normal spleen holds little blood in relation to circulating blood volume ie, no significant role.
- Spleen receives 300 mL/min of blood (approximately 6% of the cardiac output) per minute.,
- The normal spleen contains only 1% of the total red blood cell mass, which corresponds to 25 ml of red blood cells.
- In splenomegaly up to 50% of total red cell mass may reside in the spleen and 90% of platelet are trapped within the spleen (N=10%).

Function of the Spleen

■ Haemopoiesis:

- Only in fetal life with no blood formation in the organ after birth..
- In certain disease states e.g.
 - *progressive fibrosis of bone marrow i.e. myelosclerosis.
 - *In children with congenital hemolytic anemia.

Function of the Spleen

Filtration:

A. Culling—erythrocyte (or other blood cell) destruction i.e. removal

1. Physiologic (as red blood cells age)
2. Pathologic
 - a. Associated with blood cell abnormalities
 - b. Associated with primary splenic changes

B. Pitting ("facelifting" of erythrocytes)

1. Removal of cytoplasmic inclusions e.g. Howell-Jolly bodies, Siderotic granules & Heinz bodies
2. Remodeling of cell membranes. (Target cells)

C. Erythroclasis—destruction of abnormal red blood cells with liberation into circulation of erythrocyte fragments.

D. Removal of other particulate material (e.g., bacteria, colloidal particles).

Immunologic functions:

- A.** Antibody production and cell mediated response.
- B.** Phagocytosis.
- C.** Maturation of lymphoid cells.
- D.** Significant lymphopoiesis.
- E.** Major source of suppressor T-cells.

Questions ? ?



THANK YOU