SPLEEN

Azwan Kamarudin D11B038
Abdul Muhaimin Abd Wahab D11A007
Alia Zulaikha Binti Mohd Hanif D11B037
Siti Nabila Farhana Binti Halim D10B048
Ahmad Hanif bin M Amin D11B043
Siti hajar binti abu bakar D10b050
ANATOMICAL OF SPLEEN
Reddish brown to gray organ (depend on species)

Situated at caudal diaphragm within left cranial part of abdomen.

Located entirely within peritoneum in all domestic mammals except ruminant.

In ruminants: Spleen extends into the retroperitoneal zone between diaphragm and dorsal sac of rumen.
SPLEEN

- Attach to stomach by gastrosplenic ligament (part of omentum)
- In horse: additional ligament is present between spleen and left kidney (nephrosplenic or renosplenic ligament), creating nephrosplenic space, cause colic (intestine trapped)
- Has two surfaces, (diaphragmatic surface and visceral surface) marked by hilus (in all domestic mammals except ruminant)
- Spleen enclosed by soft tissue capsule (rich in smooth muscle fibers)
SHAPES OF SPLEEN

- Horse : Falciform
- Pig : Tongue-shape
- Carnivores : Boot-shape
- Small ruminants : Leaf-shape
- Ox : Wide strap
- Avian : Oval
Tongue-shape
Boot-shape

Dog

Cat

- Dorsal extremity
- Hilus
- Place of attachment for the greater omentum
- Gastric surface
- Intestinal surface
- Splenic artery and vein
- Ventral extremity
**LEAF-SHAPE**

*Goat*
- Hilus with the splenic artery and vein
- Zone of adhesion with the rumen

*Sheep*
- Liberal part covered by the peritoneum
Wide strap

- Hilus with splenic artery and vein
- Zone of adhesion with the rumen
- Liberal part covered by the peritoneum

Ox
Spleen
Spleen
BLOOD SUPPLY AND INNERVATION

- **Blood vessels**
  - **Artery**: Splenic artery and celiac artery
  - **Vein**: Splenic vein (drains into portal vein)
  - Passed through hilus
  - Course in trabeculae (repeated branching to smaller diameter)
  - Further branching leaves trabeculae and surrounded by lymphoid tissues forming central arteries within white pulp.
  - Branch again into about 50 small straight arterioles open into capillary bed.
NERVE

- Receives parasympathetic and sympathetic nerve fibers from solar plexus

LYMPHATIC DRAINAGE

- To the splenic lymph nodes (located at the hilus)
- Efferent vessel joins the celiac trunk to drain into chyle cistern.
Hilus with splenic artery and vein
Zone of adhesion with the rumen
Visceral surface
Diaphragmatic surface
Diaphragmatic surface
Visceral surface
Vessel of the trabeculae
Connective tissue of the trabeculae
Red spleen pulp
Serous tunic
Wall of a sinusoid with a reticular network
Trabeculum
Vein of a trabeculum
Periarterial lymphatic sheath
Central artery
Spleen nodule = white spleen pulp = Malpighian corpuscle
Artery of a trabeculum
Trabecular artery and vein
Capsule
Trabeculum
Red spleen pulp with sinusoids
Penicilli (small straight arteries)
HISTOLOGY OF SPLEEN
Contains largest collection of reticulo-endothelial cells

The spleen is surrounded by a capsule which consists of
- smooth muscles
- collagen
- elastic fibres

In horses and cows two or three layers of muscle are oriented perpendicular to each other, while in carnivores, pigs, sheep, and goats the muscle fibers are interwoven.
The capsule is thickest in the horse and cow, thinnest in carnivores.

Trabeculae project into the interior of the spleen from the capsule.

Large in cows and sheep

The spleen of the chicken is covered by a muscular capsule, but trabeculae are absent.
The parenchyma of the spleen is divisible into the white and red pulp.

Soft, dark red mass is the red pulp.

Consists of large, irregular, thin-walled blood vessels, the splenic sinusoids, interposed between sheets and strands of reticular connective tissue, the splenic cords.

White pulps contain lymphatic follicles.
The **capsule of the spleen of the horse** contains layers of smooth muscle oriented at right angles to each other. In this preparation there are three distinct layers of muscle.
**Spleen, Chicken.** Red pulp (pink) intermingles with white pulp (purple). The white pulp contains a few lymphatic nodules. Trabeculae of connective tissue are absent.

**Capsule, Spleen, Chicken.** Layers of smooth muscle make up a substantial part of the capsule.
Spleen (horse).
(1) Fibromuscular capsule.
(2) Fibromuscular trabeculae.
(3) Splenic pulp. H & E. ×12.5

Spleen (cat).
(1) Part of a trabecula.
(2) Ellipsoid.
(3) Bloodfilled sinusoids of the red pulp. H & E. ×250
Spleen for dog, pig and sheep
**Spleen**

- The largest mass of lymphatic tissue in the body.
- Found between stomach and diaphragm.
- Has a hilus (hilium) like the lymph nodes, which is where the major blood vessels enter and leave.
- Only has efferent lymph vessels like the thymus, which leave from the hilium, and it does not have afferent lymph.
Type of tissues

- **White pulp**
  - contains lymphoid aggregations, mostly lymphocytes, and macrophages which are arranged around the arteries. The lymphocytes are both T (mainly T-helper) and B-cells.

- **Red pulp**
  - is vascular, and has parenchyma and lots of vascular sinuses. These are sinuoids - a specialised type of capillary, which is very leaky.
Sinusoidal spleen: dogs, rabbits and man
- the red pulp contains typical venous (splenic, vascular) sinuses. These are wide channels lined by elongated, longitudinally oriented endothelial cells.

Nonsinusoidal spleen: horse, ruminants, cats, pigs
- Having poorly developed or no sinuses. Wisps of smooth muscle in the red pulp are most numerous in pigs and ruminants.
A narrow vessel (v) courses through a wide macrophage sheath (e). Parenteral lymphatic sheath (P): red pulp (R). Hematoxylin and eosin.
Sheep

An artery of the white pulp (a) is ensheathed with lymphocytes that constitute the periarteria lymphatic sheath (PALS:P). A nodule (n) is embedded within the PALS. Sheathed capillaries or elipsoids are surrounded by a wide macrophage sheath. (e). red pulp (R). Hematoxylin and eosin.
ANATOMICAL & HISTOLOGICAL CHANGES DUE TO DISTURBANCES
(HISTOLOGY AND EFFECTS)
- Spleen torsion
- Asplenia
- Tumor
- Splenomegaly
- Hematoma
Asplenia refers to the absence of normal spleen function and is associated with some serious infection risks.

Hyposplenism is used to describe reduced ('hypo-') splenic functioning, but not as severely affected as with asplenism.
TUMOR

- Tumors of the spleen are common in older dogs. Most enlargement of the spleen is not cancerous and due to blood accumulating as a result of poor circulation, often with bleeding within the spleen (hematomas).

- Tissue overgrowths (hyperplasias), either of lymphoid cells or macrophages with fibrous tissue (fibrohistiocytic nodules) are also common. Less commonly, enlargement due to infection or inflammation of the spleen (splenitis).
Splenomegaly

Fig. 1: Remarkable splenic enlargement led to fatal internal haemorrhage
Similarly, the fibrous tissue of splenic trabeculae

White Pulp
lymphocytes
surround
central arteries

Red Pulp
Red blood cells
Splenic sinuses
Splenic cords
Hematoma

- Splenic hematoma is an enlargement of the spleen that is caused by poor circulation through the spleen, or bleeding within the spleen due to weak and/or ruptured splenic blood vessels.
- Splenic hematomas can lead to mild enlargement of the spleen, but many cases present with very large, grossly abnormal spleens.
Left, a: Spleen with capsular hematoma (hematoxylin-eosin, original × 2). Right, b: Spleen with parenchymal hematoma (hematoxylin-eosin, original × 10).
Normal spleen white pulp and red pulp
H & E 4 X 10
What are Four of the Function of the Spleen?
The spleen is the largest lymphoid organ of the body. Unlike the lymph nodes in that the circulating fluid is blood instead of lymph.

**Function of the Spleen:**
- Filter
- Produces lymphocytes
- Destruction of erythrocytes
- Iron storage
GROSS ANATOMY
Splenic pulp is red because of the blood that is held within the reticular fiber mesh, which represents the part of the spleen that acts as a filter (mononuclear phagocytic system- MPS); it has numerous fixed of macrophages.

The white pulp is lymphatic tissue distributed throughout the spleen as lymphatic nodules that produces lymphocytes.

The blood circulates trough the spleen, and the spleen is active in the destruction of aged and abnormal erythrocytes by the numerous MPS cells.

The spleen also is a storage depot of iron obtained from the destruction of erythrocytes.
The end
The spleen is the largest accumulation of lymphoid tissues in the body. It is surrounded by a capsule of dense connective tissue that sends out trabeculae, which penetrate and divide the underlying parenchyma, or splenic pulp. White pulp (stained red) is characterized by the presence of lymph nodules and central arteries (CA), or white pulp arteries. The red pulp is characterized by the presence splenic cords (Billroth's cords), that lie between sinusoids. The spleen, like other lymphoid organs, has an elaborate, supporting network of reticular fibers.
White Pulp
lymphocytes surround central arteries
as periarterial lymphoid sheath (PALS)

Red Pulp
Red blood cells
Splenic sinuses
Splenic cords
This slide illustrates the distribution of reticular fibres in the spleen. They often appear coarser in the red pulp, where they have a distinct, stranded organisation. The reticular fibres of the white pulp appear somewhat finer and, at times, they are arranged as concentric rings. The peripheral localisation of the central arteries in nodules is quite distinct. Occasionally you may see small rings of reticular fibres in (or close to) the periphery of the white pulp. These rings are likely to represent the reticular fibres surrounding sheathed arteries.
This is an example of **continuous** type of Splenic-Gonadal fusion where the splenic tissue is intimately connected to the testis by fibrous tissue. In **discontinuous** type, there is no connection between spleen and splenogonad. The splenic tissue is present within tunica albuginea, scrotum, or along vascular pedicle. Most cases of splenic-gonadal fusion are seen on the **left side**.