

The Spleen

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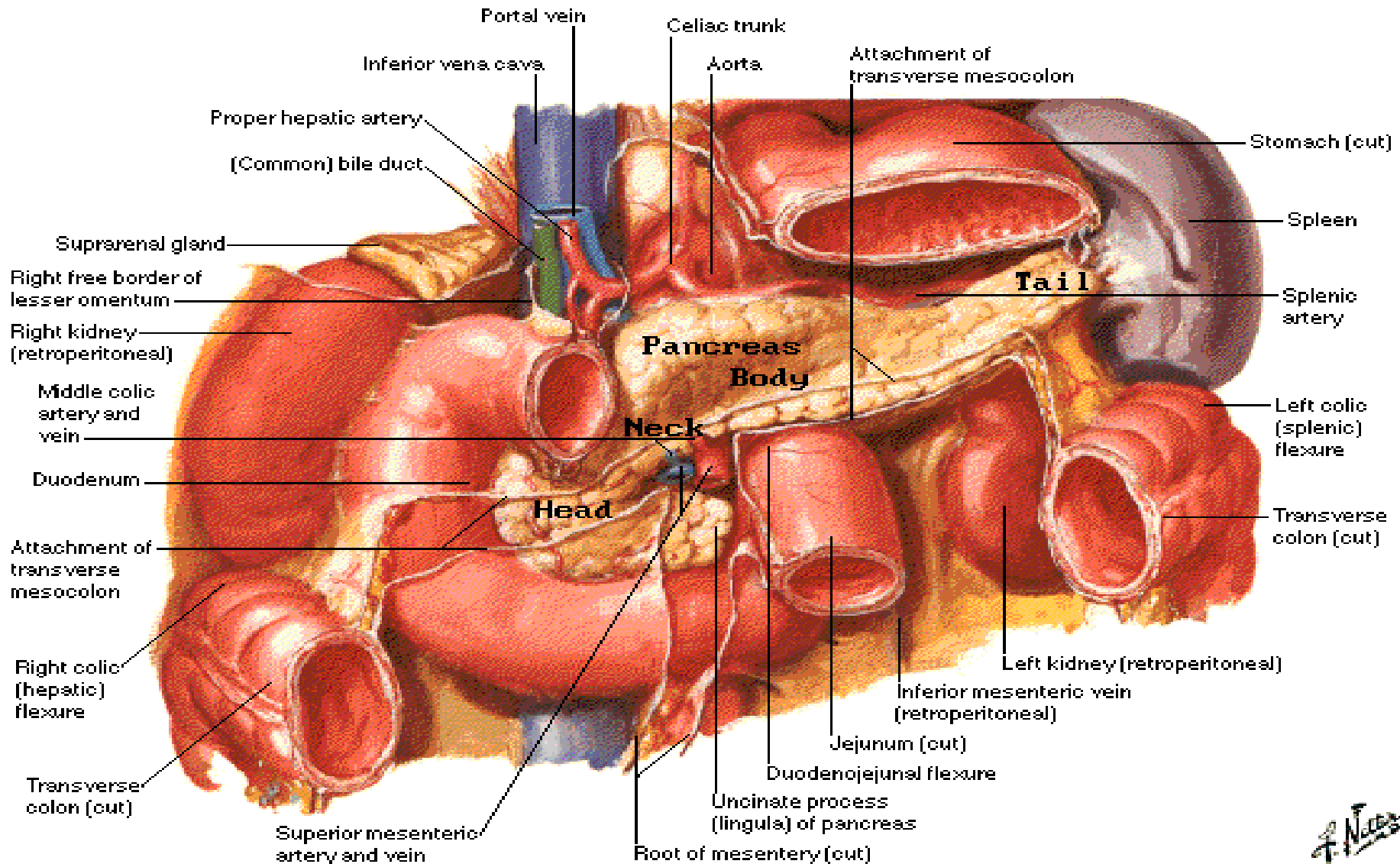
CRQ (20 marks)

- What is the blood supply to the spleen (1 mark)
- List 5 functions of the spleen with an example for each? (5 marks)
- What conditions are associated with hyposplenism (2 marks)
- What are the indications for a splenectomy? (2 marks)
- Describe your anaesthetic management for this patient? (8 marks)
- What is the current recommended vaccination schedule for patients undergoing a splenectomy? (2 marks)

Anatomy

- Weighs 100-150g
- Posteriorly – diaphragm
- Anteriorly – stomach
- Medially – left kidney
- Inferiorly – splenic flexure of the colon
- Tail of the pancreas attaches to the spleno-renal ligament and extends to the splenic hilum

Pancreas in Situ



Splenic function

Function	Examples
Immune	Antigen presentation Stores lymphocytes and macrophages and exposes to circulation
Filtration & metabolism	Removes old/damaged erythrocytes Macrophages release haem from haemoglobin
Storage	240mls red cells 30% platelets Iron
Production	Opsonins (complement activation)
Haematopoiesis	Until 5 th gestational month

Disorders of the spleen

- Splenomegaly & hypersplenism
- Splenic artery aneurysm
- Hyposplenism & overwhelming post splenectomy infection syndrome
- Splenic infarction
- Accessory spleens

Splenomegaly & hypersplenism

- No agreement on categorising the degrees of splenomegaly:
 - Length:
 - Normal spleens < 12cms in craniocaudal length
 - Moderately enlarged 12-20cms
 - Severely enlarged > 20cms
 - Weight:
 - Splenomegalic – 500-1000g
 - Massive splenomegaly > 1000g

Causes of Splenomegaly & hypersplenism

Causes	Examples
Infection	Infectious mononucleosis, malaria, HIV, TB
Neoplasia	Leukaemias, lymphomas, myeloproliferative disease, metastatic tumours
Congestion	Pre-hepatic: Portal/splenic vein thrombosis Hepatic – Cirrhosis Post hepatic – Right heart failure, Budd-Chiari , pulmonary, tricuspid disease
Increased function	Sickle cell disease, hereditary anaemias
Immune	RA, ITP, SLE, Sarcoidosis
Storage	Amyloidosis

Splenic artery aneurysm

- Dilatation of the splenic artery > 1cm diameter
- 3rd most common aneurysm
- Presentation
 - Abdominal pain
 - Incidental finding at angiography
 - Hypotension, sudden collapse following rupture

Splenic artery aneurysm

- Strong association with pregnancy
- 95% ruptures occur during pregnancy
- Most commonly in the 3rd trimester
- Mortality 25% in normal population
- Mortality 75% in pregnancy
- Mimics the symptoms of other obstetric emergencies
- Treatment – endovascular ablation

Hyposplenism

- Characterised by increasing susceptibility to infection by encapsulated microorganisms
- Associated conditions:
 - Alcoholic liver disease
 - Sickle cell disease
 - Bone marrow transplantation
 - Inflammatory bowel disease
- Markers of hyposplenism:
 - Acanthocytes
 - Target cells
 - Howell-Jolly bodies

OPSI

- Characterised by the following:
 - Massive bacteraemia
 - No obvious primary infection source
 - Short prodromal phase
 - Septic shock accompanied by multi-organ dysfunction
 - Waterhouse-Freidrichsen syndrome

OPSI

- Prompt recognition
- Intensive care sepsis treatment strategies
- IV antibiotics
- Vasopressors
- Blood products
- Mortality rate between 40-70%

Antibiotics in asplenic patients

- Offered to those at risk of pneumococcal infection:
 - Aged <16 or >50 yrs
 - Inadequate serological response to pneumococcal vaccine
 - Impaired immune function (malignancy)
 - Previous history of invasive pneumococcal disease

Vaccinations

- Cover common organisms (pneumococcal, Hib, meningococcal, influenza)
- Administered at least 2 weeks before scheduled splenectomy
- Post emergency splenectomy delayed for 2 weeks following surgery
- Delivered 2 weeks before patients commence immunosuppressive treatment
- Repeat vaccination should occur every 5 years

Splenic infarction

Cause	Examples
Malignant	Leukaemia, lymphoma
Haematological	Sickle cell disease, antiphospholipid syndrome, protein C or S deficiency
Embolic	AF, endocarditis, LV thrombus
Trauma	Blunt, torsion of the vascular pedicle
Iatrogenic	Oesophagectomy, gastrectomy, liver transplant
Miscellaneous	Splenic vein thrombosis, pancreatitis, sarcoidosis, amyloidosis, ARDS

Splenic infarction

- Third asymptomatic
- Left upper quadrant pain
- Pleuritic chest pain
- Shoulder tip pain (Kehr sign)

- CT best imaging modality

Splenectomy

- Indications:
 - Trauma
 - Refractory haematological disease (ITP, hereditary spherocytosis, thalassemia, Hodgkin disease, leukaemia's, myeloproliferative disease)

Traumatic splenic injury

- Clinical signs are unreliable
- Non-operative management mainstay of treatment
- Contrast enhanced CT best imaging modality
- American Association for Surgery of Trauma (AAST) grading system is helpful in stratifying patients
- VTE prophylaxis is important in patients with isolated splenic injuries

Spleen injury scale (1994 revision)

Grade*	Injury type	Description of injury	AIS-90
I	Hematoma	Subcapsular, <10% surface area	2
	Laceration	Capsular tear, <1 cm parenchymal depth	2
II	Hematoma	Subcapsular, 10% to 50% surface area; intraparenchymal, <5 cm in diameter	2
	Laceration	Capsular tear, 1–3 cm parenchymal depth that does not involve a trabecular vessel	2
III	Hematoma	Subcapsular, >50% surface area or expanding; ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma ≥ 5 cm or expanding	3
	Laceration	Parenchymal depth >3 cm or involving trabecular vessels	3
IV	Laceration	Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)	4
V	Laceration	Completely shattered spleen	5
	Vascular	Hilar vascular injury that devascularizes spleen	5

* Advance one grade for multiple injuries up to grade III.

AIS, Abbreviated Injury Score.

Splenectomy

- Preoperative:
 - Routine as for any major surgery
 - Liaise with haematologists – patients often anaemic and thrombocytopenic
 - May require irradiated or human leucocyte antigen (HLA), immunoglobulins, steroids
 - Involvement of the MDT (haematologist, oncologist, interventional radiologist, surgeon, anaesthetist)

Surgical approach

- Depends upon splenic size, indication and surgical preference
- Emergency/trauma – open in the supine position with a upper midline incision
- Elective – subcostal incision
- Laparoscopic – anterior or lateral

General intraoperative measures

- Intubate & use orogastric tube to decompress the stomach
- Antibiotic prophylaxis
- Eyes taped, ensure no pressure applied
- Large bore IV access, IABP, CO monitoring
- Positive pressure ventilation
- Ensure ear has not folded on positioning
- Lateral decubitus position
 - Common peroneal nerve
 - Radial nerve
 - Saphenous nerve
- Fluid management, avoid acidosis, temperature regulation

Neuraxial blockade & venous thromboembolism

- Haematological issues may preclude the use of epidural
- Haemato-oncology patients – limited evidence of minimum platelet count to guide catheter placement
- Acknowledged that $>100 \times 10^9 \text{ litre}^{-1}$
- Paracetamol patient – Lower thresholds accepted

Venous thromboembolism

- Increased in post-splenectomy patients
- Multifactorial aetiology
 - Surgery, immobility, trauma, blood transfusions
 - Malignancy
 - Haematological disorders
 - Thrombocytosis, hypercoagulability
- Myeloproliferative disease – Incidence of portal vein thrombosis 40% therefore need for post operative anticoagulation is high

Management of thrombolysis with epidural catheter in situ

- Lowest fibrinogen & plasminogen level is at 5 hours after thrombolytic therapy
- Remain depressed at 27 hours
- AAGBI recommend waiting 10 days after thrombolysis before performing a neuraxial block
- Recommend that thrombolysis should be delayed for 10 days if a neuraxial block has been performed
- If thrombolysis administered, leave epidural catheter in situ, stop the infusion, close neurological monitoring, monitor fibrinogen concentrations to help catheter removal, possible with FFP cover

Partial splenectomy, autotransplantation

- Autotransplantation – leaving splenic tissue deliberately behind in the abdomen after splenectomy
- Partial splenectomy preferable as associated with:
 - Better antibody titres
 - Better pneumococcal uptake
 - Improved survival rates
- Conditions appropriate for partial splenectomy:
 - Iatrogenic splenic injury
 - Splenic cysts
 - Benign tumours
 - Hereditary spherocytosis

Summary

- Highlighted the importance of the spleen
- Presented with trauma patients regularly
- Fundamental role in the diagnosis, resuscitation, operative and post operative management