Splenectomy and Hyposplenism

The spleen is involved in producing protective humoral antibodies, the production and maturation of B and T cells and plasma cells, removal of unwanted particulate matter (eg, bacteria) and also acting as a reservoir for blood cells, especially white cells and platelets.

Splenectomy

Splenectomy may occur in three different ways:

- Planned, where prophylactic measures can be used to prevent later complications.
- Traumatic, due to an accident or during surgery.
- Autosplenectomy, which refers to the physiological loss of spleen function (hyposplenism) - eg, associated with sickle cell anaemia (chronic damage to the spleen results in atrophy), coeliac disease, dermatitis herpetiformis, essential thrombocytopenia and ulcerative colitis.

Indications for splenectomy

- Trauma: 25% of injuries are iatrogenic.
- Spontaneous rupture: this usually occurs in patients with massive splenomegaly (eg, infectious mononucleosis) and is often precipitated by minor trauma.
- Hypersplenism: hereditary spherocytosis or elliptocytosis, idiopathic thrombocytopenic purpura.
- Neoplasia: lymphoma or leukaemic infiltration.
- With other viscera: total gastrectomy, distal pancreatectomy.
- Other indications: splenic cysts, hydatid cysts, splenic abscesses.

Complications of splenectomy

- Thrombocytosis: platelet count usually peaks after 7-10 days. There is no evidence of an increased risk of thromboembolic disease but prophylactic aspirin may be considered for very high platelet counts.
- Overwhelming post-splenectomy infection:
  - Due to encapsulated bacteria such as Streptococcus pneumoniae, Haemophilus influenzae and Neisseria meningitidis.
  - Occurs post-splenectomy in 4% of patients without prophylaxis.
  - The greatest risk of mortality is in the first two years and is estimated at 50%.
  - Management: immunisation and antibiotic prophylaxis as outlined under 'Management', below.

Hyposplenism

Causes

- Operative splenectomy: for severe splenic trauma, splenic cysts, or as part of a resective procedure for an abdominal tumour.
- Functional hyposplenism: sickle cell anaemia (HbSS) disease and haemoglobin sickle-C (HbSC) disease, thalassaemia major, essential thrombocytopenia, and lymphoproliferative diseases (Hodgkin's lymphoma and non-Hodgkin's lymphoma, chronic lymphocytic leukaemia (CLL)), coeliac disease, inflammatory bowel disease. Often, Howell-Jolly bodies on peripheral blood film give an important clue to diagnosing hyposplenism.
- Bone marrow transplantation: splenic irradiation or chronic graft-versus-host disease.
- Congenital asplenia: associated with cardiac abnormalities and biliary atresia.

Investigations

- Blood film: features of hyposplenism include Howell-Jolly bodies, Pappenheimer bodies, target cells and irregular contracted red blood cells.
- Imaging techniques: ultrasound, CT scanning, and MRI scanning.
- Other investigations, which will depend on the clinical context.

Complications of hyposplenism

- Fulminant, potentially life-threatening infection is a major long-term risk of hyposplenism; yet, such infection is largely preventable.
- The most common infection is pneumococcal infection (mortality up to 60%), followed by H. influenzae type b (Hib - less common but significant in children), and N. meningitidis.
- Other infections include Escherichia coli, malaria, babesiosis, and Capnocytophaga canimorsus (associated with dog bites).
- Asplenic patients should be strongly advised of the increased risk of severe falciparum malaria, should take all antimalarial precautions/prophylaxis and ideally avoid holidays in malaria-endemic areas.

Management
In summary the management can be considered to be two-fold:

1. Immunisations
2. Antibiotic prophylaxis

**Immunisations**
National guidelines recommend the following:[1, 2]

- All routine vaccines, including live vaccines such as measles, mumps and rubella (MMR) can be given safely to children or adults with an absent or dysfunctional spleen.
- Asplenia or hyposplenism is not a contra-indication for live vaccinations prior to travel (eg, yellow fever and live oral typhoid vaccine).
- Delay live vaccines if the patient has received immunosuppressants: delay vaccination for three months after stopping systemic steroids (eg, adults 40 mg prednisolone per day for more than one week, children following a daily dose of 2 mg/kg/day for more than one week, or 1 mg/kg/day for more than one month), delay six months after treatment with chemotherapy/radiotherapy and/or other immunosuppressants (eg, methotrexate, ciclosporin, etc) and 12 months after stopping all immunosuppressants for bone marrow transplant (longer if there is evidence of graft-vs-host disease). Further details are in the Green Book (Chapter 6).[3]
- All vaccines should be given at least two weeks before splenectomy if possible. Following splenectomy, functional antibody responses are better with delayed (14-day) vaccination. All other non-immunised patients at risk should be immunised at the first opportunity.
- Re-immunisation of asplenic patients is currently recommended every five years. However, antibody levels may decline more rapidly, particularly in patients with sickle cell anaemia and lymphoproliferative disorders. Re-immunisation in these patients may be made on the basis of antibody levels.
- Children under 2 years of age have a reduced ability to mount an antibody response to polysaccharide antigens and are, therefore, at particular risk of vaccine failure. The newer conjugate 7-valent vaccine (called PC7, as it affords protection against seven disease-causing strains of pneumococcus), produces better response in the under-2s so should be used where available in this age group and in other individuals at particularly high risk.[4]
- Hib vaccination - give to all unimmunised patients but re-immunisation is not currently recommended.

**Summary of vaccinations**[5]
Influenza vaccination - annual influenza vaccination is recommended after 6 months of age.

**Diagnosed under 6 months of age**

- Routine immunisations and MenB vaccine (2, 3 and 4 months); followed by boosters at age 12 months, as per guidelines (Hib/MenC, PCV13 and MMR). However, for this group of patients, extra boosters for MenB, PCV13 and MenACWY should be given at about 14 months (two months after the age 12 months boosters).
- If routine immunisations have already started then give the three doses of MenB with at least one month in between.
- MenC should have been given with the routine immunisations and infants should be given an extra dose of MenACWY after one month.
- If no MenC has been given, give two doses of MenACWY at least one month in between.
- After the age of 24 months, an extra dose of Hib/MenC and the pneumococcal polysaccharide vaccine (PPV23) should be given.

**Diagnosed between 6-11 months**

- Two doses of MenB at least two months apart (second one can form part of the age 12 months booster).
- If MenC is not given within the routine schedule, give two doses of MenACWY at least one month apart. If it has already been given then give a further dose one month afterwards.
- At age 12 months, boosters as per routine vaccinations (see above). Again, follow with MenACWY and PCV13 at 14 months.
- After the age of 24 months, an extra dose of Hib/MenC and the PPV23 should be given. A MenB booster should also be given.

**Diagnosis at 12-23 months**

- Routine age 2 months boosters if not already had.
- At 14 months, give MenACWY vaccine and PCV13 (as in first section above).
- Two doses of MenB vaccine should be given with a minimum of two months in between.
- After 24 months, give an extra dose of Hib/MenC with PPV23.
- An extra dose of MenB vaccine is recommended (at least 12-23 months after the initial course).

**Diagnosis over 24 months**

- Check routine immunisations from birth and boosters have been given.
- Extra dose of Hib/MenC and a first dose of MenB and PPV23.
- Two months following the Hib/MenC booster administer MenACWY conjugate vaccine and a second dose of MenB.

If validated assays are available then it is recommended that response to pneumococcal vaccination and timing for repeat doses be checked.[1]
**Lifelong prophylactic antibiotics**

These are recommended in patients at high risk of pneumococcal infections and the antibiotics of choice are oral phenoxymethylpenicillin or macrolides.\(^1\) Patients developing infection, despite measures, must be given systemic antibiotics and admitted urgently to hospital.

- Risk factors for high risk in hyposplenism include:
  - Age <16 years or >50 years.
  - Poor response to pneumococcal vaccination.
  - Previous invasive pneumococcal illness.
  - Underlying haematological malignancy resulting in splenectomy (increased risk if immunosuppressed).

- Risk is greatest in the first two years post-splenectomy but continues throughout life (it certainly doesn't stop at age 16).
- Use phenoxymethylpenicillin (adult 250-500 mg bd - although 500 mg od may be more realistic if compliance is a particular problem), amoxicillin (adult 250-500 mg daily), erythromycin (adult 250-500 mg daily) orally. Reduce the dose for children. Antibiotics may need to be altered due to differing local antibiotic sensitivities - on the advice of the local public health department.
- Consider recommending that the patient take a full therapeutic dose of antibiotics if they develop infective symptoms such as pyrexia, malaise, shivering, etc and that they seek medical advice immediately.
- Allowing patients to have a reserve supply of antibiotics at home or on holiday may also seem appropriate.
- Pneumococcal resistance to penicillins remains low in the UK. Knowledge of local resistance patterns should be used to guide the choice of antibiotic.\(^1\)
- If not deemed to be high-risk then the pros and cons of taking lifelong antibiotic prophylaxis need to be discussed with each individual patient.

Implementation of these guidelines in the UK needs improvement.\(^{5, 6}\) Only 54% of a sample of 974 post-splenectomy patients had received pneumococcal and Hib vaccinations and were taking antibiotic prophylaxis.\(^5\) A case can therefore be made for the establishment of a disease register of hyposplenic patients and for regular auditing.\(^1\) The British Committee for Standards in Haematology recommends the following:\(^1\)

- Patients should be given written information and carry a card to alert health professionals to the risk of overwhelming infection. Patients should wear an alert bracelet or pendant.
- Patients should be aware of the potential risks of overseas travel, particularly with regard to malaria and unusual infections - eg, those resulting from animal bites.
- Patient records should be clearly labelled to indicate the underlying risk of infection. Vaccination and re-vaccination status should be clearly and adequately documented.

**Further reading & references**

1. Review of guidelines for the prevention and treatment of infections in patients with an absent or dysfunctional spleen; British Committee for Standards in Haematology (2011)
2. 2013 IDSA Clinical Practice Guideline for Vaccination of the Immunocompromised Host; Clinical Infectious Diseases (Dec 2013)
3. Immunisation against infectious disease - the Green Book (latest edition); Public Health England

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**Document ID:** 1057 (v25)  
**Last Checked:** 24/02/2015  
**Next Review:** 23/02/2020

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