7

Immunisation of individuals with underlying medical conditions

Introduction

Some medical conditions increase the risk of complications from infectious diseases, and children and adults with such conditions should be immunised as a matter of priority. These groups may also require additional vaccinations or additional doses of vaccines to provide adequate protection.

Immunosuppression

Although many live vaccines are contra-indicated in immunosuppressed individuals (see **Chapter 6**: Contraindications and special considerations), individuals with immunosuppression and HIV infection (regardless of CD4 count) should be given all inactivated vaccines in accordance with national recommendations. However, these individuals may not mount as good an antibody response as immunocompetent individuals. As immunosuppressed individuals, including those with complement defects, are at particular risk from certain infections additional vaccines should be offered (see below). Household and close contacts of immunosuppressed individuals may also require additional vaccines (see below).

Wherever possible, immunisation or boosting of immunosuppressed or HIV-positive individuals should be either carried out before immunosuppression occurs or deferred until an improvement in immunity has been seen. The optimal timing for any vaccination should be based upon a judgement about the relative need for rapid protection and the likely response. For individuals due to commence immunosuppressive treatments, inactivated vaccines should ideally be administered at least two weeks before commencement. In some cases this will not be possible and therefore vaccination may be carried out

at any time and re-immunisation considered after treatment is finished and recovery has occurred.

Data on long-term antibody levels following vaccination of severely immunosuppressed individuals is limited. Additional booster doses should be considered, depending on the person's underlying condition. In patients who receive bone marrow transplants, any protective antibodies from exposure or vaccination prior to transplantation are likely to be lost and it is unclear whether the recipient acquires the donor's immunity. All such individuals should be considered for a re-immunisation programme after treatment is finished. Specialist advice may be required.

Some new biological therapies, such as those used in auto-immune disorders, are monoclonal antibodies directed against certain components of the immune system. Patients on biologics may therefore be at increased the risk of certain infections or may respond more poorly to vaccination, and should be considered for additional vaccination. In particular, individuals receiving complement inhibitor therapy (Eculizumab) are at heightened risk of meningococcal infection and should be vaccinated with both MenACWY and MenB vaccines, ideally at least two weeks prior to commencement of therapy.[1] Eculizumab (Soliris®) acts by down regulating the terminal complement component and patients are not at increased risk of pneumococcal disease.

Further guidance for the immunisation of HIV-infected individuals is provided by the British HIV Association (BHIVA; **http://www.bhiva.org/vaccination-guidelines.aspx**) and CHIVA (**http://www.chiva.org.uk/guidelines/immunisation/**).

Asplenia (absent or dysfunctional spleen)

Individuals with an absent or dysfunctional spleen are at increased risk of severe infection, particularly those caused by encapsulated bacteria. The commonest organism associated with severe infection in these patients is the pneumococcus (*Streptococcus pneumoniae*) but other organisms also appear to be a more common cause of overwhelming infection in these patients, including *Haemophilus influenzae* type b (Hib) and Neisseria meningitidis. In addition to surgical splenectomy, certain conditions, such as sickle cell disease and other haemoglobinopathies, are accompanied by functional hyposplenism. Around 30% of adults with coeliac disease have defective splenic function.

1 Summary of Product Characteristics for Soliris®, Alexion Europe, 2012.

All patients with absent or dysfunctional spleens should be fully vaccinated according to the national schedule. Because of the high risk of overwhelming infection, vaccination against pneumococcal infection is recommended for all individuals who have or are at high risk of developing splenic dysfunction (including coeliac disease) in the future. Given the high risk of secondary bacterial infection, annual influenza vaccine is also recommended for these patients.

Additional vaccination against *Haemophilus influenzae* type b, and against meningococcal groups A, C, W, Y and B should be offered to patients with absent or dysfunctional spleens, at appropriate opportunities. Hyposplenism in coeliac disease is uncommon in children, and the prevalence correlates with the duration exposure to gluten (Di Sabatino A, 2013). Therefore patients diagnosed with coeliac disease early in life and well managed are unlikely to require these additional vaccines. Only those with known splenic dysfunction should be vaccinated.

A practical schedule for vaccinating asplenic patients, depending on the age of diagnosis is shown in table 7.1. Data on long-term antibody levels in asplenic patients are limited. Additional booster doses should be considered, depending on the person's underlying condition. Specialist advice may be required.

Prematurity

It is important that premature infants have their immunisations at the appropriate chronological age, according to the schedule. Advice on the use of prophylactic paracetamol should be followed as recommended for term infants. As the benefit of vaccination is high in this group of infants, vaccination should not be withheld or delayed.

The occurrence of apnoea following vaccination is especially increased in infants who were born very prematurely. Very premature infants (born $\leq$ 28 weeks of gestation) who are vaccinated in hospital should have respiratory monitoring for 48-72 hrs when given the first dose, particularly those with a previous history of respiratory immaturity. If the child has apnoea, bradycardia or desaturations after the first immunisation, the second immunisation should also be given in hospital, with respiratory monitoring for 48-72 hrs (Pfister *et al*., 2004; Ohlsson *et al*., 2004; Schulzke *et al*., 2005; Pourcyrous *et al*., 2007; Klein *et al*., 2008).

Specific indications for immunisation of other vulnerable groups

The following list of medical conditions or treatments may increase the risk of complications from certain infectious diseases. Individuals who have such conditions or receive such treatments may require additional protection, as recommended in the appropriate chapters:

Asplenia or dysfunction of the spleen (including sickle cell and coeliac disease) (see Box 7.1 below)

- *Haemophilus influenzae* type b (Hib) (see **Chapter 16**)
- influenza vaccine (see **Chapter 19**)
- meningococcal vaccines (see **Chapter 22**)
- pneumococcal vaccine (see **Chapter 25**).

Cerebrospinal fluid leaks

- pneumococcal vaccine (see **Chapter 25**).

Chronic heart disease

- influenza vaccine (see **Chapter 19**)
- pneumococcal vaccine (see **Chapter 25**).

Chronic kidney disease (including haemodialysis patients)

- hepatitis B vaccine (see **Chapter 18**)
- influenza vaccine (see **Chapter 19**)
- pneumococcal vaccine (see **Chapter 25**)

Chronic liver disease

- hepatitis A vaccine (see **Chapter 17**)
- hepatitis B vaccine (see **Chapter 18**)
- influenza vaccine (see **Chapter 19**)
- pneumococcal vaccine (see **Chapter 25**)

Chronic neurological disease

- influenza vaccine (see **Chapter 19**)
- pneumococcal vaccine (see **Chapter 25**).

Chronic respiratory disease

- influenza vaccine (see **Chapter 19**)

- pneumococcal vaccine (see **Chapter 25**).

Cochlear implants

- pneumococcal vaccine (see **Chapter 25**).

Complement disorders (including those receiving complement inhibitor therapy) (see Box 7.1 below)

- Haemophilus influenzae type b (Hib) (see **Chapter 16**)
- meningococcal vaccine (see **Chapter 22**)
- pneumococcal vaccine (see **Chapter 25**).

Diabetes

- influenza vaccine (see **Chapter 19**)
- pneumococcal vaccine (see **Chapter 25**).

Haemophilia (follow advice on route of administration in Chapter 4[2])

- hepatitis A vaccine (see **Chapter 17**)
- hepatitis B vaccine (see **Chapter 18**)

Immunosuppression (due to disease or treatment)

- influenza vaccine (see **Chapter 19**)
- pneumococcal vaccine (see **Chapter 25**).

Morbid obesity

- influenza vaccine (see **Chapter 19**).

Other methods of protecting vulnerable individuals

To reduce the risk of vulnerable individuals being exposed to vaccine preventable conditions, all household and close contacts of immunosuppressed individuals should be fully vaccinated according to the national schedule. Most live vaccines can be safely given to close contacts of immunosuppressed individuals; although some additional precautions are advised (see **Chapter 6**: Contraindications and special considerations). Close contacts of patients with severe immunosuppression (i.e. those who would normally be in isolation) should not be given live attenuated influenza vaccine but receive the inactivated vaccine instead.

2 Vaccines normally given by the intramuscular route should be given by deep subcutaneous injection

In addition to routine vaccination, annual influenza vaccination should also be offered to contacts of immunocompromised individuals, including their carers (see **Chapter 19**). As measles and chickenpox infections can be severe, or even fatal, in immunosuppression, susceptible contacts of immunosuppressed individuals should be offered measles-mumps-rubella (MMR) vaccine (see **Chapter 21**) and varicella vaccine (see **Chapter 34**).

Immunosuppressed individuals (as above) can also be protected against some infections by the administration of passive antibody. After exposure to measles or chickenpox, such individuals should be considered for an injection of the appropriate preparation of immunoglobulin (varicella zoster immunoglobulin (VZIG) for chickenpox (see **Chapter 34**) or intravenous normal immunoglobulin for measles (see **Chapter 21**). As administration of these products should be undertaken promptly, it is important to ensure that any past history of measles and varicella disease and/or vaccination is documented and antibody testing may be indicated. This will help during the assessment and management of possible exposure incidents.

Individuals exposed to chickenpox may also benefit from prophylactic acyclovir at a dose of 40mg/kg per day in four divided doses (Kumagai *et al*., 1999). This may be considered in addition to VZIG or as an alternative when VZIG is not indicated. Treatment with acyclovir should also be commenced promptly in this group.

Prophylaxis with immunoglobulins other antibiotic or antiviral drugs may also be indicated in immunosuppressed or other vulnerable individuals exposed to infections such as hepatitis A (see **Chapter 17**), pertussis (see **Chapter 24**) or influenza (see **Chapter 19**). Advice on the management of exposed individuals should be sought from the local health protection team.

Antibiotic prophylaxis (usually phenoxymethyl penicillin) is advisable for asplenic and hyposplenic patients and for patients with complement disorders. Guidelines on patients with splenic dysfunction have been published (Davies *et al*., 2011) and patient resources are available (details at the end of this chapter).

Box 7.1 Practical schedule for immunising individuals with asplenia, splenic dysfunction or complement disorders (including those receiving complement inhibitor therapy*).

First diagnosed under 1 year of age

Children should be fully immunised according to the national schedule, and should also receive:

- two doses of MenACWY vaccine at least one month apart during infancy;
- one additional dose of PCV13* and one dose of MenACWY conjugate vaccine two months after the 12-month vaccinations; and
- one additional dose of Hib/MenC and one dose of PPV23[1] after the second birthday.

First diagnosed at 12-23 months of age

If not yet administered, give the routine 12-month vaccines: Hib/MenC, PCV13, MMR and MenB, plus:

- one additional dose of PCV13* and one dose of MenACWY conjugate vaccine two months after the 12-month vaccinations; and
- one additional dose of Hib/MenC and one dose of PPV23*,** after the second birthday.

If not already received, two primary doses of MenB vaccine should be given two months apart at the same visit as the other vaccinations.

First diagnosed from two years to under ten years of age

Ensure children are immunised according to the national schedule, and they should also receive:

- one additional dose of Hib/MenC and one dose of PPV23*; followed by:
- one dose of MenACWY conjugate vaccine two months later.

If not already received, two primary doses of MenB vaccine should be given two months apart at the same visit as the other vaccinations.

First diagnosed at age ten years onwards

Older children and adults, regardless of previous vaccination, should receive:

- one dose of Hib/MenC and one dose of PPV23*; followed by:
- one dose of MenACWY conjugate vaccine one month later.

If not already received, two primary doses of MenB vaccine should be given one month apart at the same visit as the other vaccinations.

All patients

- Annual influenza vaccine each season (see **Chapter 19**)

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* Patients on Eculizumab (Soliris®) therapy are not at increased risk of pneumococcal disease and do not require PPV23 or additional doses of PCV13.

** Patients with splenic dysfunction should receive boosters of PPV at five yearly intervals.

Resources

The Public Health England leaflet and card for patients who have had their spleen removed, whose spleen isn't present or doesn't work can be accessed here:

https://www.gov.uk/government/publications/splenectomy-leaflet-and-card

The NHS Health Scotland *A guide for people without a working spleen 2015* can be accessed here:

http://www.healthscotland.com/documents/25070.aspx

The Welsh Government *A guide for people without a working spleen* (2012) can be accessed here:

http://www.healthchallengewales.org/document/242901

In Northern Ireland, '*Splenectomy factsheet for health professionals*', '*Splenectomy patient leaflet*' and a Splenectomy wallet card for patients are available from The Public Health Agency:

http://www.publichealth.hscni.net/publications/splenectomy-factsheet-health-professionals

http://www.publichealth.hscni.net/publications/splenectomy-patient-leaflet

http://www.publichealth.hscni.net/publications/splenectomy-wallet-card

References

Davies JM, Lewis MP, Wimperis J *et al*. (2011) Review of guidelines for the prevention and treatment of infection in patients with an absent or dysfunctional spleen: prepared on behalf of the British Committee for Standards in Haematology by a working party of the Haemato-Oncology task force. *Br J Haematol* **155**(3): 308-17.

Di Sabatino A, Brunetti L, Carnevale Maffè G, Giuffrida P, Corazza GR. Is it worth investigating splenic function in patients with celiac disease? *World J Gastroenterol* 2013; 19(15): 2313-2318 Available from: URL: http://www.wjgnet.com/1007-9327/full/v19/i15/2313.htm DOI: **http://dx.doi.org/10.3748/wjg.v19.i15.2313**.

Klein NP, Massolo ML, Greene J *et al.* (2008) Risk factors for developing apnea after immunization in the neonatal intensive care unit. *Pediatrics* **121**(3): 463-9.

Kumagai T, Kamada M, Igarashi C *et al*. (1999) Varicella-zoster virus-specific cellular immunity in subjects given acyclovir after household chickenpox exposure. *J Infect Dis* **180**(3): 834–7.

Ohlsson A and Lacy JB (2004) Intravenous immunoglobulin for preventing infection in preterm and/or low-birth-weight infants. *Cochrane Database Syst Rev* (1): CD000361.

Pfister RE, Aeschbach V, Niksic-Stuber V *et al.* (2004) Safety of DTaP-based combined immunization in very-low-birth-weight premature infants: frequent but mostly benign cardiorespiratory events. *J Pediatr* **145**(1): 58-66.

Pourcyrous M, Korones SB, Arheart KL *et al.* (2007) Primary immunization of premature infants with gestational age <35 weeks: cardiorespiratory complications and C-reactive protein responses associated with administration of single and multiple separate vaccines simultaneously. *J Pediatr* **151**(2): 167-72.

Schulzke S, Heininger U, Lucking-Famira M *et al.* (2005) Apnoea and bradycardia in preterm infants following immunisation with pentavalent or hexavalent vaccines. *Eur J Pediatr* **164**(7): 432-5.