Measles

This disease is notifiable in the UK, see [1]. Measles is the archetypal childhood infection - whilst self-limiting in most, it is not a trivial disease, with complications in about 10% requiring hospital admission, and fatality rates of 1 per 5,000 in the UK. Immunisation programmes in the UK and elsewhere had limited many modern clinicians’ exposure to the disease. Falls in the uptake of immunisation following inappropriate concerns about the measles, mumps and rubella (MMR) vaccine safety have increased the susceptible population; however, it is hoped this was addressed by a vaccine catch-up programme and patient education about the vaccination.

The European region of the World Health Organization (WHO) set a target for the elimination of measles from Europe by 2010 but this target was not met and the target date was reset to 2015; [2, 3]. In fact measles has been on the rise since 2008 in several regions including Europe, North America and Southeast Asia. WHO attributes much of this reversal of progress to the global economic situation. [4]

Transmission

- Measles is an acute infection caused by a single-stranded RNA *Morbillivirus* from the paramyxovirus family.
- It is one of the most contagious infectious diseases.
- Transmission is airborne via respiratory droplets.
- These spread to surfaces and the virus can remain transmissible for up to two hours, removing the need for direct person-to-person contact.
- The infection has an average incubation period of 10-12 days (range 7-18 days) and infectivity lasts from four days before, until four days after the rash of measles appears. [6]

Epidemiology

- The epidemiology of measles is affected by uptake of vaccination. With extra efforts being made to improve the efficacy of vaccination programmes and a recovery of uptake after vaccine scares, the rates of confirmed measles are reducing in the UK.
- Measles is still the leading cause of vaccine-preventable childhood mortality in the world.
- Coverage of the MMR vaccine in England for children reaching their second birthday was 92.3% in 2012-13 compared to 91.2% in 2011-12. This was the highest level of MMR coverage since the vaccine was first introduced in 1988. [7]
- The number of people with confirmed measles in England and Wales in 2013 was 1,843. This compares to a total of 2,030 in 2012. [8]
- In the USA, endemic measles has been virtually eradicated although imported measles still occasionally occurs due to international travel and visitors from abroad. [9]

Presentation

The following features are strongly suggestive of measles:

- Rash for at least three days.
- Fever for at least one day and at least one of the following:
  - Cough
  - Coryza
  - Conjunctivitis
Prodrome:
- This lasts 2-4 days with fever, cough, runny nose, mild conjunctivitis and diarrhoea.
- Koplik's spots are pathognomonic and appear on the buccal mucosa - opposite the second molar teeth - as small, red spots, each with a bluish-white speck (sometimes compared with a grain of rice) in the centre. They occur in 60-70% of patients during the prodrome and for up to 2-3 days after the rash disappears.

Rash (morbilliform = measles-like):
- This is first seen on the forehead and neck and spreads, involving the trunk and finally the limbs, over 3-4 days. It may become confluent in some areas.
- The rash then fades after 3-4 days in the order of its appearance.
- It leaves behind a brownish discoloration, sometimes accompanied by fine desquamation.

- Often, there is high fever (may be >40°C) and a non-productive cough, with the patient being clearly ill.
- Also, swelling around the eyes and photophobia may be present.

Clinical recovery in uncomplicated measles tends to occur soon after the appearance of the rash.

Investigations
Case definition of measles helps to identify cases for notification but clinical diagnosis is unreliable, particularly in countries with low incidence of the disease, so laboratory confirmation is required.

Laboratory diagnosis of measles:
- Salivary swab or serum sample for measles-specific immunoglobulin M (IgM) taken within six weeks of onset.
- RNA detection in salivary swabs or other samples.

Differential diagnosis
- Rubella.
- Parvovirus B19.
- Enterovirus.
- Scarlet fever.
- Human herpesvirus type 7.
- Kawasaki disease.
- Meningococcaemia.
- Toxic shock syndrome.
- Dengue fever.
- Human immunodeficiency virus (HIV).
- Secondary syphilis.
- Drug allergy.

Management
There can be significant public health implications and these need careful consideration as a matter of urgency alongside management of the affected individual.

Individual management
- Uncomplicated measles is usually self-limiting and treatment is mainly symptomatic, with paracetamol or ibuprofen and with plenty of fluids. Patients should remain at home to limit disease spread.
- Monitor patients carefully for signs of complications and consider hospitalisation if these appear.
Public health management[2]

Even in countries with a low incidence, suspected cases of measles require urgent public health action. Appropriate public health measures are detailed in Public Health England (PHE) guidance. The rationale for this is clear and worthy of defining:

- Early detection of outbreaks can prompt vaccination campaigns to limit spread where appropriate.
- Vulnerable contacts (infants, pregnant women and immunocompromised individuals) should be identified for post-exposure prophylaxis where appropriate.
- Any susceptible healthcare workers need urgent assessment because they can be a source of transmission.
- Even healthy contacts (including unimmunised children and adults) may benefit from post-exposure vaccination.

Complications

Rates of complications vary by age, geographical region and outbreak. They increase where factors such as co-existent immunodeficiency, malnutrition, vitamin A deficiency, pregnancy and high exposure levels due to overcrowding exist.

Respiratory

- **Bronchopneumonia** occurs in up to 5% of cases, producing serious respiratory difficulties and it accounts for 56-86% of deaths. The infecting organism is usually *Staphylococcus aureus* or secondary viral infection with herpes simplex or adenovirus. Lobar pneumonia can occur and is caused by *Streptococcus pneumoniae*. Other secondary bacterial infections include cervical adenitis and otitis media.
- Giant cell pneumonitis in immunocompromised patients presents 2-3 weeks following infection with measles, with worsening breathing.

Neurological

Measles is associated with three different encephalitic diseases:

- Acute demyelinating encephalitis - this occurs in 1/1,000 cases of infection. It occurs within two weeks of the rash appearing, usually with seizures often accompanied by fever, irritability, headache and changing consciousness that may progress to coma. It is believed to be a neuro-allergic process. It carries a 10-15% mortality rate and 25% of children have permanent brain damage. Treatment is supportive with no clear benefit from dexamethasone. Intravenous methylprednisolone, intravenous immunoglobulin G and plasmapheresis are occasionally of benefit.
- Subacute sclerosing panencephalitis - this is a rare complication occurring in 0.001% of infected children in developed countries. It is more common in boys and, where the initial infection occurs before the age of 2, onset is usually 5-10 years after apparently normal measles, with disturbance in intellect and personality, behavioural disorders and worsening school work. This is followed by seizures, signs of extrapyramidal and pyramidal disease and, finally, decerebrate rigidity and death. Trials of treatment with interferon, ribavirin and isoprinosine have reported some success.
- Measles inclusion body encephalitis - this occurs in the immunocompromised 1-7 months following exposure and is progressive over months. It is largely fatal and, of the approximate 15% of survivors, all will have neurological sequelae.

The reduced incidence of measles, brought about by vaccination, has caused the almost total disappearance of subacute sclerosing panencephalitis in England and Wales.

Gastrointestinal

Measles is commonly accompanied by diarrhoea due to secondary bacterial or protozoal infections. This is particularly significant in malnourished individuals. Clinical hepatitis and hypocalcaemia may also occur, more usually in adults.
Vitamin A deficiency and blindness

Those with borderline vitamin A deficiency are at greater risk of death and blindness from measles. Vitamin A deficiency manifests itself as xerophthalmia and is an important cause of blindness worldwide. The WHO recommends high-dose vitamin A for all children with measles in countries where the case fatality rate is greater than 1%.

Vitamin A is sometimes used to reduce the risk of complications in people with confirmed measles. [18, 19]

Immunodeficiency

Infants and adults show delayed recovery from the lymphopenia that infection with measles causes. Even after lymphocyte counts have normalised, immunodeficiency persists for many weeks and this is thought to be a major contributor to the high all-cause mortality following acute measles worldwide.

Obstetric

Like many infections, measles can be more severe in pregnancy, as a potentially fatal pneumonitis may follow. Measles is also associated with increased risk of miscarriage, prematurity, and low birth weight, but not with congenital malformation.

Prognosis

Disease severity varies from mild (usually in the well-fed child) to severe (usually in the malnourished or immunosuppressed patient). However, severe measles can occasionally present in a previously healthy child and particularly in young adults who have not been vaccinated or exposed to the virus naturally.

- In the West, mortality is <0.05% of cases. [20]
- Worldwide, measles is the leading cause of vaccine-preventable death. [21]
- Complication and mortality rates are highest in infancy and lowest in those aged 1-9 years, before rising again into adulthood.

Prevention

- The measles vaccine and vitamin A are proven effective interventions to prevent measles mortality in children. [22]
- See separate Measles, Mumps and Rubella (MMR) Vaccination article.

Post-exposure prophylaxis

- MMR vaccination may be effective if given to those who are susceptible (over 6 months old), ideally within 72 hours of exposure.
- If the individual is already incubating measles, mumps or rubella, the MMR vaccination will not exacerbate the symptoms.
- As response to MMR in infants is sub-optimal, where the vaccine has been given before 12 months of age, immunisation with two further doses of MMR should be given at the normal ages.
- Human normal immunoglobulin should be considered within five days of exposure for children and adults with compromised immune systems.
- Pregnant women who are exposed to measles may also be considered for intramuscular normal immunoglobulin.
- A very high proportion of pregnant women will be immune and therefore normal immunoglobulin is only offered to women who are likely to be susceptible.
- Recommendations for post-exposure prophylaxis for infants, immunosuppressed and pregnant contacts have recently been changed. [23]

Further reading & references

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