

# 32

## Tuberculosis

NOTIFIABLE

### The disease

Human tuberculosis (TB) is caused by infection with bacteria of the *Mycobacterium tuberculosis* complex (*M. tuberculosis*, *M. bovis* or *M. africanum*) and may affect almost any part of the body. The most common form is pulmonary TB, which accounts for almost 60% of all cases in the UK (Table 32.1). Non-respiratory forms of TB are more common in young children in communities with connections to areas of the world with high prevalence, and in those with impaired immunity.

The symptoms of TB are varied and depend on the site of infection. General symptoms may include fever, loss of appetite, weight loss, night sweats and lassitude. Pulmonary TB typically causes a persistent productive cough, which may be accompanied by blood-streaked sputum or, more rarely, frank haemoptysis. Untreated, TB in most otherwise healthy adults is a slowly progressive disease that may eventually be fatal.

Almost all cases of TB in the UK are acquired through the respiratory route, by breathing in infected respiratory droplets from a person with infectious respiratory TB. Transmission is most likely when the index case has sputum that is smear positive for the bacillus on microscopy, and often after prolonged close contact such as living in the same household.

The initial infection may:

- be eliminated
- remain latent – where the individual has no symptoms but the TB bacteria remain in the body, or
- progress to active TB over the following weeks or months.

Latent TB infection may reactivate in later life, particularly if an individual's immune system has become weakened, for example by disease (e.g. HIV), certain medical treatments (e.g. cancer chemotherapy, corticosteroids) or in old age.

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Table 32.1 Site of disease in cases of TB occurring in England, Wales and Northern Ireland in order of frequency (Health Protection Agency, Enhanced Tuberculosis Surveillance, data for 2001)

Site of disease	Number of cases	% of total cases
Pulmonary	3907	59.4
Extra-thoracic lymph nodes	1066	16.2
Pleural	484	7.4
Intra-thoracic lymph nodes	475	7.2
Bone/joint	310	4.7
Gastro-intestinal	227	3.5
Genito-urinary	115	1.7
Miliary	106	1.6
Meninges	99	1.5
CNS (other than meningitis)	52	0.8
Cryptic	49	0.7
Laryngeal	12	0.2
Other	452	6.9

### History and epidemiology of the disease

Notifications of TB declined in the UK over most of the last century (Figure 32.1). In 1913, the first year of statutory notification, 117,139 new TB cases were recorded in England and Wales; the lowest number of reported cases (5086) was in 1987. Since then, new reported cases rose by nearly 40% to around 7000 in 2004 in England and Wales. In London, the numbers doubled, accounting for almost 3000 (40%) of the national total in 2004. In Scotland, the number of new cases remains relatively constant at around 400 each year.

The epidemiological changes in the UK have occurred against a background of deteriorating TB control in many parts of the world such that the World Health Organization (WHO) declared TB a global public health emergency in 1993.

The resurgence of TB in some parts of the UK has been associated with changing patterns in its epidemiology. Over the last 50 years, it has moved from a disease that occurred across all parts of the population to one occurring predominantly in specific population subgroups. Rates are higher in certain communities, mainly by virtue of their connections to higher-prevalence areas of the world. In other communities, endemic factors such as homelessness and alcohol misuse are important factors. In 2003, two-thirds of

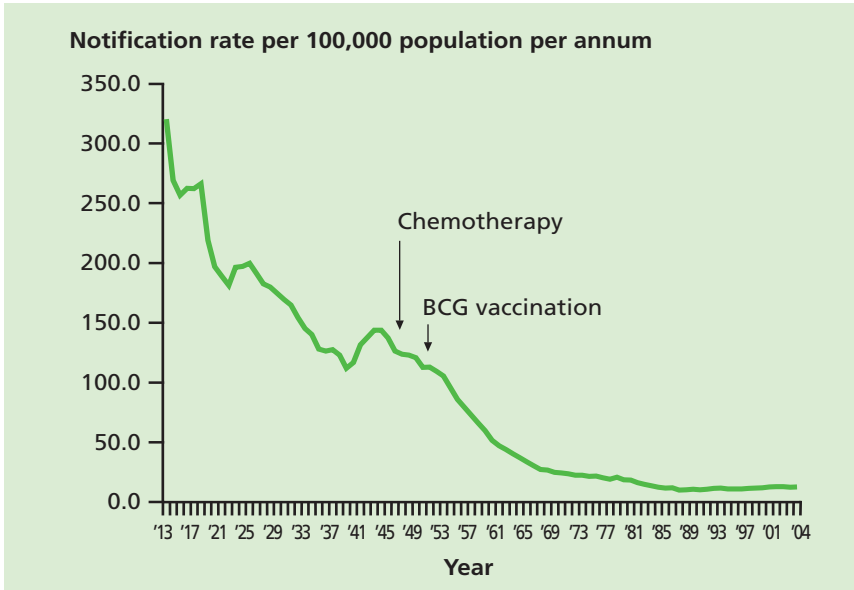


Figure 32.1 Notifications of TB in England and Wales 1913–2004

patients with TB were born abroad (Health Protection Agency, 2003); the proportion is reversed in Scotland. TB is also concentrated in certain areas of the UK, mainly inner city areas.

In the UK, mortality from TB decreased rapidly after the introduction of effective chemotherapy in the 1940s and the introduction of routine adolescent BCG (*Bacillus Calmette-Guérin* vaccine) programmes in 1953. However, there are still around 350 deaths each year either directly due to or associated with TB (Health Protection Agency, 2005). Although levels of drug-resistant and multidrug-resistant TB remain low in the UK, they increased slightly between 1998 and 2003 (Health Protection Agency, 2004).

### The BCG immunisation programme

The BCG immunisation programme was introduced in the UK in 1953 and has undergone several changes since, in response to changing trends in the epidemiology of TB. The programme was initially targeted at children of school-leaving age (then 14 years), as the peak incidence of TB was in young, working-age adults.

In the 1960s, when TB rates in the indigenous population were continuing to decline, rates were shown to be much higher in new immigrants from

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high-prevalence countries and their families. Recommendations were made, therefore, to protect the children of these new entrants, wherever they were born, at the earliest opportunity. As part of this, a selective neonatal BCG immunisation programme was introduced to protect infants born in the UK to parents from high-prevalence countries by vaccinating them shortly after birth.

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By the 1990s, uptake of BCG in schoolchildren aged 10–14 years was around 70%; a further 8% were exempt from immunisation as they were already tuberculin-positive (Department of Health). In 2005, following a continued decline in TB rates in the indigenous UK population, the schools programme was stopped. The BCG immunisation programme is now a risk-based programme, the key part being a neonatal programme targeted at protecting those children most at risk of exposure to TB, particularly from the more serious childhood forms of the disease.

### The Bacillus Calmette-Guérin (BCG) vaccine

BCG vaccine contains a live attenuated strain derived from *M. bovis*. BCG Vaccine Statens Serum Institut (SSI) is the only available licensed vaccine in the UK. It contains the Danish strain 1331. BCG vaccine does not contain thiomersal or any other preservatives. It contains live organisms that have been attenuated (modified).

Studies of the effectiveness of BCG vaccine have given widely varying results, between countries and between studies, ranging from no protection to 70 to 80% protection in UK schoolchildren (Sutherland and Springett, 1987, Rodrigues *et al.*, 1991). However, meta-analyses have shown the vaccine to be 70 to 80% effective against the most severe forms of the disease, such as TB meningitis in children (Rodrigues *et al.*, 1993). It is less effective in preventing respiratory disease, which is the more common form in adults. Protection has been shown to last for 10 to 15 years (WHO, 1999). Data on duration of protection after this time are limited, but protection may wane with time.

There are few data on the protection afforded by BCG vaccine when it is given to adults (aged 16 years or over), and virtually no data for persons aged 35 years or over. BCG is not usually recommended for people aged over 16 years, unless the risk of exposure is great (e.g. healthcare or laboratory workers at occupational risk).

### Storage

The unreconstituted vaccine and its diluent should be stored in the original packaging at +2°C to +8°C and protected from light. All vaccines are sensitive

to some extent to heat and cold. Effectiveness of vaccines cannot be guaranteed unless they have been stored at the correct temperature. Heat speeds up the decline in potency of most vaccines, thus reducing their shelf life. Freezing may cause increased reactivity and loss of potency in some vaccines. It can also cause hairline cracks in the container, leading to contamination of the contents. If the vaccine and/or diluent has been frozen, it must not be used.

The vaccine should be reconstituted with the diluent supplied by the manufacturer and used immediately. Unused reconstituted vaccine should be discarded after four hours. The vaccine is usable for up to four hours at room temperature after reconstitution.

## Presentation

The vaccine is a freeze-dried powder for suspension for injection. BCG Vaccine SSI is supplied in a glass vial containing the equivalent of 10 adult or 20 infant doses, fitted with a bromobutyl rubber stopper which does not contain latex. The powder must be reconstituted with 1ml of the diluted Sauton SSI diluent which is supplied separately.

## Administration of BCG vaccination

In all cases, BCG vaccine must be administered strictly intradermally, normally into the lateral aspect of the left upper arm at the level of the insertion of the deltoid muscle (just above the middle of the left upper arm – the left arm is recommended by WHO). Sites higher on the arm, and particularly the tip of the shoulder, are more likely to lead to keloid formation and should be avoided. Jet injectors and multiple puncture devices should not be used.

The upper arm should be positioned approximately 45° to the body. This can be achieved in older children and adults if the hand is placed on the hip with the arm abducted from the body, but in infants and younger children this will not be possible. For this age group, the arm must be held firmly in an extended position (see Chapter 4).

If the skin is visibly dirty it should be washed with soap and water. The vaccine is administered through either a specific tuberculin syringe or, alternatively, a 1ml graduated syringe fitted with a 26G 10mm (0.45mm × 10mm) needle for each individual. The correct dose (see below) of BCG vaccine should be drawn into the tuberculin syringe and the 26G short bevelled needle attached to give the injection. The needle must be attached firmly and the intradermal injection administered with the bevel uppermost.

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The operator stretches the skin between the thumb and forefinger of one hand and with the other slowly inserts the needle, with the bevel upwards, about 3mm into the superficial layers of the dermis almost parallel with the surface. The needle can usually be seen through the epidermis. A correctly given intradermal injection results in a tense, blanched, raised bleb, and considerable resistance is felt when the fluid is being injected. A bleb is typically of 7mm diameter following a 0.1ml intradermal injection, and 3mm following a 0.05ml intradermal injection. If little resistance is felt when injecting and a diffuse swelling occurs as opposed to a tense blanched bleb, the needle is too deep. The needle should be withdrawn and reinserted intradermally before more vaccine is given.

**No further immunisation should be given in the arm used for BCG immunisation for at least three months because of the risk of regional lymphadenitis. The subject must always be advised of the normal reaction to the injection and about caring for the vaccination site (see below).**

BCG should ideally be given at the same time as other live vaccines such as MMR. If live vaccines cannot be administered simultaneously, a four-week interval is recommended.

### Dosage and schedule

A single dose of:

- 0.05ml for infants under 12 months
- 0.1ml for children aged 12 months or older and adults.

### Disposal

Equipment used for vaccination, including used vials or ampoules, should be disposed of at the end of a session by sealing in a proper, puncture-resistant 'sharps' box (UN-approved, BS-7320).

## Recommendations for the use of the vaccine

The aim of the UK BCG immunisation programme is to immunise those at increased risk of developing severe disease and/or of exposure to TB infection.

BCG immunisation should be offered to:

- all infants (aged 0 to 12 months) living in areas of the UK where the annual incidence of TB is 40/100,000 or greater

- all infants (aged 0 to 12 months) with a parent or grandparent who was born in a country where the annual incidence of TB is 40/100,000 or greater
- previously unvaccinated children aged one to five years with a parent or grandparent who was born in a country where the annual incidence of TB is 40/100,000 or greater. These children should be identified at suitable opportunities, and can normally be vaccinated without tuberculin testing
- previously unvaccinated, tuberculin-negative children aged from six to under 16 years of age with a parent or grandparent who was born in a country where the annual incidence of TB is 40/100,000 or greater. These children should be identified at suitable opportunities, tuberculin tested and vaccinated if negative (see section on tuberculin testing prior to BCG vaccination)
- previously unvaccinated tuberculin-negative contacts of cases of respiratory TB (following recommended contact management advice – see National Institute for Health and Clinical Excellence (NICE), 2006)
- previously unvaccinated, tuberculin-negative new entrants under 16 years of age who were born in or who have lived for a prolonged period (at least three months) in a country with an annual TB incidence of 40/100,000 or greater.

### Individuals at occupational risk

People in the following occupational groups are more likely than the general population to come into contact with someone with TB:

- healthcare workers who will have contact with patients or clinical materials
- laboratory staff who will have contact with patients, clinical materials or derived isolates
- veterinary and staff such as abattoir workers who handle animal species known to be susceptible to TB, e.g. simians
- prison staff working directly with prisoners
- staff of care homes for the elderly
- staff of hostels for homeless people and facilities accommodating refugees and asylum seekers.

Unvaccinated, tuberculin-negative individuals aged under 35 years in these occupations are recommended to receive BCG. There are no data on the protection afforded by BCG vaccine when it is given to adults aged 35 years or over.

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Not all healthcare workers are at an equal risk of TB. There are likely to be categories of healthcare workers who are at particular risk of TB, and should be part of the clinical risk assessment when the use of BCG is being considered for a healthcare worker over 35 years of age.

### Travellers and those going to reside abroad

BCG may be required for previously unvaccinated, tuberculin-negative individuals according to the destination and the nature of travel (Cobelens *et al.*, 2000). The vaccine is recommended for those under 16 years who are going to live or work with local people for more than three months in a country where the annual incidence of TB is 40/100,000 or greater (see Department of Health, 2001, *Health information for overseas travel*, for more information).

### Individual requests for BCG vaccination

People seeking vaccination for themselves or their children should be assessed for specific risk factors for TB. Those without risk factors should not be offered BCG vaccination but should be advised of the current policy and given written information. Further information is available at [www.immunisation.nhs.uk](http://www.immunisation.nhs.uk). People with risk factors should be tuberculin tested and offered BCG vaccination according to local service arrangements.

### Repeat BCG vaccination

Although the protection afforded by BCG vaccine may wane with time, there is no evidence that repeat vaccination offers significant additional protection and repeat BCG vaccination is not recommended.

### Contraindications

The vaccine should not be given to:

- those who have already had a BCG vaccination
- those with a past history of TB
- those with an induration of 6mm or more following Mantoux (SSI) tuberculin skin testing
- those who have had a confirmed anaphylactic reaction to a component of the vaccine
- neonates in a household where an active TB case is suspected or confirmed
- people who are immunocompromised by virtue of disease or treatment, e.g.:

- patients receiving corticosteroid or other immunosuppressive treatment, including general radiation. Inhaled steroids are not a contraindication
- those suffering from a malignant condition such as lymphoma, leukaemia, Hodgkin's disease or other tumour of the reticuloendothelial system.

BCG is contraindicated in symptomatic HIV-positive individuals. In countries such as the UK where the risk of TB is low, it is recommended that BCG is also withheld from all those known to be or suspected to be HIV positive, regardless of clinical status. Where vaccination is indicated, for example infants born to HIV-positive mothers, this can be administered after two appropriately timed negative postnatal PCR tests for HIV infection (see Chapter 6 Contraindications and special considerations).

## Precautions

Minor illnesses without fever or systemic upset are not valid reasons to postpone immunisation.

If an individual is acutely unwell, immunisation should be postponed until they have fully recovered. This is to avoid confusing the differential diagnosis of any acute illness by wrongly attributing any sign or symptoms to the adverse effects of the vaccine.

Individuals with generalised septic skin conditions should not be vaccinated. If eczema exists, an immunisation site should be chosen that is free from skin lesions.

## Pregnancy and breast-feeding

Although no harmful effects on the fetus have been observed from BCG during pregnancy, it is wise to avoid vaccination, particularly in the first trimester, and wherever possible to delay until after delivery. A further tuberculin test may be required if more than three months has elapsed since the test on which a recommendation for BCG was based. Breast-feeding is not a contraindication to BCG.

## Premature infants

It is important that premature infants have their immunisations at the appropriate chronological age, according to recommendations. The occurrence of apnoea following vaccination is especially increased in infants who were born very

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prematurely. The potential risk of apnoea and the need for respiratory monitoring for 48-72 hours should be considered when administering the primary immunisation series to infants who were born very prematurely (born  $\leq$  28 weeks of gestation) and particularly for those with a previous history of respiratory immaturity (Pfister et al., 2004; Ohlsson et al., 2004; Schulzke et al., 2005; Pourcyrus et al., 2007; Klein et al., 2008).

The first immunisation of a child born very prematurely should be administered in hospital.

As the benefit of vaccination is high in this group of infants, vaccination should not be withheld or delayed.

### Previous BCG vaccination

BCG should not be administered to previously vaccinated individuals as there is an increased risk of adverse reactions and no evidence of additional protection. Evidence of a previous BCG vaccination includes: documentary evidence; a clear, reliable history of vaccination; or evidence of a characteristic scar.

Determining a reliable history of BCG vaccination may be complicated by:

- absent or limited documentary evidence
- unreliable recall of vaccination
- absence of a characteristic scar in some individuals vaccinated intradermally
- absence of a scar in a high proportion of individuals vaccinated percutaneously
- use of non-standard vaccination sites.

Individuals with an uncertain history of prior BCG vaccination should be tuberculin tested before being given BCG. The final decision whether to offer BCG, where there is a possible history of previous vaccination but no proof, must balance the risk of possible revaccination against the potential benefit of vaccination and the individual's risk of exposure to TB, particularly in an occupational setting.

### Immunisation reaction and care of the immunisation site

The expected reaction to successful BCG vaccination, seen in 90 to 95% of recipients, is induration at the injection site followed by a local lesion which starts as a papule two or more weeks after vaccination. It may ulcerate and then

slowly subside over several weeks or months to heal, leaving a small, flat scar. It may also include enlargement of a regional lymph node to less than 1cm.

It is not necessary to protect the site from becoming wet during washing and bathing. The ulcer should be encouraged to dry, and abrasion (by tight clothes, for example) should be avoided. Should any oozing occur, a temporary dry dressing may be used until a scab forms. It is essential that air is not excluded. If absolutely essential (e.g. to permit swimming), an impervious dressing may be used but it should be applied only for a short period as it may delay healing and cause a larger scar.

Further observation after routine vaccination with BCG is not necessary, other than as part of monitoring of the quality of the programme, nor is further tuberculin testing recommended.

## Adverse reactions

Severe injection site reactions, large, local discharging ulcers, abscesses and keloid scarring are most commonly caused by faulty injection technique, excessive dosage or vaccinating individuals who are tuberculin positive. It is essential that all health professionals are properly trained in all aspects of the process involved in tuberculin skin tests and BCG vaccination. Training materials for health professionals are available from Department of Health Publications (e-mail: [dh@prolog.uk.com](mailto:dh@prolog.uk.com)). For further information, see [www.immunisation.nhs.uk](http://www.immunisation.nhs.uk).

## Other adverse reactions

Adverse reactions to the vaccine include headache, fever and enlargement of a regional lymph node to greater than 1cm and which may ulcerate.

Allergic reactions (including anaphylactic reactions), more severe local reactions such as abscess formation, and disseminated BCG complications (such as osteitis or osteomyelitis) are rare.

All serious or unusual adverse reactions possibly associated with BCG vaccination (including abscess and keloid scarring) should be recorded and reported to the Commission on Human Medicines through the Yellow Card system, and vaccination protocols and techniques should be reviewed. Every effort should be made to recover and identify the causative organism from any lesion constituting a serious complication.

### Management of adverse reactions

Individuals with severe local reactions (ulceration greater than 1cm, caseous lesions, abscesses or drainage at the injection site) or with regional suppurative lymphadenitis with draining sinuses following BCG vaccination should be referred to a chest physician or paediatrician for investigation and management.

An adherent, suppurating or fistulated lymph node may be incised and drained, and left to heal. There is little evidence to support the use of either locally instilled anti-mycobacterial agents or systemic treatment of patients with severe persistent lesions.

Disseminated BCG infection should be referred to a chest physician or paediatrician for specialist advice and will normally require systemic anti-TB treatment following current guidance for managing *M. bovis* infection (currently Joint Tuberculosis Committee of the British Thoracic Society, 2000, and NICE, 2006).

*In vitro* testing has shown that, for treatment purposes, BCG SSI is susceptible to both isoniazid and rifampicin.

### Overdose

Overdose increases the risk of a severe local reaction and suppurative lymphadenitis, and may lead to excessive scar formation. The extent of the reaction is likely to depend on whether any – and how much – of the vaccine was injected subcutaneously or intramuscularly instead of intradermally.

Any incident resulting in administration of an overdose of BCG vaccine should be documented according to local policy. The vaccine recipient or their carer and the local chest physician should be informed. The clinician should decide whether preventive chemotherapy is indicated and ensure arrangements are made for appropriate monitoring for early signs of an adverse reaction.

### Tuberculin skin testing prior to BCG immunisation – the Mantoux test

**BCG should not be administered to an individual with a positive tuberculin test – it is unnecessary and may cause a more severe local reaction. Those with *strongly* positive tests should be referred to a chest clinic for assessment of the need for further investigation and treatment.**

A tuberculin skin test is necessary prior to BCG vaccination for:

- all individuals aged six years or over
- infants and children under six years of age with a history of residence or prolonged stay (more than three months) in a country with an annual TB incidence of 40/100,000 or greater
- those who have had close contact with a person with known TB
- those who have a family history of TB within the last five years.

BCG can be given up to three months following a negative tuberculin test.

The Mantoux test is used as a screening test for tuberculosis infection or disease and as an aid to diagnosis. The local skin reaction to tuberculin purified protein derivative (PPD) injected into the skin is used to assess an individual's sensitivity to tuberculin protein. The greater the reaction, the more likely it is that an individual is infected or has active TB disease.

**The standard test for use in the UK is the Mantoux test using 2TU/0.1ml tuberculin PPD.**

## Purified protein derivative

### Storage

Tuberculin PPD SSI should be stored in the original packaging at +2°C to +8°C and protected from light. Freezing may cause loss of activity.

### Presentation

Tuberculin PPD SSI is a sterile preparation made from a culture of seven selected strains of *M. tuberculosis*. It is available as a clear colourless to light yellow solution for injection. It is available as 2TU/0.1ml (for routine screening) and 10TU/0.1ml (for clinical diagnostic purposes) and is supplied in glass vials with a chlorobutyl rubber stopper that does not contain latex.

### Dosage

0.1ml of the appropriate tuberculin PPD preparation.

The preparation for routine use and in patients in whom TB is suspected contains 2TU/0.1ml.

A 10TU/0.1ml preparation may be used if a second Mantoux test is required for clinical diagnostic purposes.

### Administration of the Mantoux test

In all cases, the Mantoux test should be administered intradermally (sometimes referred to as intracutaneous administration) normally on the flexor surface of the left forearm at the junction of the upper third with the lower two-thirds.

If the skin is visibly dirty it should be washed with soap and water. The Mantoux test is performed using the 0.1ml tuberculin syringe or, alternatively, a 1ml graduated syringe fitted with a short bevel 26G (0.45mm × 10mm) needle. A separate syringe and needle must be used for each subject to prevent cross-infection. 0.1ml of PPD should be drawn into the tuberculin syringe and the 25G or 26G short bevelled needle attached to give the injection. The needle must be attached firmly and the intradermal injection administered with the bevel uppermost.

The operator stretches the skin between the thumb and forefinger of one hand and with the other slowly inserts the needle, with the bevel upwards, about 3mm into the superficial layers of the dermis almost parallel with the surface. The needle can usually be seen through the epidermis. A correctly given intradermal injection results in a tense, blanched, raised bleb, and considerable resistance is felt when the fluid is being injected. A bleb is typically of 7mm diameter following 0.1ml intradermal injection. If little resistance is felt when injecting and a diffuse swelling occurs as opposed to a tense, blanched bleb, the needle is too deep. The needle should be withdrawn and reinserted intradermally.

Mantoux tests can be undertaken at the same time as inactivated vaccines are administered. Live viral vaccines can suppress the tuberculin response, and therefore testing should not be carried out within four weeks of having received a live viral vaccine such as MMR. Where MMR is not required urgently it should be delayed until the Mantoux has been read (see below).

### Disposal

Equipment used for Mantoux testing, including used vials or ampoules, should be disposed of at the end of a session by sealing in a proper, puncture-resistant 'sharps' box (UN-approved, BS 7320).

### Reading the Mantoux test

The results should be read 48 to 72 hours after the test is taken, but a valid reading can usually be obtained up to 96 hours later. The transverse diameter of the area of induration at the injection site is measured with a ruler and the

result recorded in millimetres. **As several factors affect interpretation of the test, the size of the induration should be recorded and NOT just as a negative or positive result.** The area of erythema is irrelevant.

There is some variability in the time at which the test develops its maximum response. The majority of tuberculin-sensitive subjects will be positive at the recommended time of reading. A few, however, may have their maximum response just before or after the standard time.

## Interpretation of the Mantoux test

For convenience, responses to the Mantoux test are considered in three categories of diameter, divided as follows:

Diameter of induration	Positivity	Interpretation
Less than 6mm	Negative – no significant hypersensitivity to tuberculin protein	Previously unvaccinated individuals may be given BCG provided there are no contraindications
6mm or greater, but less than 15mm	Positive – hypersensitive to tuberculin protein	Should not be given BCG.* May be due to previous TB infection or BCG or exposure to non-tuberculous mycobacteria
15mm and above	Strongly positive – strongly hypersensitive to tuberculin protein	Suggests tuberculosis infection or disease. Should be referred for further investigation and supervision (which may include preventive chemotherapy)

\* When Mantoux tests are being performed as part of an immunisation programme, no further action is required for people with a reaction in this range. In other contexts (e.g. new immigrant screening, contact-tracing programmes), where the subject has not previously been vaccinated with BCG, and taking account of the precise size of the reaction and the circumstances of the case, referral to a chest clinic may be indicated for further investigation.

### Factors affecting the result of the tuberculin test

The reaction to tuberculin protein may be suppressed by the following:

- glandular fever
- viral infections in general, including those of the upper respiratory tract
- live viral vaccines (tuberculin testing should not be carried out within four weeks of having received a live viral vaccine)
- sarcoidosis
- corticosteroid therapy
- immunosuppression due to disease or treatment, including HIV infection.

Subjects who have a negative test but who may have had an upper respiratory tract or other viral infection at the time of testing or at the time of reading should be re-tested two to three weeks after clinical recovery before being given BCG. If a second tuberculin test is necessary it should be carried out on the other arm: repeat testing at one site may alter the reactivity either by hypo- or more often hyper-sensitising the skin, and a changed response may reflect local changes in skin sensitivity only.

For further information and training materials on the administration, reading and interpretation of the Mantoux test, please see [www.immunisation.nhs.uk](http://www.immunisation.nhs.uk).

### Management of suspected cases, contacts and outbreaks

Contacts of cases known to be suffering from active pulmonary TB should be managed according to current guidance (Joint Tuberculosis Committee of the British Thoracic Society, 2000). Contacts of a sputum smear-positive index case should have a tuberculin test and, if positive or strongly positive (depending on prior vaccination status), be referred for assessment. Contacts with a negative tuberculin skin test when first seen may still be in the early stages of infection before tuberculin sensitivity has developed. A further skin test should therefore be performed six weeks after the last period of possible exposure. If the second skin test is positive, the patient has converted and must be referred for assessment and treatment. If the second test is negative, unvaccinated contacts under 16 years of age should be given BCG.

Exceptions to this advice include:

- newly born babies who are contacts of a smear-positive case, who should not be tested immediately but should be given prophylactic isoniazid chemotherapy and tuberculin tested after three to six months. If the skin

test is positive, chemotherapy is continued; if negative, BCG vaccine is given provided the infant is no longer in contact with infectious TB. It is not necessary to use isoniazid-resistant BCG

- children under two years of age who have contact with a smear-positive case and have not received BCG. They should be given chemoprophylaxis even if the skin test is negative and then tuberculin tested after six weeks. If the skin test is positive, refer for assessment; if negative, BCG vaccine is given
- children under two years of age who have received BCG and who have contact with a smear-positive case. They should be skin tested and managed as for older children
- all HIV-positive contacts of a smear-positive case. They should be referred for consideration of chemoprophylaxis.

Newly born babies who are contacts of a TB case that is not smear positive should be immunised with BCG immediately.

## Supplies

- BCG vaccine is manufactured by Statens Serum Institut (SSI).
- Tuberculin PPD is manufactured by Statens Serum Institut (SSI). Tuberculin PPD from SSI is not licensed medicine in the UK (although it has a marketing authorisation for use in other European countries).

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