

## Chapter 3

# Bacterial and viral infections

*A mighty creature is the germ  
 Though smaller than the pachyderm  
 His customary dwelling place  
 Is deep within the human race  
 His childish pride he often pleases  
 By giving people strange diseases  
 Do you, my poppet, feel infirm?  
 You probably contain a germ  
 (Ogden Nash, *The Germ*)*

### Bacterial infections

#### Streptococcal infection

##### Cellulitis

Cellulitis is a bacterial infection of subcutaneous tissues that, in immunologically normal individuals, is usually caused by *Streptococcus pyogenes*. 'Erysipelas' is a term applied to superficial streptococcal cellulitis that has a well-demarcated edge. Occasionally, other bacteria are implicated in cellulitis—*Haemophilus influenzae* is an important cause of facial cellulitis in children, often in association with ipsilateral otitis media. In immunocompromised individuals, a variety of bacteria may be responsible for cellulitis.

Cellulitis frequently occurs on the legs, but other parts of the body may be affected—the face is a common site for erysipelas. The organisms may

gain entry into the skin via minor abrasions, or fissures between the toes associated with tinea pedis, and leg ulcers provide a portal of entry in many cases. A frequent predisposing factor is oedema of the legs, and cellulitis is a common condition in elderly people, who often suffer from leg oedema of cardiac, venous or lymphatic origin.

The affected area becomes red, hot and swollen (Fig. 3.1), and blister formation and areas of skin necrosis may occur. The patient is pyrexial and feels unwell. Rigors may occur and, in elderly people, a toxic confusional state.

In presumed streptococcal cellulitis, penicillin is the treatment of choice, initially given as benzylpenicillin intravenously. If the leg is affected, bed rest is an important aspect of treatment. Where there is extensive tissue necrosis, surgical debridement may be necessary.

A particularly severe, deep form of cellulitis, involving fascia and muscles, is known as 'necrotizing fasciitis'. This disorder achieved notoriety a few years ago when it attracted the attention of the UK popular press and was described as being caused by a 'flesh-eating virus'. It is associated with extensive tissue necrosis and severe toxæmia, and is rapidly fatal unless urgent treatment, including excision of the affected area, is undertaken.

Some patients have recurrent episodes of cellulitis, each episode damaging lymphatics and leading to further oedema. These cases should be treated with prophylactic oral phenoxymethylpenicillin

## Chapter 3 Bacterial and viral infections



**Figure 3.1** Cellulitis.

(penicillin V) or erythromycin, to prevent further episodes.

### Staphylococcal infection

#### Folliculitis

Infection of the superficial part of a hair follicle with *Staphylococcus aureus* produces a small pustule on an erythematous base, centred on the follicle.

Mild folliculitis can be treated with a topical antibacterial agent, but if it is extensive a systemic antibiotic may be required.

#### Furunculosis ('boils')

A boil (furuncle) is the result of deep infection of a hair follicle by *S. aureus*. A painful abscess develops at the site of infection, and over a period of a few days becomes fluctuant and 'points' as a central

pustule. Once the necrotic central core has been discharged, the lesion gradually resolves. In some patients, boils are a recurrent problem, but this is rarely associated with a significant underlying disorder. Such individuals may be nasal or perineal carriers of staphylococci, and organisms are transferred on the digits to various parts of the body.

Patients suffering from recurrent boils should have swabs taken from the nose for culture, and if found to be carrying staphylococci should be treated with a topical antibacterial such as mupirocin, applied to the nostrils. They may also be helped by an antibacterial bath additive, for example 2% triclosan, and a prolonged course of flucloxacillin.

#### Carbuncle

A carbuncle is a deep infection of a group of adjacent hair follicles with *S. aureus*. A frequent site for a carbuncle is the nape of the neck. Initially, the lesion is a dome-shaped area of tender erythema, but after a few days suppuration begins, and pus is discharged from multiple follicular orifices. Carbuncles are usually encountered in middle-aged and elderly men, and are associated with diabetes and debility. They are uncommon nowadays. Flucloxacillin should be given for treatment.

#### Impetigo

This is a contagious superficial infection which occurs in two clinical forms, non-bullous and bullous. Non-bullous impetigo is caused by *S. aureus*, streptococci or both organisms together. The streptococcal form predominates in warm, humid climates, for example the southern USA. Bullous impetigo is caused by *S. aureus*. Lesions may occur anywhere on the body. In the non-bullous form, the initial lesion is a small pustule which ruptures to leave an extending area of exudation and crusting (Fig. 3.2). The crusts eventually separate to leave areas of erythema, which fade without scarring. In the bullous form, large, superficial blisters develop. When these rupture, there is exudation and crusting, and the stratum corneum peels back at the edges of the lesions.



**Figure 3.2** Impetigo.

Streptococcal impetigo may be associated with poststreptococcal acute glomerulonephritis.

Impetigo may occur as a secondary phenomenon in atopic eczema, scabies and head louse infection.

In localized infection, treatment with a topical antibiotic such as mupirocin will suffice, but, in more extensive infection, treatment with a systemic antibiotic such as flucloxacillin or erythromycin is indicated.

### Staphylococcal scalded skin syndrome

This uncommon condition occurs as a result of infection with certain staphylococcal phage types that produce a toxin which splits the epidermis at the level of the granular layer. The superficial epidermis peels off in sheets, producing an appearance resembling scalded skin. Infants and young children are usually affected. It responds to parenteral therapy with flucloxacillin.

### Erythrasma

Caused by a Gram-positive organism, *Corynebacterium minutissimum*, erythrasma occurs in intertriginous areas—axillae, groins and submammary regions. However, the most common site colonized by this organism is the toe-web spaces, where it produces a macerated scaling appearance identical to that caused by fungal infection. In other



**Figure 3.3** Erythrasma.

sites, it produces marginated brown areas with a fine, branny surface scale (Fig. 3.3). It is usually asymptomatic. *Corynebacterium minutissimum*

### Chapter 3 Bacterial and viral infections

produces a porphyrin that fluoresces a striking coral-pink under Wood's light.

Erythrasma may be treated with topical imidazoles (e.g. clotrimazole, miconazole), topical fusidic acid or a 2-week course of oral erythromycin.

## Mycobacterial infection

### Cutaneous tuberculosis

Cutaneous tuberculosis is now uncommon in Europe and the USA, but may be encountered in immigrants from other parts of the world where tuberculosis remains problematic.

### Scrofuloderma

Scrofuloderma results from involvement of the skin overlying a tuberculous focus, usually a lymph node, most commonly in the neck. The clinical appearance is of multiple fistulae and dense scar tissue.

### Lupus vulgaris

The majority of lesions of lupus vulgaris occur on the head and neck. The typical appearance is of a reddish-brown, nodular plaque (Fig. 3.4). When pressed with a glass slide (diascopy), the brown nodules, which are referred to as 'apple jelly' nodules, are more easily seen. The natural course is gradual peripheral extension, and in many cases

this is extremely slow, over a period of years. Lupus vulgaris is a destructive process, and the cartilage of the nose and ears may be severely damaged.

Histology shows tubercles composed of epithelioid cells and Langhans giant cells, usually without central caseation. Tubercle bacilli are sparse. The tuberculin test is strongly positive. The patient should be investigated for an underlying focus of tuberculosis in other organs, but this is only found in a small proportion of cases.

Treatment should be with standard antituberculous chemotherapy.

There is a risk of the development of squamous cell carcinoma in the scar tissue of longstanding lupus vulgaris.

### Warty tuberculosis

This occurs as a result of direct inoculation of tubercle bacilli into the skin of someone previously infected, who has a high degree of immunity. It may develop on the buttocks and thighs as a result of sitting on ground contaminated by infected sputum. The clinical appearance is of a warty plaque. It responds to standard antituberculous chemotherapy.

### Tuberculides

This term is applied to skin lesions that occur in response to tuberculosis elsewhere in the body. They



**Figure 3.4** Lupus vulgaris on the chin.



**Figure 3.5** Fish tank granuloma showing sporotrichoid spread.

are probably the result of haematogenous dissemination of bacilli in individuals with a moderate or high degree of immunity. Included in this group are erythema induratum (Bazin's disease), papulonecrotic tuberculide and lichen scrofulosorum.

### Atypical mycobacteria

The most common of the skin lesions produced by atypical mycobacteria is 'swimming pool' or 'fish tank' granuloma. This is usually a solitary granulomatous nodule, caused by inoculation of *Mycobacterium marinum* into the skin via an abrasion sustained whilst swimming, or (in tropical fish fanciers) whilst cleaning out the aquarium—often after the demise of the fish contained therein. Occasionally, in addition to the initial lesion, there are several secondary lesions in a linear distribution along the lines of lymphatics (sporotrichoid spread—because it resembles sporotrichosis) (Fig. 3.5). Most cases respond to treatment with minocycline.

### Leprosy (Hansen's disease)

The Norwegian Armauer Hansen discovered the leprosy bacillus, *Mycobacterium leprae*, in 1873 and, if the possibility of leprosy enters into the discussion of differential diagnosis in the clinic, the eponymous title of this condition should always be

used, because the fear of leprosy is so ingrained, even in countries where it is not endemic.

Leprosy has a wide distribution throughout the world, with most cases occurring in the tropics and subtropics, but population movements mean that the disease may be encountered anywhere in the world.

Leprosy is a disease of peripheral nerves, but it also affects the skin, and sometimes other tissues such as the eyes, the mucosa of the upper respiratory tract, the bones and the testes. Although it is infectious, the degree of infectivity is low. The incubation period is lengthy, probably several years, and it is likely that most patients acquire the infection in childhood. A low incidence of conjugal leprosy (leprosy acquired from an infected spouse) suggests that adults are relatively non-susceptible. The disease is acquired as a result of close physical contact with an infected person, the risk being much greater for contacts of lepomatous cases—the nasal discharges of these individuals are the main source of infection in the community.

The clinical pattern of disease is determined by the host's cell-mediated immune response to the organism. When this is well developed, tuberculoid leprosy occurs, in which skin and peripheral nerves are affected. Skin lesions are single, or few in number, and are well defined. They are macules or plaques that are hypopigmented in dark skin. The lesions are anaesthetic, sweating is absent, and

## Chapter 3 Bacterial and viral infections

hairs are reduced in number. Thickened branches of cutaneous sensory nerves may be palpable in the region of these lesions, and large peripheral nerves may also be palpable. The lepromin test is strongly positive. Histology shows well-defined tuberculoid granulomas, and bacilli are not seen. The Wade–Fite stain is used to demonstrate leprosy bacilli.

When the cell-mediated immune response is poor, the bacilli multiply unchecked and the patient develops lepromatous leprosy. The bacilli spread to involve not only the skin, but also the mucosa of the respiratory tract, the eyes, testes and bones. Skin lesions are multiple and nodular. The lepromin test is negative. Histology shows a diffuse granuloma throughout the dermis, and bacilli are present in large numbers.

In between these two extreme, ‘polar’ forms of leprosy is a spectrum of disease referred to as borderline leprosy, the clinical and histological features of which reflect different degrees of cell-mediated response to the bacilli. There is no absolute diagnostic test for leprosy—the diagnosis is based on clinical and histological features.

Tuberculoid leprosy is usually treated with a combination of dapsone and rifampicin for 6 months; lepromatous leprosy with dapsone, rifampicin and clofazimine for at least 24 months. The treatment of leprosy may be complicated by immunologically mediated ‘reactional states’, and should be supervised by someone experienced in leprosy management.

### The leprosy spectrum

#### Tuberculoid

- One or two skin lesions only
- Good cell-mediated immune response
- Positive lepromin test
- Few bacilli

#### Borderline

- Scattered skin lesions
- Intermediate cell-mediated immune response
- Some organisms

#### Lepromatous

- Extensive skin lesions and involvement of other organs
- Poor cell-mediated immune response
- Negative lepromin test
- Numerous organisms

## Viral infections

### Warts

*‘Mr Lely, I desire you would use all your skill to paint my picture truly like me, and not flatter me at all; but remark all these roughnesses, pimples, warts, and everything as you see me, otherwise I will never pay a farthing for it’.* (Oliver Cromwell to the artist Sir Peter Lely—origin of ‘Warts and all’)

Warts are benign epidermal neoplasms caused by viruses of the human papillomavirus (HPV) group. There are a number of different strains of HPV that produce different clinical types of warts. Warts are also known as ‘verrucae’, although the term verruca in popular usage is usually reserved for the plantar wart.

### Common warts

These are raised, cauliflower-like lesions that occur most frequently on the hands (Fig. 3.6). They are extremely common in childhood and early adult life. They may be scattered, grouped or periungual in distribution. Common warts in children usually resolve spontaneously.

Common warts are usually treated with wart paints or cryotherapy. Preparations containing salicylic acid are often quite effective, and a wart paint should certainly be used for at least 3 months before considering alternative treatment.

Cryotherapy with liquid nitrogen can be used on warts that do not respond to wart paints. A simple applicator of cotton wool wrapped around the end of an orange stick may be used. This is dipped in the liquid nitrogen and then applied to the wart until it and a narrow rim of surrounding skin are frozen. Alternatively, a liquid nitrogen cryospray may be used. This is a painful procedure, and should not be inflicted on children—however, most tiny tots will, sensibly, retreat under the desk protesting loudly at first sight of the nitrogen evaporating in its container. Multiple warts usually require more than one application, and the optimum interval between treatments is 2–3 weeks.



**Figure 3.6** Viral warts.



**Figure 3.7** Mosaic plantar warts.

### Plantar warts

Plantar warts may be solitary, scattered over the sole of the foot, or grouped together producing so-called 'mosaic' warts (Fig. 3.7). The typical appearance is of a small area of thickened skin which, when pared away, reveals numerous small black dots produced by thrombosed capillaries. Plantar warts are frequently painful. They must be distinguished from calluses and corns, which develop in areas of friction over bony prominences. Calluses are patches of uniformly thickened skin, and corns have a painful central plug of keratin that does not contain capillaries.

Treatment is with wart paints or cryotherapy, after paring down overlying keratin.

### Plane warts

These are tiny, flat-topped, flesh-coloured warts which usually occur on the dorsa of the hands and the face (Fig. 3.8). They often occur in lines due to inoculation of the virus into scratches and abrasions. Plane warts are extremely difficult to treat effectively, and attempts at treatment may do more harm than good. They will resolve spontaneously eventually, and are best left alone.

### Genital warts (*condylomata acuminata*)

In recent years, the importance of certain types of genital wart viruses in the aetiology of penile and cervical cancer has been recognized, and this has

### Chapter 3 Bacterial and viral infections



**Figure 3.8** Plane warts.

modified attitudes to what was previously considered a minor sexually transmitted inconvenience. It is now more appropriate that patients suffering from genital warts are seen and treated in a department of genitourinary medicine, so that coexisting sexually transmitted disease may be detected and treated, and sexual contacts traced and examined.

#### Molluscum contagiosum

The lesions of molluscum contagiosum are caused by a poxvirus. They are typically pearly, pink papules with a central umbilication filled with a keratin plug (Fig. 3.9). The lesions may occur anywhere on the body, but are most common on the head and neck area and the trunk. They are frequently grouped, and may be surrounded by a mild eczematous reaction. They may be very extensive in children with atopic eczema.

These lesions resolve spontaneously, and in infants and small children are best left alone to do so.



**Figure 3.9** Molluscum contagiosum.

However, if parents of small children are anxious, they can be advised to squeeze each lesion between the thumbnails to express the central plug—this will often speed their resolution. In older children and adults, molluscum contagiosum can be treated by cryotherapy.

#### Orf

Orf is caused by a parapoxvirus. It is a disease of sheep that can be transmitted to humans. Those usually affected are people who bottle-feed lambs, and butchers and abattoir workers who handle the carcasses of sheep. The typical clinical picture is of a solitary, inflammatory papule that rapidly develops into a nodule of granulation tissue—usually on a finger, but occasionally on the face. The diagnosis can be confirmed by electron microscopy of smears from the granulation tissue. Orf lesions resolve spontaneously in 6–8 weeks, but the disease may act as a trigger for erythema multiforme.



**Figure 3.10** Hand, foot and mouth disease: vesicles on the hand.

### Hand, foot and mouth disease

This is not related to foot and mouth disease of sheep and cattle, but is a harmless disease caused by Coxsackie virus infection, usually type A16. Characteristic small grey vesicles with a halo of erythema occur on the hands and feet (Fig. 3.10), and the buccal mucosa is studded with erosions resembling aphthous ulcers. The condition resolves within 2 weeks, and no treatment is required.

### Herpes simplex

Herpes simplex is caused by herpes virus hominis (HSV). There are two antigenic types: type 1 is classically associated with the common 'cold sore' on the lips and face, and type 2 with genital herpes. However, neither has rigid territorial demarcation, and lesions anywhere may be caused by either antigenic type.

#### Primary herpes simplex

Initial contact with type 1 HSV usually occurs in early childhood, for example adults with cold sores kissing children, and any lesions that develop are often so mild that they are not noticed. Occasionally, however, a severe primary herpetic gingivostomatitis occurs, with painful erosions on the buccal mucosa and lips. Primary cutaneous herpes simplex may also occur, and in atopic eczema this

can be very extensive and may be life-threatening (see eczema herpeticum below). Genital herpes may result from sexual transmission of type 2 HSV or orogenital transmission of type 1 HSV.

Physical contact during sport provides another means of HSV transmission—in rugby, herpes simplex thus acquired is known as 'scrumpox', and in wrestling as 'herpes gladiatorum'.

Following a primary infection, the virus settles in sensory ganglia, and may be triggered to produce recurrent lesions by a variety of stimuli. In immunodeficient individuals, for example those who are immunosuppressed following organ transplantation, or in association with human immunodeficiency virus (HIV) infection, herpes simplex infection may be clinically atypical and run a prolonged course.

#### Recurrent herpes simplex

Recurrent cold sores on the lips (herpes labialis) are common. Itching and discomfort in the affected area precedes, by a few hours, the eruption of a group of small vesicles. The vesicle contents subsequently become cloudy, and then crusting occurs, before resolution in about 10 days. The trigger for these episodes is often fever, but exposure to strong sunlight, and menstruation are also recognized precipitants. Occasionally, as a result of inoculation of the virus into a finger, painful episodes of 'herpetic whitlow' occur. The frequency of

### Chapter 3 Bacterial and viral infections

episodes of herpes simplex usually gradually declines with advancing age.

Labial herpes simplex is usually a minor cosmetic inconvenience, and does not require treatment. However, if episodes are frequent and troublesome, topical aciclovir may be of benefit. This blocks viral replication—it is not viricidal, and is not curative.

#### Herpes simplex and erythema multiforme

Recurrent herpes simplex can trigger erythema multiforme. Prophylactic oral aciclovir may be of considerable benefit in the management of severe cases.

#### Eczema herpeticum (Kaposi's varicelliform eruption)

This is a widespread herpes simplex infection that occurs in atopic eczema. The head and neck are frequently affected (Fig. 3.11), but lesions may spread rapidly to involve extensive areas of skin. Lymphadenopathy and constitutional upset may occur. If the disease is limited in distribution and the patient is seen early in its course, oral aciclovir therapy is appropriate. However, if the lesions are extensive, and the patient is unwell, they should be admitted to hospital and treated with intravenous aciclovir. If the patient is using topical steroid therapy to treat the eczema, this should be

stopped until the herpes has resolved. Eczema herpeticum may recur, but in many cases subsequent episodes tend to be less severe.

#### Herpes zoster (shingles)

Chickenpox and herpes zoster are both caused by the varicella-zoster virus. 'Shingles' is a distortion of the Latin *cingulum*, meaning a girdle.

Following an attack of chickenpox, the virus remains dormant in dorsal root ganglia until some stimulus reactivates it and causes shingles. Middle aged and elderly people are most often affected, but it occasionally occurs in childhood. It is also more frequent in immunosuppressed individuals.

Shingles usually affects a single dermatome, most commonly on the thorax or abdomen. The eruption may be preceded by pain in the region of the dermatome, and this occasionally leads to an incorrect diagnosis of internal pathology. The lesions consist of a unilateral band of grouped vesicles on an erythematous base (Fig. 3.12). The contents of the vesicles are initially clear, but subsequently become cloudy. There may be scattered outlying vesicles on the rest of the body, and these tend to be more numerous in elderly people. However, numerous outlying vesicles (disseminated zoster) are also seen in immunosuppressed individuals, and their presence should prompt further investigation of the patient. After a few days, the vesicles dry up and form crusts, and in most cases



Figure 3.11 Eczema herpeticum.



**Figure 3.12** Herpes zoster.

the eruption resolves within 2 weeks. In elderly people, shingles can produce quite severe erosive changes that take considerably longer to heal. Even in milder cases there is usually some residual scarring.

The most troublesome aspect of shingles is the persistence of pain after the lesions have healed (postherpetic neuralgia). This may be severe, and is particularly distressing for elderly patients.

#### Sacral zoster

Involvement of the sacral segments may cause acute retention of urine in association with the rash.

#### Trigeminal zoster

Herpes zoster may affect any of the divisions of the trigeminal nerve, but the ophthalmic division is the most frequently involved (Fig. 3.13). Ocular problems such as conjunctivitis, keratitis and/or iridocyclitis may occur if the nasociliary branch of the ophthalmic division is affected (indicated by vesicles on the side of the nose), and patients with ophthalmic zoster should be examined by an ophthalmologist.

Involvement of the maxillary division of the trigeminal nerve produces vesicles on the cheek, and unilateral vesicles on the palate.



**Figure 3.13** Ophthalmic zoster.

### Chapter 3 Bacterial and viral infections

#### Motor zoster

Occasionally, in addition to skin lesions in a sensory dermatome, motor fibres are affected, leading to muscle weakness.

#### Treatment of herpes zoster

Many cases do not require any treatment. However, in severe cases, oral aciclovir, valaciclovir or

famciclovir are of benefit. In disseminated zoster in immunosuppressed patients, intravenous aciclovir can be life saving.

Pain relief is often difficult to achieve in postherpetic neuralgia, and patients with severe discomfort should be referred to a pain relief specialist.