PRESENTATION OF SURGICAL INFECTION Major and minor surgical site infection (SSI)

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Infection acquired from the environment or the sta ff following surgery or admission to hospital is termed hospital-acquired infection (HAI). There are four main groups: respiratory infections (including ventilator-associated pneumonia), urinary tract infections (mostly related to urinary catheters), Figure 5.6 bacteraemia (mostly related to indwelling vascular catheters) and SSIs. A major SSI is defined as a wound that either discharges significant quantities of pus spontaneously or needs a second - ary procedure to drain it (Figure 5.4) . The patient may have systemic signs such as tachycardia, pyrexia and a raised white cell count (Summary box 5.6). Summary box 5.6 Major wound infections /uni25CF /uni25CF /uni25CF Minor wound infections may discharge pus or infected - serous fluid but are not associated with excessive discomfort, of systemic signs or delay in return home (Figure 5.7) . - Figure 5.7

release SIRS IL-6, TNF , etc. Release of endotoxin Macrophage Colonisation by Mesenteric aerobic gram- nodes negative bacilli (in gut failure Translocation and starvation) (failure of gut-associated lymphoid tissue, villous atrophy) Gut failure, colonisation and translocation related to the development of systemic in /f_l ammatory response syndrome (SIRS) and multiple organ dysfunction syndrome (MODS). IL, interleukin; TNF , tumour necrosis factor. Signi /f_i cant quantity of pus Delayed return home Patients are systemically ill Minor wound infection that settled spontaneously without antibiotics.

Abscess An abscess presents all the clinical features of acute inflamma tion originally described by Celsus: calor (heat), rubor (redness), dolor (pain) and tumor (swelling). To these can be added laesa (loss of function: if it hurts, the infected part is not used). Abscesses usually follow a puncture wound of some kind, which may have been forgotten, as well as surgery , but can be metastatic in all tissues following bacteraemia. Pyogenic organisms, predominantly Staphylococcus aureus, cause tissue necrosis and suppuration. Pus is composed of dead and dying white blood cells, predominantly neutrophils, that have succumbed to bacterial toxins. An abscess is surrounded by an acute inflammatory response composed of a fibrinous exudate, oedema and the cells of acute inflammation. Gran ulation tissue (macrophages, fibroblasts and new blood vessel proliferation)

forms later around the suppurative process and leads to collagen deposition. If it is not drained or resorbed completely , a chronic abscess may result. If it is partly sterilised with empirical antibiotics, an antibioma may form. Abscesses contain hyperosmolar material that draws in fluid. This increases the pressure and causes pain. If they spread, they usually track along planes of least resistance and point towards the skin. Wound abscesses may discharge spontaneously by tracking to a surface but may need drainage through a surgical incision. Most abscesses relating to surgical wounds take 7–10 days to form after surgery . As many as 75% of SSIs present after the patient has left hospital and may thus be overlooked by the surgical team. Abscess cavities need cleaning out after incision and drain age and are traditionally encouraged to heal by secondary intention. When the cavity is left open to drain freely , there is no need for antibiotic therapy as well. Antibiotics should be used if the abscess cavity is closed after drainage, but the cavity should not be closed if there is any risk of retained loculi or f oreign material. Thus a perianal abscess can be incised and drained, the walls curetted and the skin closed with good results using appropriate antibiotic therapy , but a pilonidal abscess has a higher recurrence risk after such treatment because a nidus of hair may remain in the subcutaneous tissue adjacent to the abscess. Some small breast abscesses can be managed by simple needle aspiration of the pus and antibiotic therapy (Summary box 5.7). Persistent chronic abscesses may lead to sinus or fistula for mation. In a chronic abscess, lymphocytes and plasma cells are seen. There is tissue sequestration and later calcification may occur. Certain organisms are associated with chronicity and Mycobacte with sinus and fistula formation. Common ones are rium and Actinomyces. They should not be forgotten when these complications occur and persist. Perianastomotic contamination may be the cause of an abscess but, in the abdomen, abscesses are more usually the result of anastomotic leakage. An abscess in a deep cavity suc as the pleura or peritoneum may be di ffi cult to diagnose or locate even when there is strong clinical suspicion that it is Aulus Aurelius Cornelius Celsus , 25 /uni00A0/b.sc/c.sc/e.sc –50 /uni00A0/c.sc/e.sc , Roman surgeon and the author of Abscesses - /uni25CF /uni25CF functio /uni25CF /uni25CF present (Figure 5.8). Plain or contrast radiographs may not be helpful, but ultrasonography , computed tomography (CT), magnetic resonance imaging (MRI) and isotope-labelled white - cell scans are all useful and may allow image-guided aspiration and drainage of intra-abdominal abscesses without the need for surgical intervention. Cellulitis and lymphangitis Cellulitis is a non-suppurative, invasive infection of tissues, which is usually related to the point of injury . There is poor localisation in addition to the cardinal signs of spreading inflammation. Such infections presenting in surgical practice are typically caused by organisms such as β -haemolytic strepto - cocci (Figure 5.9) , staphylococci (Figure 5.10) and Clostridium perfringens. Tissue destruction, gangrene and ulceration may follow , which are caused by release of proteases. - - - Figure 5.8 h De Re Medico Libri Octo.

Abscesses need drainage Modern imaging techniques may allow guided needle aspiration, e.g. ultrasound-guided drainage of breast abscesses Antibiotics are indicated if the abscess cavity is not left open to drain freely An open abscess cavity heals by secondary intention Plain radiograph showing a subphrenic abscess with a gas/ /f_l uid level (white arrow). Gastrogra /f_i n is seen leaking from the oesophagojejunal anastomosis (after gastrectomy) towards the abscess (black arrow).

Figure 5.9 Figure 5.10 Systemic signs (the old-fashioned term is toxaemia) are common, with chills, fever and rigors. These events follow the release of toxins into the circulation, which stimulate a

cytokine-mediated systemic inflammatory response even though blood cultures may be negative. Lymphangitis is part of a similar process and presents as painful red streaks in a ff ected lymphatics draining the source of infection. Lymphangitis is often accompanied by painful lymph node groups in the related drainage area, e.g. cervical, axillary or inguinal (Summary box 5.8). Summary box 5.8 Cellulitis and lymphangitis /uni25CF /uni25CF /uni25CF Gas gangrene Gas gangrene is caused by Clostridium perfringens . These Gram-positive, anaerobic, spore-bearing bacilli are widely found in nature, particularly in soil and faeces. Patients who are immunocompromised, diabetic or have malignant disease are at greater risk, particularly if they have wounds containing necrotic or foreign material, resulting in anaerobic conditions. Military wounds provide an ideal environment as the kinetic energy of high-velocity missiles or shrapnel causes extensive tissue damage. The cavitation which follows passage of a missile through the tissues causes a ‘sucking’ entry wound, leaving clothing and environmental soiling in the wound in addition to devascularised tissue. Gas gangrene wound infections are associated with severe local wound pain and crepitus (gas in the tissues, which may also be visible on plain radiographs). The wound produces a thin, brown, sweet-smelling exudate, in which Gram staining will reveal bacteria. Oedema and spread - ing gangrene follow the release of collagenase, hyaluronidase, other proteases and alpha toxin. Early systemic complications with circulatory collapse and organ failure follow if prompt action is not taken (Summary box 5.9). Antibiotic pr ophylaxis should always be considered in patients at risk, especially when amputations are performed for peripheral vascular disease with open necrotic ulceration. Once gas gangrene infection is established, large doses of intra venous penicillin and aggressive debridement of a ff ected tissues are required. Summary box 5.9 Gas gangrene /uni25CF /uni25CF /uni25CF /uni25CF Clostridium tetani This is another anaerobic, terminal spore-bearing, Gram- positive bacterium, which can cause tetanus following implan - tation into tissues or a wound. The spores are widespread in soil and manure. The signs and symptoms of tetanus are mediated by the release of the exotoxin tetanospasmin; these include spasms in the distribution of the short motor nerves of the face followed by the development of severe generalised motor spasms including opisthotonus, respiratory arrest and death. Prophylaxis with tetanus toxoid is the best preventative treatment but, in an established infection, minor debridement of the wound may need to be performed and antibiotic treatment with benzylpenicillin provided in addition. Relaxants may also be required and the patient will require ventilation in severe forms, which are associated with a high mortality .

Streptococcal cellulitis of the leg following a minor punc ture wound. Staphylococcal cellulitis of the face and orbit following severe

infection of an epidermoid cyst of the scalp. Non-suppurative, poorly localised Commonly caused by streptococci, staphylococci or clostridia Blood cultures are often negative

Caused by Clostridium perfringens Gas and smell are characteristic Immunocompromised patients are most at risk Antibiotic prophylaxis is essential when performing amputations to remove dead tissue

gangrene, necrotising fasciitis) This is a rare but serious bacterial infection that a ff ects and spreads via the deep fascia; hence, it is termed fasciitis. A mixed pattern of organisms is responsible for this serious condition: coliforms, staphylococci, Bacteroides spp., anaerobic streptococci and peptostreptococci have all been implicated, acting in synergy . Often, aerobic bacteria destroy the living tissue, allowing anaerobic bacteria to thrive. Severe wound pain, signs of spreading inflammation with crepitus and odour are all signs of the infection spreading. Untreated, it will lead to widespread local gangrene and systemic multisystem organ failure. Abdominal wall infections are known as Meleney's synergistic gangrene and scrotal infections as Fournier's gangrene (Figure 5.11). Patients are almost always immuno compromised, with conditions such as diabetes mellitus. The wound initiating the infection may have been minor, but severely contaminated wounds are more likely to be the cause. The subdermal spr ead of gangrene is always much more extensive than appears from initial examination. The finger test can be used in the diagnosis of patients who present with suspected necrotising fasciitis. The area of suspected inv olvement is first infiltrated with local anaesthesia. A 2-cm incision is made in the skin down to the deep fascia. Lack of bleeding is a sign of necrotising fasciitis. On some occasions, a dishwater-coloured fluid is noticed seeping from the wound. Figure 5.11 Frank Lamont Meleney , 1889–1963, Professor of Clinical Surgery , Columbia University , New Y ork, NY , USA. Jean Alfred Fournier , 1832–1915, syphilologist, the founder of the V enereal and Dermatological Clinic, Hôpital Saint-Louis, Paris, France. by a sterile glove is then performed at the level of the deep fascia. If the tissues dissect with minimal resistance, the finger test is positive. Tissue biopsies are then sent for frozen section analysis. The characteristic histological findings are obliterative vasculitis of the subcutaneous vessels, acute inflammation and subcutaneous tissue necrosis. If either the finger test or rapid frozen section analysis is positive, or if the patient has progressive clinical findings consistent with necrotising fasciitis, immediate operative treatment must be initiated. Broad-

spectrum antibiotic therapy must be combined with aggressive circulatory support. Locally , there should be wide otic tissue and laying open of a ff ected areas. excision of necr The debridement may need to be extensive, and patients who survive may need large areas of skin grafting later. -

A classic presentation of Fournier’s gangrene of the scrotum with ‘shameful exposure of the testes’ following excision of the gangrenous skin.

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