
Surgery in Africa - Monthly Review

Surgical Infections - I

Preface

With this Review, Surgery in Africa begins a series of discussions on fundamental surgical questions. We are starting with the topic of Surgical Infections. Surgical Infections can be classified as those requiring surgical treatment or those, like wound infections, which arise as a result of surgical intervention. In this Review we deal with Surgical Infections requiring surgical intervention and in particular, soft tissue infections. Subsequent reviews in this series will deal with septic arthritis, acute and chronic osteomyelitis and the surgery of specific abscesses and infected spaces, including hands. Post-surgical infections will be considered in subsequent Reviews as well.

Surgical Infections I

Soft-tissue infections: Abscess, Cellulitis, Ulcers, Tropical Pyomyositis, Necrotizing Fasciitis, Myonecrosis/Gas Gangrene and Tetanus

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Introduction

The surgery of infections is an important adjunct to the medical control of the etiologic agent. Drainage of abscesses and debridement of the necrotic tissue, which are the sequelae of infection and the inflammatory response to it, are extremely common procedures. Nowhere is this truer than in Africa where rural life, poverty, trauma, the lack of protective apparel such as shoes and exposure to a wide variety of organisms make infections one of the most important causes of disease and disability. In this Review we will focus on infections of skin and soft tissue and, in particular, those which require a surgical response. (1) We will highlight those infections common to Africa and the pre-disposing conditions, such as HIV infection, which increase the patients' susceptibility. Since this Review can do no more than touch on the essential aspects of each topic, readers are strongly encouraged to access the online articles for a more complete discussion.

Abscess and Cellulitis

The skin is the primary barrier to infectious agents. Breach of intact skin through trauma, disease or inflammation of hair follicles creates portals of entry for pathogenic organisms. (2) A wide variety of skin infections exist from pyoderma and folliculitis to localized abscesses such as furuncles and carbuncles, which require simple drainage with cruciate incisions. (3) The dictum: "Never let the sun rest on an undrained abscess" is appropriate and worth remembering.

The cardinal manifestations of inflammation are: heat, swelling, erythema and pain. As the infection proceeds into deeper, subcutaneous tissue, the surgeon is called upon to distinguish cellulitis from abscess. Cellulitis is a soft tissue infection characterized by leukocytic infiltration of the dermis, capillary dilatation and proliferation of bacteria. Apart from antibiotics, rest and elevation of the affected part, it does not normally require surgical intervention. Abscess formation does.

While the detection of subcutaneous abscesses is often clinical, imaging such as ultrasound may play an important role in deeper infections. (4) Aspiration of suspected masses is a common diagnostic approach in Africa. Its efficacy has not been subjected to rigorous scrutiny. When performed, attention should be paid to aseptic technique, appropriate analgesia, relevant anatomy, culture of obtained fluid where possible and recognition that "absence of proof is not proof of absence." While surgical drainage remains the standard for most abscesses, aspiration and tube drainage under imaging control is being used in some clinical situations. (5, 6)

The main organisms causing skin and subcutaneous infections are staphylococcus aureus and streptococcus pyogenes. The former is almost universally resistant to penicillin and requires treatment with B-lactamase stable agents such as cloxacillin. The development of staphylococci resistant to this group of agents poses a major health hazard in the developed world. (7) The search for effective antibiotics for these MRSA bacteria is an important undertaking. (8, 9, 10) MRSA infections are less common in Africa and the developing world but do occur. (11) Surgeons can help deter the emergence of resistant organisms by avoiding prolonged and inappropriate antibiotic use. Streptococci are generally sensitive to penicillin but resistance is developing. (12) While these are the most common agents, under specific

clinical conditions – bites, burns, water immersion, HIV infection (13, 14), etc.- other agents predominate. (2)

Guides to empiric antibiotic therapy for soft tissue infections in the developed world are available. (15, 16) Rational antibiotic therapy must be based on the likelihood of infection by particular organisms given the clinical setting, the known local epidemiology of infectious agents and when available, specific bacteriologic culture and identification. In Africa, where most hospitals do not have facilities for culture and identification of causative agents, such guides are of greater importance.

Infectious Ulcers

A variety of infectious agents may cause specific clinical syndromes, where ulceration of the skin is a component. (2) These include syphilis, chancroid, anthrax, diphtheria, tularaemia, leishmaniasis, etc. Particularly relevant in Africa are tropical ulcer and the Buruli ulcer.

Buruli ulcer is caused by mycobacterium ulcerans and has widespread prevalence in Africa, primarily in wet areas. It may present in an early papular form but is usually late with extensive ulceration. (17) Most lesions are on the lower legs and more than 75% of affected people are under 15 years of age. Elderly people are also at risk. (18) Management of ulcerative lesions has stressed extensive surgical debridement followed by skin grafting. A significant development in the treatment of Buruli ulcer is the use of antibiotic therapy with rifampicin and streptomycin for 8 weeks and less aggressive surgery. (19)

Tropical ulcer is a poorly understood condition, related to trauma and anaerobic fusobacteria. (20, 21) It occurs below the knees and predominately in males 5-20 years of age. The mean time to healing is 11 months. Dressings and penicillin or metronidazole may cure lesions less than 5 cm.; debridement of necrotic and infected material with skin grafting is the mainstay for larger ulcers (22) A recent excellent review indicates how neglected this condition is. (23) The author recommends wearing leg clothing as a preventative measure.

Tropical Pyomyositis

Pyomyositis is a common disease in Africa, where it may account for 4% of hospital admissions. A number of good reviews are available. (24, 25, 27) It may affect all age groups but is more common in the first two decades of life with a slight male predominance. The major muscle groups around the pelvis are most commonly affected and there may be multiple abscesses in up to 40% of cases. Non-tuberculous primary psoas abscess may be included in this condition. (28)

The pathophysiology is not clear. The infection is felt to be secondary to a transient bacteremia and mild trauma is often associated. Immunologic factors have been implicated, possible related to parasitic infection. (29) The association with HIV infection is well documented. (30) In temperate countries up to 75% of cases are associated with HIV infection or other chronic diseases, including intravenous drug use and in the homeless. (31) In a report from Malawi (32) with high HIV seropositivity, surgical patients with “deep” bacterial abscesses were twice as likely to be HIV positive as other surgical patients. Staph aureus is the predominant infectious agent in more than 75% of cases but other bacteria, streptococci (33) and even anaerobic organisms (34) have been isolated. The disease has three distinct phases with an early invasive stage associated with fever, malaise and muscle pain progressing to the stage with abscess formation and finally septicaemia, if untreated.

Pyomyositis must be distinguished from other deep lying abscesses like osteomyelitis. For this reason, radiographs should always be taken. Imaging techniques with ultrasound, CT scan or MRI can identify typical abnormalities in affected patients. (35) However, most patients with suspected pyomyositis in Africa have the affected area aspirated for diagnosis. (36)

Treatment consists of Cloxacillin or similar B-lactamase resistant antibiotics and surgical drainage. (37, 38) In areas where staph aureus is proven to be penicillin sensitive, this agent might be used. There are reports from developed countries of percutaneous drainage under imaging control. (39) The mortality rate is under 5% but recurrences may prolong recovery.

Necrotizing Fasciitis

While cellulitis and pyomyositis can be treated with reasonable success and low mortality rates, this is not the case for necrotizing soft tissue infections (NSTI). Here mortality rates range from 30-70% and have not decreased significantly despite modern therapy. (40) Reports from Singapore (41), India (42) and Oman (43) give a sense of the non-Western experience. NSTIs can be divided into two major categories: 1. Necrotizing fasciitis (NF) and 2. Gas gangrene. (44) Necrotizing fasciitis is further divided on the basis of clinical picture and microbiology into types I and II.

In type I NF the infection often begins after a surgical incision in an immuno-compromised patient with diabetes mellitus or peripheral vascular disease. Mucosal tear or skin breakdown are additional initiating factors. There is polymicrobiology with mixed aerobic and anaerobic bacteria. (45) Necrotizing infections, commencing in the oral cavity and invading the deep fascia of the head and neck, are called Ludwig’s angina. (46) Airway control is an important factor in these cases. Fournier’s gangrene, necrotizing fasciitis of the scrotum, is another common clinical entity. It occurs often as a result of urethral disruption secondary to strictures. Burn patients are susceptible. (47) Meleney’s synergistic gangrene is another clinical variant caused by staph aureus and microaerophilic streptococci. It is more indolent and occurs in post surgical patients.

Type II NF is an invasive infection caused by group A streptococci (GAS). It may occur in otherwise healthy individuals with a history of blunt trauma or muscle strain and as part of GAS toxic shock syndrome. (48, 49) Type II NF may occur in small clusters and its incidence is increasing. Because of the presence of toxic superantigens, immunoglobulin intravenous therapy may play a role in the treatment of these cases. (50)

The clinical challenge of NF lies in its early diagnosis and treatment. Distinguishing NF from cellulitis is difficult but crucial. Marked pain beyond what might be expected for the physical findings is characteristic. Fever, malaise and myalgia rapidly develop into toxicity and shock. The local findings may be initially mild with local or diffuse erythema, but blisters, bullae and violaceous colouring soon develop. Unfortunately by this stage the condition is advanced. In black skinned individuals these changes may be obscured. Rather the skin appears swollen, glistening and slightly lighter than the surrounding normal skin. When there is crepitus the diagnosis is easy.

Guides to early diagnosis have been developed. (51) A Laboratory Risk Indicator for Necrotizing Fasciitis has been developed. (52) It uses WBC, Haemoglobin, Na, Glucose, Creatinine, and C-Reactive Protein levels to distinguish NF from cellulitis. Gas may or may not be present in x-rays of the affected area. CT scans and MRI show soft tissue swelling. Surgery plays an important role in diagnosis. Treatment of NF entails three components: surgical debridement, appropriate antibiotics and intensive supportive care. Surgical debridement requires the excision of all necrotic tissue, in this case fat and

fascia, beyond the area of infection. Viable skin is preserved and the underlying muscle is usually normal. Amputation is not usually required. Repeated debridements are usually necessary and extensive incisions require reconstructive measures.

Because of the seriousness of the condition and the inability to predict the infecting agents, broad-spectrum antibiotics are indicated. One regime suggests ampicillin (to cover enterococci), clindamycin (for other gram-positive cocci and anaerobes) and an aminoglycoside such as gentamycin (for the enterobacteracea). (45) Standard supportive measures for septic shock including ventilation and inotropic support are indicated as required. These patients require significant nutritional support as well. (53)

Myonecrosis/Gas Gangrene

Surgeons have been familiar with the deadly features of clostridial myonecrosis since Hippocrates. In contrast to NF, myonecrosis involves the progressive necrosis of muscle by clostridial toxins. (54)

There are two main forms: 1.traumatic gas gangrene caused by clostridium perfringens and 2. non-traumatic gas gangrene caused by other clostridial species. (44)

Traumatic gas gangrene is associated with the delayed treatment of contaminated wounds and war injuries. Probably the most important principle in the management of these injuries lies in preventing gas gangrene. Early and aggressive debridement of all devitalized tissue using the principle of delayed primary closure is combined with short term penicillin therapy. (55)

The presentation of the active infection is usually dramatic, of rapid onset and associated with high mortality. Severe pain and skin changes initially pale, but quickly turning to bronze and purplish red, tense and exquisitely tender are present with increasing systemic toxicity, followed by shock and organ failure. Rapid surgical exploration is essential with aggressive debridement, including amputation, if necessary. Antibiotic management requires high doses of anti-clostridial agents. Interestingly, in experimental studies clindamycin has greater efficacy than penicillin. (43)

The role of hyperbaric oxygen is controversial. Retrospective studies have shown some improvement in survival. (56) A recent review of the literature indicates that the quality of studies is poor as no RCTs have been carried out. (57)

Spontaneous gas gangrene occurs in patients with gastrointestinal disease, immunocompromise and AIDS. (58) Bacteremia occurs early here with seeding of normal tissue. It shares rapidity, high toxicity and mortality with the more common, traumatic form.

Tetanus

Tetanus is a potentially fatal disease manifested by spasms and autonomic instability caused by the potent neurotoxin of clostridia tetani.(59) While the disease can be readily prevented by vaccination with tetanus toxoid and has been virtually eliminated in developed countries, there are an estimated 1 million cases per year in the developing world, with a case mortality of over 50% (60, 61). It has been estimated that there are 200,000 deaths from neonatal tetanus yearly. UNICEF has initiated a maternal vaccination programme to address this. (62)

Since tetanus enters the body through injured skin, surgeons play an important role in the prevention and treatment of non-neonatal tetanus. Routine vaccination of non-immune wounded patients in the emergency department has a public health function. While wounds have typically been classified into tetanus or non-tetanus prone, on the basis of the degree of contamination, this has recently been questioned. (63) The reality is that the majority of cases of adult tetanus result from minor or non-contaminated wounds. In 25% of cases no source of injury is detected. As a result new recommendations have been advanced to treat all patients lacking a history of adequate prior vaccination or one beyond the previous 10 years with human tetanus immune globulin (HTIG). 250 U of HTIG are given IM in the extremity opposite the one used for tetanus toxoid vaccination. However HTIG is not widely available in Africa. Surgical debridement and delayed primary closure of wounds with devitalized tissue is of course mandatory.

Clinically tetanus may take generalized, localized and cephalic forms, ranging from mild to severe. (64) In the generalized form, symptoms begin after an incubation period averaging 7-10 days from injury. Sore throat, difficulty opening the mouth, generalized rigidity leading to trismus or lockjaw progress to muscular spasms in 1-7 days. Episodic spasms occur spontaneously or as a response to noise, touch or nursing measures. Autonomic instability with a hyperkinetic circulation, fever, gastric and urinary retention may ensue and last for weeks.

The treatment of tetanus includes high doses of HTIG, 3,000-10,000 U IM, surgical debridement when necessary, antibiotics active against c. tetani and supportive measures. With regard to antibiotics, high dose penicillin is standard, but metronidazole has been deemed superior. (64) Diazepam is used to control spasms but artificial ventilation with non-depolarizing muscle relaxants may be necessary.

Magnesium sulfate has been used to treat autonomic instability. High quality nursing care is critical to prevent bedsores. Tracheostomy is often required for airway management and nutrition is provided by nasogastric feedings. The rehabilitation of survivors is prolonged. The mortality rate is highly dependent on the level of ICU facilities. (65) Control of this disease will only be achieved through universal vaccination.

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