A review of necrotising fasciitis in the extremities

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Objective To review currently available evidence on the epidemiology and methods of management for necrotising fasciitis, with particular reference to Hong Kong.

Data sources and study selection Medline, PubMed, and Cochrane Library searches of local and internationally published English language journals, from 1990 to July 2008 using the terms 'necrotising fasciitis', 'Hong Kong', 'diagnosis', 'epidemiology', 'vibrio', 'streptococci', 'clostridia', and 'management'.

Data extraction All articles involving necrotising fasciitis in Hong Kong were included in the review.

Data synthesis The incidence of necrotising fasciitis in Hong Kong and around the world has been increasing. This rapidly progressive infection is a major cause of concern, due to its high morbidity and mortality. Up to 93% of affected patients at our hospital were admitted to the Intensive Care Unit and many still died from septic complications, such as pneumonia and multi-organ failure. Radical debridements in the form of amputations and disarticulations were considered vital in 46% of the patients. Early recognition and treatment remain the most important factors influencing survival. Yet, early diagnosis of the condition is difficult due to its similarities with many other soft tissue disorders such as cellulitis. Repeated surgical debridement or incisional drainage continues to be essential for the survival of sufferers from necrotising fasciitis. Many authorities have reported that carrying out the first fasciotomy and radical debridement within 24 hours of symptom onset was associated with significantly improved survival, which also emphasises the importance of early diagnosis.

Conclusion Clinicians must adopt a high index of suspicion for necrotising fasciitis. Empirical antibiotics must be started early and repeated physical examinations should be performed, while maintaining a low threshold for tissue biopsy and surgery. The timing of the first fasciotomy and radical debridement within a window of 24 hours from symptom onset is associated with significantly improved survival.

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Introduction

Necrotising fasciitis is a severe form of soft tissue infection that primarily involves the superficial fascia. It may result from any insult to the integumentary system or from haematogenous spread. It can develop at the site of a skin biopsy, laceration, insect bite, needle puncture, surgical wound, skin abscess, and areas affected by herpes zoster, or a chronic venous ulcer. It may spread rapidly to involve a whole limb, for which reason early debridement and antibiotic interventions are essential to avoid a fatal outcome. The two commonest pitfalls in management are: failure to make an early diagnosis and inadequate surgical debridement.

Necrotising fasciitis places significant demands upon hospital and medical resources. In the US, the annual age-adjusted incidence was 4.3 invasive infections per 100 000 of the population.[1] An Australian study[2] reported that the mean hospital length of stay for survivors of necrotising fasciitis was 36 days, and the average cost per patient during their hospital stay was AUS$64 517. For the 63% of their patients admitted to the Intensive Care Unit (ICU), the average length of stay in the ICU was 11 days. A similar average duration of hospitalisation (34 days) was reported from Taiwan.[3] In Hong Kong, the numbers of

TABLE 1. Numbers of registered deaths and crude death rates due to fasciitis, not elsewhere classified (ICD10:M725), 2001-2006

Year	No. of registered deaths	Crude death rate (number of registered deaths per 100 000 inhabitants)
2001	7	0.1
2002	15	0.2
2003	14	0.2
2004	4	0.1
2005	25	0.4
2006	24	0.4

TABLE 2. Numbers of patients with necrotising fasciitis reported to the Centre for Health Protection, Hong Kong (2005-July 2008)

Year	Reported cases
2005	12
2006	3
2007	11
2008 (up to July)	4

registered discharges from hospital and deaths due to necrotising fasciitis have been increasing. The crude death rate (number of registered deaths per 100 000 inhabitants) due to fasciitis in Hong Kong increased from 0.1 in 2001 to 0.4 in 2006 (Table 1).[4] In the recent few years (2005-July 2008), four out of 30 patients succumbed to necrotising fasciitis (Table 2).[5]

Methods

A literature search using electronic databases, including Medline, PubMed, and the Cochrane Library was performed. Search terms included 'necrotising fasciitis', 'Hong Kong', 'diagnosis', 'epidemiology', 'vibrio', 'streptococci', 'clostridia', and 'management'. The same investigator screened each article for inclusion. Major inclusion criteria were articles that (i) were published in the English language from 1990 up to and including July 2008, and (ii) involved necrotising fasciitis in the extremities. Major exclusion criteria were articles on Fournier's gangrene. Articles were reviewed and data regarding the epidemiology, causative agents, diagnosis methods, management, and long-term outcomes (such as mortality and survival) were retrieved. Bibliographies of review articles were reviewed for potentially relevant studies not identified through the electronic searches. All articles describing necrotising fasciitis in Hong Kong were included in this review. The same investigator undertook the data extraction from these articles. One article describing the location of vibrio species found in Hong Kong waters published in 1986 was also included because of its noteworthy information.[6]

肢體壞死性筋膜炎的回顧

目的 回顧壞死性筋膜炎流行病學和處理方法的現有實證，尤其是針對香港的研究。

資料來源與研究選取 使用以下關鍵詞，搜索從1990年至2008年7月於Medline、PubMed及Cochrane Library發表過的本地及外國的英文文獻：'necrotising fasciitis'「壞死性筋膜炎」、'Hong Kong'「香港」、'diagnosis'「診斷」、'epidemiology'「流行病學」、'vibrio'「弧菌」、'streptococci'「鏈球菌」、'clostridia'「梭狀芽胞桿菌」，和'management'「處理」。

資料選取 所有關於香港發生的壞死性筋膜炎的文獻都被納入回顧範圍內。

資料綜合 壞死性筋膜炎無論在香港或全世界都有上升的趨勢。由於患病率及死亡率很高，這種快速惡化的感染病很值得關注。我們的醫院接近93%受影響的病人須入住深切治療部，當中很多因為患上如肺炎和多器官衰竭的膿毒症而死亡。46%的病人中，發現截肢術和關節離斷術的積極清瘡方法很重要。早期識別和處理是影響存活率的最重要因素。可是，由於此病與很多其他軟組織病如蜂窩織炎很相似，所以早期診斷尤其困難。不斷重複的清瘡術和切開引流術對於維持壞死性筋膜炎病人的生命仍然相當重要。很多機構的報告顯示，在出現徵兆的24小時內進行首次筋膜切開術及積極清瘡術，與存活率有顯著關係；這亦表明早期識別此病的重要性。

結論 醫生必須對壞死性筋膜炎提高警惕。病人應盡早服用抗生素及重複進行健康體檢，同時維持低程度的組織活檢和手術。在出現徵兆的24小時窗口期內進行首次筋膜切開術及積極清瘡術的時間性，與存活率的提高有顯著關係。

Risk factors

The majority of patients with necrotising fasciitis (82%) had some form of chronic debilitating diseases such as diabetes mellitus, alcohol abuse, or renal insufficiency.[7] Of these conditions, diabetes mellitus was the most common, being present in 57% of the patients according to one report.[8] The implication of diabetes mellitus as a co-morbidity was important, as a higher percentage of these patients succumbed to the necrotising fasciitis (83% vs 37%, P=0.047).[9] Being immunocompromised (17% of the patients in one sample) was also an important predictor of mortality (odds ratio [OR]=3.97; 95% confidence interval [CI], 1.04-15.19; P=0.044).[10]

There was no consensus in the medical literature about any association between exposure to non-steroidal anti-inflammatory drugs (NSAIDs) and susceptibility to necrotising fasciitis. One study, however, claimed that there was such an association (adjusted OR=31.4; 95% CI, 6.4-153.8).[11] As NSAIDs inhibit prostaglandins, the authors suggested that

this results in an altered inflammatory response to the responsible organisms. Moreover, as NSAIDs suppress the cytoprotective effects of prostaglandins, it was suggested they might potentiate the development of acute renal failure (via inhibition of renal prostaglandin synthesis).

Causative agents

Necrotising fasciitis is usually divided into two categories. Type I disease (polymicrobial) involved anaerobic bacteria and streptococci other than serogroup A, and type II disease (monomicrobial) was caused by group A streptococci (GAS).[12] There was no consistent evidence on which type was more common. Taiwanese studies showed 20 to 38% of patients had polymicrobial disease and 49 to 68% had monomicrobial disease.[3,13] Monobacterial infection was most commonly due to *Streptococcus pyogenes* (25% of cases).[14] In US studies, however, 71 to 75% of tissue culture isolates yielded mixed aerobic and anaerobic bacteria.[14] A Turkish study found 82% of cases had polymicrobial infections.[15] Worldwide, GAS was the commonest pathogen responsible; the two most common portals of entry being sites of prior trauma and skin lesions (44.8% of patients).[3] Yet, of 30 patients with necrotising fasciitis in Hong Kong during the recent few years, 25 (83%) of the relevant tissue cultures grew vibrio, whilst only four (13%) grew *S pyogenes*, and one (3%) was diagnosed clinically without a culture result.[5]

The most prevalent types of GAS in Hong Kong were M1 (15%) and M12 (21%)[16]; these two types were usually found in skin and throat isolates and were most commonly associated with invasive disease (64% of cases). Notably, M1 was more frequent in invasive than non-invasive isolates (8/24 vs 8/83, P=0.004).[16] The case-fatality rate of GAS giving rise to necrotising fasciitis was approximately 20%.[17] The virulence of the M1 type may be related to its ability to increase the adhesion of streptococci to tissues and thus prevent phagocytosis by neutrophils.

In Hong Kong and other coastal cities around the world, another common pathogen responsible for necrotising fasciitis was the vibrio species, for which fishermen are an occupation group at risk.[18] The relevant vibrio species are common in seawater and have been isolated from brackish waters and seafood.[19] The organisms are halophilic (require high concentrations of salt for growth), motile, and encountered in warm coastal waters during the warmer months of summer,[19] and high concentrations have been found in shellfish, especially oysters.[20] Exposure to these bacteria usually occurs through ingestion of shellfish or inoculation via traumatic injury in marine environments.[20,21] Up to 50% of oysters and 11% of crabs cultured positive for the organism during summer months, when the incidence

of vibrio infections peaks.[21] The highest densities of vibrio species in Hong Kong were detected in water samples from the Aberdeen shelter and the Jordan ferry pier.[6]

In necrotising fasciitis due to *Vibrio vulnificus*, predisposing factors included chronic liver disease (haemochromatosis and cirrhosis), adrenal insufficiency, malignancy, immunocompromised states such as AIDS and achlorhydria.[20] High serum iron levels appear to predict severe infections, very likely related to iron sequestration from transferrin and haemoglobin and the production of siderophores.[20] Thus, cirrhosis also appears to be an important risk factor, due to its relation to dysfunctional iron metabolism, portal drainage, and impaired hepatocellular function.

In the last decade, cases of necrotising fasciitis caused by other strains of vibrionaceae have also been reported. In Hong Kong, *Vibrio alginolyticus* infections have followed injuries inflicted by stingrays, and *Vibrio damsela* infections after rabbitfish injuries.[22-24] These organisms are more virulent than *V vulnificus* and cause rapidly advancing necrotising fasciitis. Very early surgical debridement and amputation may be required for survival.[24]

Other bacteria commonly associated with necrotising fasciitis include *Aeromonas* and the clostridia species. *Aeromonas*, like vibrio, are very virulent; in one Taiwanese study all infected patients died.[3] *Aeromonas hydrophilia* infections are encountered in association with immunosuppression, burns, or trauma; 78% of cases had recent exposure to contaminated freshwater.[25,26]

Injection drug abuse and prior surgery were risk factors of necrotising fasciitis caused by clostridia.[27,28] Most of these bacteria are killed by brief heating to temperatures of 72°C, but their spores are more resistant to heat.[29] Thus, infection is possible after contact with instruments to which heating procedures have been applied. Clostridial infections are also associated with bowel surgery; infections with *Clostridium perfringens* have been encountered after procedures such as laparoscopic cholecystectomy.[30]

Pathogenesis

Most bacteria and fungi multiply within viable tissue, but fibrous attachments between subcutaneous tissues and fascia can help limit the spread of infection. The natural lack of fibrous attachments in larger areas of the body such as the trunk or extremities facilitates widespread infection.[31] The primary site of such pathology is the superficial fascia; the mechanism of spread being attributed to the expression of bacterial enzymes such as hyaluronidase (which degrade fascia).[32] Uncontrolled proliferation of bacteria causes angiothrombotic microbial invasion and liquefactive

FIG 1. (a) Early stage of necrotising fasciitis with only erythema and oedema. (b) Late stage of necrotising fasciitis with haemorrhagic bullae and blistering

necrosis of the superficial fascia.[32] The infection spreads along fascial planes, causing widespread thrombosis of perforating nutrient vessels to the skin and progressive skin ischaemia.[32,33]

This is the underlying event responsible for the cutaneous manifestations of evolving necrotising fasciitis. Initially a horizontal phase predominates with rapid spread through the fascia with extensive undermining of apparently normal-looking skin. As the condition evolves, ischaemic skin necrosis ensues and manifests as gangrene in subcutaneous fat, the dermis, and epidermis, followed by progressive bullae formation, ulceration, and skin necrosis.[32]

Clinical stages

The clinical presentation of necrotising fasciitis entails progressive skin changes. Early on, only tenderness, swelling, erythema, and warm skin are present

and specific signs such as crepitus and blistering are rare (Fig 1a).[32,34,35] In an Indian study involving 75 patients, 91% of patients presented with local tenderness, 99% with oedema, 72% with erythema, 73% with ulceration, and 72% with a purulent or serous discharge.[36] Occasionally, some patients had unstable presentations. Some US studies reported that in addition to common presenting symptoms such as swelling and redness (in 78-100% of cases), 83% of patients had severe pain, 86% had fever, and 33% also had hypotension (systolic blood pressure, <90 mm Hg), 23% were also disorientated and 24% experienced local anaesthesia.[28,37,38] Rarer symptoms such as crepitus and blistering were also noted (in <40% of patients).[28,37,38] In a Hong Kong study of 24 patients, 79% presented with toxic shock but the most consistent symptom was severe pain (present in all patients).[39] In the same study, tenderness and generalised swelling of the limb was observed in 58% of the patients, erythema in 50%, and skin oedema in 13%.

When critical skin ischaemia occurs, blisters or bullae are formed, such an appearance being rare in cellulitis or erysipelas.[32,34] Blistering is due to ischaemia-induced necrolysis as the invading organisms cause progressive thrombosis of vessels that penetrate the fascia to supply the skin.[32]

In their late stage, necrotising fasciitis lesions turn black and form a necrotic crust (Fig 1b),[34] with fascial tissue and brown grayish secretions underneath the crust.[34] The occurrence of tissue necrosis results in hyposensitivity (or anaesthesia) as the nerves become involved.[34] The subcutaneous cellular tissue was friable and could be easily removable.[34] Tissue crepitation was present due to the gas produced by aerobic and anaerobic bacteria.[34] Characteristically the skin becomes more erythematous, painful and swollen, and also displays indistinct borders,[34] violaceous hues, and necrotic bullae.[40] The skin eventually becomes haemorrhagic and gangrenous. Table 3 summarises the stages.[40]

Clinical diagnosis

Diagnosis of necrotising fasciitis depends on recognition of the characteristic rapidly progressive clinical course.[41] There could be a history of soft

TABLE 3. Clinical stages of necrotising fasciitis

Stage 1	Stage 2	Stage 3
Tenderness	Blisters and bullae formation	Tissue necrosis
Erythema		Hyposensitivity
Oedema		Anaesthesia
Warm skin		Tissue crepitation
Fever		Haemorrhagic bullae

FIG 2. Intra-operative photo of debridement procedure

tissue injury from an animal or insect bite, blunt or penetrating trauma, minor skin infection, postoperative infection, or even injections (eg subcutaneous insulin or illicit drugs).[31,36]

Due to overlapping diagnostic characteristics between cellulitis and necrotising fasciitis, initially many patients were mistakenly diagnosed as cellulitis, resulting in delayed management. Usually, pain out of proportion to the physical findings is the only early distinguishing feature. In cellulitis, infection begins at the junction between the dermis and superficial fascia, but in necrotising fasciitis it starts at the level of subcutaneous fat and deep fascia, and in the early stages the epidermal and dermal layers are spared.[39] Oedema of the epidermal and dermal layers and erythema of skin are therefore not obvious initially.[39]

However, a number of symptoms and signs that may help differentiate the two conditions have been proposed. A Canadian study described patients with necrotising fasciitis as more likely to have a generalised erythematous rash (OR=11.0; 95% CI, 2.0-262.5) and a toxic appearance (OR=23.0; 95% CI, 2.0-262.5).[42] The responsible organisms produce pyogenic exotoxins and cytolysin that are responsible for hypotension, multi-organ failure, and disseminated intravascular coagulation.[39] Patients with necrotising fasciitis were also more likely to have low platelet counts at presentation (mean, 194.0 x 10^9/L for necrotising fasciitis vs 299.3 x 10^9/L for cellulitis, P=0.03).[42] Thrombosis of skin vessels leads to necrosis and the severe pain fades as nerves die.[39]

Surgical diagnosis

The gold standard for detecting necrotising soft tissue infections is tissue biopsy obtained at the time of wound exploration and surgical debridement.[31] During wound exploration, tissue integrity and depth of invasion can also be evaluated. Presence of fascial necrosis and myonecrosis are indicative of necrotising

infection. Loss of fascial integrity along tissue planes and frank evidence of muscle involvement are also diagnostic (Fig 2).[31]

A bedside procedure that aids diagnosis is the 'finger test'. A 2-cm incision down to the deep fascia is made under local anaesthesia, and the level of the superficial fascia is then probed with a gloved finger. Lack of bleeding, foul-smelling 'dishwater' pus, and minimal tissue resistance to finger dissection indicate a positive finger test,[32,33] and are considered diagnostic of necrotising fasciitis.

In necrotising fasciitis, the operative findings include the presence of dusky gray subcutaneous fat and fascia with a scanty serosanguineous discharge.[33] Also there is a lack of resistance to blunt dissection of the normally adherent superficial fascia, accompanied by a lack of bleeding and the presence of foul-smelling 'dishwater' pus.[32] Surgical diagnosis also involves examination of frozen sections after exploration of suspect areas to look for neutrophil infiltrates at wound margins.

Management options

Prompt diagnosis, adequate support to maintain vital functions, as well as thorough and frequent surgical debridement are the mainstay for achieving a successful outcome. According to published reports, a mean of three debridements controlled the infective process,[3] and survivors underwent a mean of 3.8 operations and fascial excision of up to 35% of the total body surface area.[43] Significant morbidity and mortality due to toxaemia, dehydration, and severe biochemical disturbances were reported to occur, whenever treatment was delayed.[44] A US study indicated that aggressive surgical debridement at the outset was associated with a mortality rate of 4.2%, versus 38% after delayed treatment (P=0.0007).[45] In another US study, 17 of 29 patients who underwent early operation (within 24 hours of admission) had a 6% mortality, while after delayed surgery it was 25%.[46] This finding was consistent with a Singaporean study (surgery delayed by more than 24 hours increasing mortality; relative risk=9.4, P<0.05) and a Taiwanese study (early debridements conferred a lower mortality than after delayed operations; 26% vs 46%, P=0.069).[3,47] The timing of the first fasciotomy within 24 hours of injury enhanced survival when compared to later surgery (hospital mortality 5% vs 23%, P=0.005).[48]

Although surgical debridement or incisional drainage is essential to survival in patients with necrotising fasciitis, use of appropriate antibiotics is equally important. Since the condition is usually polymicrobial, the initial regimen should include agents effective against aerobic Gram-positive cocci, Gram-negative rods, and anaerobes. The mainstay antibiotic regimen consists of a combination of

penicillin and clindamycin.[49] Clindamycin is often used because of a 68% failure rate attributed to lone use of cell wall–inhibiting antibiotics.[50] In these deep infections, adding an inhibitor of protein synthesis has a more favourable outcome (83% vs 14%, P=0.006).[50] Clindamycin also facilitates phagocytosis of GAS by inhibiting M protein synthesis. A combination of ciprofloxacin and amoxicillin-clavulanate was successful in treating necrotising fasciitis caused by *V alginolyticus*.[22] The overall rate of erythromycin resistance in GAS isolates in Chinese patients was 92%, compared to reported rates of 2.1 to 4.6% in the US and Canada.[51] In Hong Kong, the resistance rate to erythromycin was 32%.[16] There was also a high (53%) rate of resistance to tetracycline,[16] reflecting a high level of indiscriminate local usage.

Hyperbaric oxygen (HBO) therapy involves placing the patient in an environment of increased ambient pressure while breathing 100% oxygen, and results in enhanced oxygenation of arterial blood and tissues.[52] This significantly increases tissue oxygen tension, resulting in bacteriostasis of clostridia and halting the production of their α-toxin.[52] Infected tissue is known to be hypoxic through a combination of poor perfusion and oedema, whereas HBO improves neutrophil function by raising tissue oxygen tension. Hypoxia reduces the effectiveness of several antibiotics such as vancomycin and ciprofloxacin, but potentiates the action of aminoglycosides (as microorganism expel these drugs via an oxygen-dependent pump).[52] Once the infection is controlled, HBO-induced fibroblast proliferation and angiogenesis appear to assist wound closure.[12,52] In a US review, on average, HBO-treated patients achieved wound closure 28 days after first debridement compared to 48 days in those not receiving such therapy.[38] In an Australian study, two out of 33 (6%; 95% CI, 1-20%) HBO-treated patients died, compared to 4 of 11 (36%; 95% CI, 11-69%) among those not receiving such therapy (P=0.03).[52] This amounted to a relative risk reduction of 83%, and corresponded to an OR for survival of 8.9 (95% CI, 1.3-58.0). A study from the US involving 42 patients showed that HBO adjunctive to comprehensive, aggressive debridements reduced mortality compared to controls not receiving HBO (12% vs 34%), and morbidity (amputations being reduced 50% vs 0%).[53] However such findings are not reported consistently. In a Canadian study of 30 patients treated with HBO therapy and 24 treated without it, mortality rates for the respective groups were 30% and 42%, which was not a statistically significant difference.[54]

Use of HBO therapy in Hong Kong has been limited. The Recompression Treatment Centre on Stonecutters Island was opened in April 1994 and was mostly used for diving-related incidents.[55] Less than 5% of all patients admitted to the treatment centre received HBO for conditions other than decompression sickness, carbon monoxide poisoning, or radionecrosis.[55] This may have been due to the remote location of the facility and the risk of transporting critically ill patients.

Intravenous immunoglobulin (IVIG) has been shown to reduce mortality in necrotising fasciitis associated with the toxic shock syndrome, possibly by neutralising superantigen activity of beta-haemolytic streptococci on cytokine release by T cells and by reducing plasma levels of tumour necrosis factor and interleukin-6.[49,56] Intravenous immunoglobulin given to patients with streptococcal toxic shock syndrome yielded a 67% 30-day survival, versus 34% in controls.[57] Accordingly, with IVIG therapy, the OR for survival was 8.1 (95% CI, 1.6-45; P=0.009).[57] An Australian study reported that patients receiving IVIG had an overall survival rate of 80%, but there was no significant reduction of the case fatality rate.[12]

Sequelae

Due to difficulties in diagnosing necrotising fasciitis, the condition is associated with high rates of morbidity and mortality. An Australian study reported that out of 14 patients, 93% were admitted to the ICU, 79% required mechanical ventilation, and 71% received inotropic support.[12] In a US study, of 46 patients with necrotising fasciitis, 28 (61%) were admitted to the ICU.[58]

Urgent limb amputation is performed in patients with irreversible necrotic changes following sepsis and failed multiple debridements.[59] In Turkey, nine (41%) of 22 such patients had below- or above-knee amputations.[60] In the UK, out of 451 such patients, 22.3% underwent amputation or limb disarticulation.[59] In Taiwan, amputation was performed to control infections in 12% of patients out of a total of 59,[3] and in Hong Kong radical debridements (amputations and disarticulations) were performed in 46% of 24 patients.[39]

Despite efforts to treat the rapid infective process, many patients still die through complications of sepsis (pneumonia, heart failure, and metabolic disturbance).[61] The mortality rate of necrotising fasciitis ranges from 20 to 75%.[15,61] In a US study, four (33%) of 12 patients died with multi-organ failure.[61] Admission with white cell counts exceeding 30×10^9/L, hyperkalaemia, high partial thromboplastin times and aspartate aminotransferase levels, low arterial pH and bicarbonate concentrations all predicted mortality.[62,63] A Taiwanese study showed that vibrio infections, aeromonas infections, hypotension, and malignancies were associated with a higher mortality rate (P<0.05), while the presence of haemorrhagic bullae was associated with reduced mortality (P<0.05).[64] Patients who died were significantly older than survivors (P=0.038).[60]

TABLE 4. Factors favouring limb salvage surgery versus amputation

Limb salvage surgery	Amputation
Good past health Not life-threatening state Multiple sites Responsive to inotropic support	Concurrent medical disease with high anaesthetic risk from multiple operations (eg poorly controlled diabetes mellitus, valvular heart disease) Myonecrosis Unremitting shock Concurrent peripheral vascular insufficiency Rapidly progressive infection Large area of tissue necrosis (heel pad and sole skin loss)

Discussion

The incidence of necrotising fasciitis has been increasing in Hong Kong and around the world. Due to difficulties in diagnosis and management of this condition, it is a growing concern for health care providers.

Early recognition of necrotising fasciitis is difficult, even for experienced clinicians. Yet, certain clinical settings should raise suspicions. Patients with diabetes mellitus, compromised immunity, and a history of intravenous drug abuse are particularly at risk, and in them there is an increased mortality. The public should also be aware of the risks and the common clinical symptoms associated with necrotising fasciitis; affected individuals must seek medical attention immediately.

One of the most challenging aspects of necrotising fasciitis is its similarities with cellulitis, initially at least. The distinction is crucial, as cellulitis responds readily to antibiotic treatment alone, whereas in patients with necrotising fasciitis, survival also depends on early extensive surgical drainage and debridement, or even amputation. Necrotising fasciitis is more likely if the patient presents with a toxic appearance and/or there is crepitus and blistering. However, this is rare and usually both conditions present with the classic inflammatory features: pain, swelling, erythema, fever, and warm skin. Interestingly though, studies from Hong Kong reported a greater proportion with toxic manifestations than in other countries,[39] possibly due to late presentations to hospitals, limited public awareness, or more virulent vibrio species encountered locally. The period elapsing between symptom onset and admission into hospital could be an interesting direction for further studies.

The two most common organisms encountered in Hong Kong were streptococci and vibrio species. Vibrio in particular is highly virulent and particularly encountered by seafood handlers. Prevention measures therefore include: wearing gloves by those handling raw seafood, eating adequately cooked seafood, and avoiding raw oysters, clams, shrimp, and fish (associated with a high carriage rate of vibrio by high-risk individuals). Exposure of open wounds to seawater or raw seafood should also be avoided, especially in warm weather. One study pointed out the need for a high index of suspicion in regions endemic for vibrio necrotising fasciitis, and even suggested that antibiotic prophylaxis should be given to swimmers before entering such waters.[59]

The importance of early surgical management has been stressed in every study. Many articles reported that the timing of first fasciotomy and debridement (within a window period of 24 hours from symptom onset) was critical to improving survival. Yet, this poses a dilemma. Namely, is surgical exploration necessary in every case of suspected invasive soft tissue infection? The yield may not be high and could pose a huge burden on pathologists and surgeons. As yet there is no consensus on resorting to radical surgery in terms of amputations versus limb salvage surgery and repeated debridements. The authors recommend that surgeons should aim at limb salvage surgery as long as the patient's life is not compromised. Currently there is no evidence to support amputation in the early stages. Achieving better function versus the risks from disease severity must be balanced in the individual clinical setting (Table 4).

This review alerts clinicians to a high index of suspicion for necrotising fasciitis, which has an aggressive clinical course and can progress rapidly (within hours). Investigations such as computed tomography and magnetic resonance imaging can help diagnose necrotising fasciitis at presentation, but these imaging tools take time to process and may delay management. The most reliable approach is to have increased clinical awareness. Complaints of pain out of proportion to the visible findings or excruciating tenderness are clinical aids to early diagnosis. Upon admission, the general approach to soft tissue infections is to start empirical antibiotics, as most conditions such as cellulitis will respond. If the infection persists despite antibiotics, repeated physical examinations should be performed whilst maintaining a low threshold for tissue biopsy and surgery. If significant changes such as blistering, shock, or hyposensitivity ensue within hours, there should be no hesitation in proceeding to surgery. Where the progression is less pronounced, tissue biopsy should be performed. It is safer to treat these ambiguous cases as necrotising fasciitis and manage them aggressively, as delay in treatment can be life-threatening.

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