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General Surgery

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GAS GANGRENE – FULMINANT INFECTION IN TRAUMA VICTIM

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ABSTRACT

Gas gangrene is a rapidly progressing life threatening necrotic soft tissue infection, distinctive and complex in management, with high rates of mortality. Most commonly seen in post war scenarios, but rarely seen in a post traumatic patients. Management usually involves amputation at a higher level than the diseased part. We had a young patient with typical signs of gas gangrene such as limb discoloration, subcutaneous crepitus with no distal arterial pulsation. Comprehension of gas gangrene caused due to clostridium species by the clinician is essential for early detection and limitation of the disease progression with appropriate management saving the patient from such a devastating infection.

Introduction

Gas gangrene is a life threatening necrotic soft tissue infection described for ages as fulminant in nature [1], characterized by muscle necrosis and formation of subcutaneous gas and complex in management[1], with high rates of mortality. Early reports have identified Clostridium perfringes being the primary organism in gas gangrene[2,3].

The terminology gas gangrene is used commonly referring to presence of gas in the sub cutaneous tissue, although the Infectious Disease Society of America clearly defines gas gangrene as being caused by Clostridium species. The distinguishing features from other gas producing gangrene were elicited by Altmeier and fullen[4] as the true gas gangrene is aggressively invasive.

Necrotizing clostridium infection of the soft tissue are classified into traumatic and spontaneous gas gangrene and are largely attributed to Clostridium perfringens, Clostridium septicum, Clostridium Sordellii, and Clostridium novyi [5]. C. Perfringens would require a penetrating trauma where as C. Septicum and C. Sordellii may be associated with minor trauma.

Gas gangrene is characterized by extensive local destruction of muscle (myonecrosis) due to reduced tissue perfusion leading to ischemia, shock and ultimately death [6]. Delay in the diagnosis, immune suppression, diabetes mellitus and old age widely pre disposes for the spread of the disease. Histopathologically the picture of gas gangrene is very different from any other bacterial infections [7]. Poor blood flow due to arterial occlusion would attribute to the exacerbation of the anaerobic condition [8]. Studies show mortality varying from 22.6 to 42.9% [9-10].

Early diagnosis with early intervention by amputation at appropriate level followed by post operative use of broad spectrum antibiotics, Penicillin group of drugs and clindamycin [11,12] would help reduce mortality due to disease per se. Hyperbaric oxygen has been controversial, largely due to lack of data from RCT.

Case Report

A 32-year-old male came to the emergency room with complaints of pain in the right lower limb, swelling and foul smelling discharge. He gave a history of a road traffic accident [4], three days ago where he had sustained a laceration over the right knee that had been sutured at a private clinic. On examination patient was febrile, his right lower limb was found to be cold and tense, foul smelling discharge with skin discoloration noted up to the mid thigh, also multiple blebs were noted on the leg (Fig. 1). The sutured laceration was discolored, puffy and showed a khaki colored discharge. Subcutaneous crepitations were noted up to the thigh region with no distal pulsation felt below femoral region. Basic blood investigations showed leukocytosis with neutrophilia and increased blood sugars. Liver and renal function were normal. Arterial blood gas was normal and patient was not in coagulopathy.

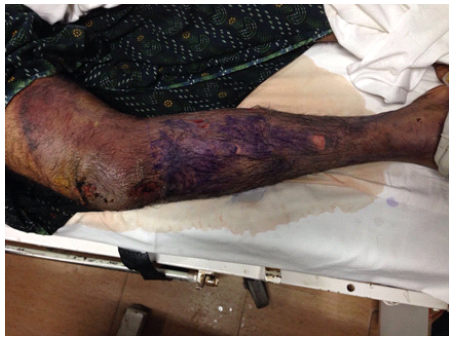


Fig. 1 In the emergency room, the sutured laceration was explored and underlying muscle showed myonecrosis.

X-ray right lower limb was done which showed air in the subcutaneous plane (Fig 2-5), suggested of gas gangrene.

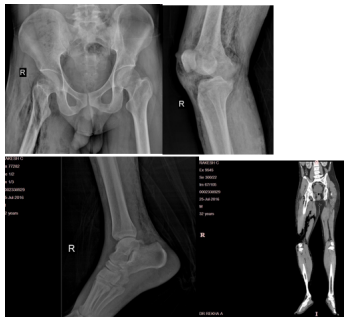


Fig. 2-5

CT lower limb arteriogram showed anterior tibial artery attenuated. Air pocket was seen diffusely tracking along

subcutaneous intra and inter muscular planes from right foot upto hip joints. Peroneal artery were smaller in caliber on both sides (Fig 6-7).

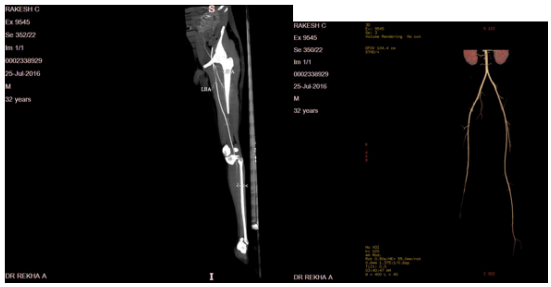
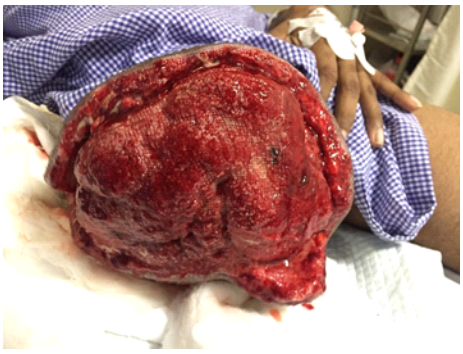


Fig 6-7

In view of extensive involvement of the right lower limb an above knee guillotine was done and the fascial planes were liberally opened up.



Post operative wound picture.

Post operatively patient was started on piperacillin-tazobactam in combination with clindamycin. Wound swab culture showed sporing gram positive bacilli that grew C. perfringens. Histopathology evidently showed myonecrosis. The wound significantly improved and patient underwent closure at a later date. Post operative period was uneventful and patient was referred for prosthesis fitting.

DISCUSSION

Gas gangrene is a rare and devastating illness caused in the setting of muscle injury and contamination with soil containing spores of C. Perfringens(80%) [7] or other clostridial species, the disease is associated with high morbidity and mortality. Gas gangrene can be classified post traumatic (60%) and Spontaneous/ Non-traumatic. Diabetes mellitus, leukemia, intestinal tract abnormalities such as colon cancer, bowel infarction (the aero tolerant spores enter through bacteremia with out any injury and multiply within) are associated with non traumatic gas gangrene [13-15].

The major extracellular exotoxins are alpha toxin (phospholipase C - PLC) and theta toxin (perfringolysin O - PFO). PLC and PFO each have different mechanisms. PLC is a lecithinase causing break down of heme, cytotoxic to platelets and leukocytes which shows increased capillary permeability. These are effects that are likely related to its inability to break down of sphingomyelin and the phosphoglycerides of choline, ethanolamine and serine that are present in eukaryotic cell membranes. PLC requires calcium for activity. Zinc enhances alpha toxin production and histidine residues have shown to be useful for zinc binding[16]. Titball et al. [17] have determined that the protein is composed of two functional units : N-terminal domain and C – terminal domain. N-terminal domain contains phospholipase C and the C-terminal domain binds to eukaryotic cell membrane. PFO is a member of the cholesterol-dependent cytolysins which includes streptolysin O from GAS, pneumolysin from streptococcus pneumonia and several others [18-19]. On contact with cell membrane cholesterol, theta toxin monomers olgomerize and insert into the membrane, forming a pore and resulting in cell lysis [20].

The usual incubation period of gas gangrene is between 2-3 days, but it may start as early as 6 hours. There is acute onset of pain, and characterized clinically by sub cutaneous crepitus, discoloration, soft tissue induration, tense extremities, development of multiple blisters, foul smelling with brown color fluid [21]. Evidence suggest that alpha and theta toxin are the major factors leading to myonecrosis[22]. Intravascular thrombosis due to alpha toxins effect on platelets and granulocytes are responsible for the severe pain and extensive myonecrosis [23]. Alpha toxin also provokes systemic hypotension by directly suppressing heart contractility and triggering the release of inflammatory mediators [16]. Rapid progression of the disease causes renal shut down and jaundice.

A Gram stained smear of the wound would show gram positive bacilli with blunt ends. Plain x-ray shows gas in the subcutaneous and muscle planes. CT/ MRI can be done to assess the extent of spread of the disease [24]and tissue biopsy would show myonecrosis and connective tissue destruction with scanty neutophilic infiltration.

Hyperbaric oxygen therapy role has been largely controversial. According to Nedaa Skeik, et al [25] clostridial myonecrosis showed good improvement. But still it stands that early surgery contains the spread of the disease.

Active immunization was developed for prevention of C. perfringens gas gangrene based on the structure/ function attributes of alpha toxin, mainly targeting the C- Terminal domain [21]. Based upon invitro susceptibility, penicillin is always the drug of choice, Later studies showed clindamycin to be more efficient in combination with penicillin [11,12,26]. But empirical remains so for after multiple clinical trails, ampicillin-sulbactam or piperacillin-tazobactam in combination with clindamycin and metronidazone [26-27].

In conclusion gas gangrene remains uncommon in the civilian population yet soil contamination of lacerations may cause it to be encountered in civilian setting also through washing, extensive debridement and delayed closure of contaminated laceration is essential in prevention. The practicing surgeon should be aware of this uncommon entity to limit the morbidity associated with it.

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