

## Case Report

# Improved vacuum sealing drainage in the treatment of gas gangrene: a case report

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**Abstract:** In this case, improved vacuum sealing drainage was used for gas gangrene treatment, which is different from traditional therapies of gas gangrene and this is the first report of using improved vacuum sealing drainage to treat gas gangrene. The patient was a 12-year-old Asian Male who was presented to the Emergency Department with a one-day history of left femoral progressing swelling, pain and fever. Four days ago, rusty iron bars were plugged into the muscle of the left femoral when he played. Then he was taken to the local clinic and injected with tetanus antitoxin. A diagnosis of gas gangrene was made and modified vacuum sealing drainage device was used after thorough debridement. After two weeks' treatment, left femoral was kept and gas gangrene was cured successfully.

**Keywords:** Gas gangrene, vacuum sealing drainage, treatment

## Introduction

Gas gangrene, is anaerobic bacteria infection disease caused by clostridium. For its rapidly developing and poor prognosis, it often causes amputation and even death and it is one of the most serious complications in trauma. Gas gangrene mainly occurs in traffic accidents, earthquakes and regional war. Muscle tissue necrosis were the mainly characteristics of gas gangrene. Muscle skin usually changes from red to black, then appears necrosis. Mortality rate for patients with gas gangrene are as high as 20% [1], and amputation rate is still keeping high of 25%-88% [2, 3]. The high mortality rate and disability rate of gas gangrene usually bring tremendous sadness to the patient and family members. And necrosis could cause severe toxemia easily because of its quick spreading and there will be pneumatosis, edema, necrosis and stench in local muscle tissue. Necrosis could cause amputation and even death for its rapidly developing and poor prognosis. It is one of the most serious complications in trauma. Early diagnosis and aggressive treatment is the key to save lives and preserve the wounded limb. Debridement and hydrogen peroxide hydroperoxide compress, hyperbaric oxygen, antibiotics were typically used in the conventional treatments of gas gangrene.

Since the traditional treatments can control the progression of disease effectively, however the morbidity is relatively high. Therefore, a modified vacuum sealing drainage treatment was used to reduce the amputation rate and mortality rate of patients with gas gangrene.

## Case presentation

The patient was a 12-year-old Asian Male who was presented to the Emergency Department with a one-day history of left femoral progressing swelling, pain and fever. Four days ago, rusty iron bars were plugged into the muscle of the left femoral when he played. Then he was taken to the local clinic and injected with tetanus antitoxin. Gas among muscles was found through X-Ray. Besides, Ultrasound examination showed that subcutaneous edema in the left femoral, gas and liquid was existed in muscles. Then a diagnosis of gas gangrene was made and we use modified VSD (vacuum sealing drainage) device after thorough debridement when treating gas gangrene. Our surgical method is as follow: the wound was fully exposed and we further take more extensive deep incision. All necrotic tissues were removed thoroughly until seeing the healthy bleeding tissue when patients are taken thorough debridement. At the same time, take bacterial culture

and drug sensitive test of pus and blood, which was conducive to the choice of sensitive antibiotics and antibacterial drugs. The wound was irrigated repeatedly with 3% hydrogen peroxide in the operation. After thorough debridement, the VSD with multiple side holes drainage tube was clipped according to the debridement area size, and the material's size was equal to or slightly less than the wound. The prepared VSD materials were built-in to cover the wound, make it having a good contact with the healthy tissue, keep flushing tube and drainage tube outside the skin, interrupted suture in the incision, wiped the area skin clean, covered the incision with transparent glue sticky. The next step is as follows: (1) Close drainage tube, flush the wound tissue with 0.2% metronidazole through flushing pipe, and metronidazole solution not overflow the wound, reserve 10-20 min within the wound, switched on the VSD device, drip physiological saline to the wound through flushing pipe, flush the wound until drainage fluid was clear. Adjust to metronidazole irrigation 2-4 times a day according to the nature of liquid drainage. (2) Open VSD device between two metronidazole irrigation, offering oxygen sustaining through flushing pipe on debridement area, keep oxygen flux to 5~6 L/min. Meanwhile, flush the wound tissue with 1% potassium permanganate through flushing pipe. Stop oxygen offering and metronidazole irrigation when the bacterial culture results that anaerobic bacteria growth was negative. And then drip sensitive antibiotics to the wound through flushing pipe until aerobic bacteria culture is negative. (3) Drip sensitive antibiotics through flushing pipe after the infection was controlled, 1 time/day. The therapy was given priority to pressure suction, which promoted the healing of tissue.

After two weeks' treatment, left femoral was kept and gas gangrene was cured successfully.

### Discussion

Clostridial myonecrosis is most often seen in settings of trauma, surgery, malignancy, and other underlying immunocompromised conditions. Since 1953 cases of gas gangrene have been reported in orthopaedic patients including open fractures, closed fractures, and orthopaedic surgeries [4]. Gas gangrene is generally regarded as a disease associated with war or other mass casualty situations and is seldom a feature of normal peaceful time medical prac-

tice. The cause of gas gangrene could be grouped into following different types: clostridial myonecrosis, clostridial cellulitis, nonclostridial lesion simulation gas gangrene [5]. About 10% of patients with gas gangrene are spontaneous (non traumatic), caused by clostridium septicum [6, 7]. The mainly clostridium caused gas gangrene are clostridium peoeringens, clostridium septicum, clostridium novyi, clostridium histolyticum, clostridium bifermentans and clostridium fallax, etc [8]. The difficulties in diagnosis not only lie in unfamiliarity with the signs and symptoms of gas gangrene but also in the lack of differentiation between contamination and infection and to the confusion between gas gangrene and various clostridial infections and other bacterial and nonbacterial lesions simulating gas gangrene [9, 10]. Bacteria can't survive in the aerobic environment, but spore can survive long-term in nature for its strong resistance. The growth and reproduction of clostridium need certain conditions, that is the vast inactivation tissue, ischemia and hypoxia.

Clostridium propagate at all layers in the organizations and then decompose carbohydrate and protein. A large amount of gas was produced after Carbohydrate's decomposition, which made tissue expansion. The wounds were stink because of the protein's decomposition and liquefy. Vascular endothelial cell's damage and permeability's increase both cause local edema. With the combined effect of ischemia and exotoxins, it makes tissue in the wound necrosis and decay further. Since necrosis and decay of tissue in the wound was beneficial to bacteria's breeding, infection's rapidly spread. Tissue necrosis and toxin absorption can cause severe toxemia and further lead to the septic shock. Infection can spread to the patients' whole body within one day in appropriate conditions, then cause shock and even death. The body's defense function declines in a short time when patients infected with clostridium, then systemic pyemia appeared. Gas gangrene was an acute and life threatening infection characterized by fever, sudden onset of prominent pain, massive local edema, severe extensive myonecrosis, and the accumulation of gas at the site of infection [11]. Therefore, how to eradicate the deactivation organization thoroughly, eliminate ischemia and anoxia environment, prevent infection's spreading, are the key to the treatment of gas gangrene in clinical.

In this study, a modified VSD device was used after thorough debridement in the treatment of gas gangrene. There were many advantages of modified VSD device in the treatment of gas gangrene, such as supplying oxygen persistently could rapidly improve the oxygen concentration of the infected sites, inhibit the growth of anaerobic bacteria, stop clostridium secreting toxins, control the spread of the anaerobic bacteria. Sensitive antibiotics also restrain the growth of anaerobic bacteria. Besides, necrotic tissue and seepage were taken away through drainage tube, it could ensure cleanness of wound and eliminate this study, a modified VSD device was used after thorough debridement in the treatment of gas gangrene. There were many advantages of modified VSD device in the treatment of gas gangrene, such as supplying oxygen persistently could rapidly improve the oxygen concentration of the infected sites, inhibit the growth of anaerobic bacteria, stop clostridium secreting toxins, control the spread of the anaerobic bacteria. Sensitive antibiotics also restrain the bacteria growth medium, which played an important role in inhibiting the spread of anaerobic bacteria. What's more, supplying oxygen persistently increase the oxygen content in the capillaries, which could improve the microcirculation of local tissue, reduce post-traumatic tissue oedema, strengthen aerobic metabolism, promote the damaged cells recovering, stimulate growth of granulation tissue and accelerate wound polymerization. Through this methods in the operation, patients' pain was avoided and there was no special treatment after post-operation, which showed the simple process of this operation. We can observe the skin blood supply, limb swelling degree and the drainage properties through transparent glue sticker, adopt correct counter-measures according to the skin and wound infection situation.

## Conclusion

The traditional methods of treating gas gangrene could control the disease effectively, however, it couldn't significantly reduce the mortality. Vacuum sealing drainage technology was mainly applied to the treatment of defecation, infection and necrosis of skin and soft tissue wound in orthopaedics department. Modify vacuum sealing the indication was innovatively use for gas gangrene and it could significantly increase the cure rate and reduced the morbidity of gas gangrene, reduce the spirit and life pressure of the patients and family members.

We need more cases to proof the feasibility of VSD in treating gas gangrene, ultimately requires a large number of clinical validation, evaluation and further well-designed.

## Disclosure of conflict of interest

None.

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