

Case Report

Hyperbaric Oxygen Therapy in Extensive Fournier's Gangrene-our Experience of Treatment

Ming-Chran Hung¹

Mu-Song Pan²

Li-Chin Cheng²

Yu-Feng Tian²

Chia-Lin Chou²

¹Nurse Practitioner, Department of Surgery

²Division of General Surgery, Department of Surgery, Chi-Mei Medical Center, Tainan, Taiwan

Key Words

Fasciotomy;

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Fournier's gangrene is a fulminant necrotizing fasciitis of the perineum and a lethal disease. Obliterative endarteritis, caused by the pathogens, blocks the circulation, impairs tissue perfusion, and then causes gangrene and necrosis of the skin and fascia. The pathogens rapidly proliferate along the necrotic fascia and skin, leading to serious infection and sepsis. The mortality rate of patients with Fournier's gangrene with extensive lesions is higher than that for patients with localized lesions. Old age, trauma, diabetes, immunosuppression, and chronic systemic diseases are predisposing factors. Sepsis is the most important factor of mortality. The principles of treatment include eradicating the bacteria and blocking the progress of extensive Fournier's gangrene. Eradication of bacteria includes use of broad-spectrum antibiotics, wound debridement, drainage and frequent dressing changes. Blockage of the progress of necrotizing fasciitis can be done by increasing tissue oxygenation. Hyperbaric oxygen therapy is a good modality to increase tissue oxygen and, therefore, improves the outcome. However, the clinical effects of hyperbaric oxygen therapy are controversial. We present our clinical experience with hyperbaric oxygen therapy in extensive Fournier's gangrene.

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Fournier's gangrene, a necrotizing fasciitis of perineum and around the anus, is a highly fatal disease, because of its sudden onset and rapid progress.¹ The initial clinical symptoms and signs include local redness, swelling, heat and pain, and even high fever or chills. The disease may rapidly progress and spread along the subcutaneous tissues, leading to predominant swelling and gangrene with abscess formation. Without aggressive treatment, severe sepsis and death can occur.² The traditional treatment for Fournier's gangrene includes the following: 1. Thorough debri-

dement after diagnosis and repeat the debridement to not any other necrosis tissue left if necessary; 2. Broad-spectrum antibiotics administration; 3. Support hemodynamic status and provide adequate nutrition; 4. Well coverage of wound including suture and skin grafting. The rationale for hyperbaric oxygen (HBO) therapy includes the following: 1. Increase blood oxygenation to improve anoxia of the tissues; 2. Constrict the vessels to reduce tissue swelling; 3. Promote wound healing; 4. Accelerate removal of carbon monoxide, nitrogen and other poisons; 5. Increase the bactericidal abi-

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Correspondence to: Dr. Chia-Lin Chou, Division of Urology, Department of Surgery, Chi-Mei Medical Center, No. 901, Zhonghua Road, Yongkang Dist., Tainan 710, Taiwan. Tel: +886-6-281-2811; Fax: +886-6-281-4813; E-mail: hung.jojo54@gmail.com

lity of neutrophils to control infection; 6. Reduce further injury to the tissue. Fournier's gangrene usually causes local tissue hypoxia. HBO therapy brings to an improvement of the perfusion of ischemic tissue, improved oxygen supply, neovascularization and it also has an antimicrobial effect which is related to anaerobic bacteria.³ We present our experience in the treatment of Fournier's gangrene in the present article.

Case 1

A 48-year-old man with diabetes mellitus was admitted because of a traumatic perianal injury. He had fever, perianal swelling and pain for one week. Initially, he visited a clinic and incisions and drainage of purulent material were performed. However, erythema and swelling of the right buttock rapidly progressed to the perineum, scrotum and bilateral inguinal areas and buttocks. He visited our emergency department (ED). Laboratory data disclosed leukocytosis and hyperglycemia (white blood cells [WBCs] 34,800/uL, blood glucose: 717 mg/dl). Abdominal computed tomography (CT) revealed a gas-forming abscess in the subcutaneous tissues of the bilateral gluteal and perineal regions, penis, and the right side of the scrotum. Under the impression of Fournier's gangrene, he received an immediate fasciotomy (Fig. 1). After the operation, he was admitted to the ICU because of severe sepsis. Peripheral parenteral nutritional support was given. Wound care with normal sa-

line wet dressings was done every 8 hours. Broad-spectrum antibiotics were administered. On the 11th day of hospitalization, he was transferred to an ordinary ward in a stable hemodynamic status. The wound healed slowly. A plastic surgeon performed bilateral scrotal skin flap surgery on the 70th day of hospitalization. His hospital stay was 81 days.

Case 2

A 63 year-old man with diabetes mellitus had perineal pain and fever for four days, accompanied by an intermittent pus-like discharge from the anus. In the ED, physical examination showed perianal erythematous changes with tenderness without obvious discharge. Laboratory data showed WBCs 15,900/uL and blood glucose 426 mg/dl. Abdominal CT revealed necrotizing fasciitis of the pelvic area extending bilaterally to the bladder and groin area (Fig. 2). Fournier's gangrene was diagnosed and an emergency fasciotomy with debridement was performed (Fig. 3). A broad-spectrum antibiotic (Tazocin) was administered and wound care with normal saline wet dressings was applied. The infection progressed and the erythema, swelling and tenderness extended cephalad to the lower abdomen. Septic shock was noted. Therefore, extended debridement and a colostomy for stool diversion were performed. After the operation, the patient was transferred to the intensive care unit. On the 7th hospital day his hemodynamic status stabilized. HBO



Fig. 1. The picture shows Fournier's gangrene and wound after serial debridement.

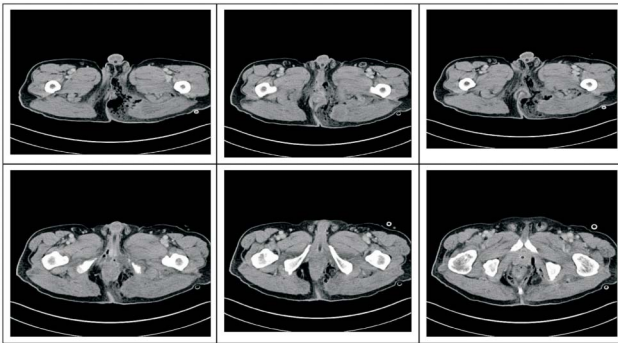


Fig. 2. Gas-forming abscess formation in the perineal area and extended to bilateral bladder around the groin area.

therapy consisting of cycles of 95 minutes at 2.0 atmosphere absolute pressure was applied. With repeated debridement surgery and adjuvant treatment with HBO, the wound healed gradually. After five debridements and five HBO treatments, the wound was closed. The hospital stay was 33 days.

Case 3

A 53 year-old man with diabetes mellitus initially complained of perineal pain. One week later, the pain extended to the bilateral scrotal area accompanied by fever. He denied any trauma history. In the ED, physical examination showed bilateral scrotal swelling and crepitus in the groin area. Laboratory data showed WBCs 44,700/uL and blood glucose 440 mg/dl. Fournier's gangrene was diagnosed and an emergency fasciotomy of the scrotum, perineum, and inner thigh with a colostomy was performed. Broad-spectrum antibiotics were administered and debridement was done daily (Fig. 4). On the 5th hospital day, adjuvant HBO therapy consisting of cycles of 95 minutes at 2.0 atmosphere absolute pressure was applied. He received four debridements and ten HBO treatments. Finally, the sepsis was controlled and the wound was reconstructed with a skin flap. The hospital stay was 58 days.

Discussion

Fournier's gangrene is a necrotizing fasciitis which



Fig. 3. Fournier's gangrene of bilateral buttock status post extensive debridement and HBO therapy.

rapidly spreads from the perineum. It is typically characterized by sudden inflammation of the perineum with rapid extension to the penis, abdominal wall and thigh.⁴ It is considered a rare but serious soft tissue infection in the elderly, and mostly in men. In our study, all three patients were men with an average age of 55 years. The source of infection may be urogenital (45%), ano-rectal (33%), or cutaneous (21%).⁵ Fournier's gangrene is a disease with combination of more than one disease, mostly diabetes mellitus, followed by chronic renal failure, cirrhosis, obesity, cancer metastasis and immunocompromised status, all of which can impair the patient's immune system and cause uncontrolled sepsis and death.⁶ Our three patients all had type 2 diabetes mellitus. The clinical presentation included redness, swelling, heat and pain, accompanied by constitutional symptoms and signs, such as fever and leukocytosis. Two of these patients had septic shock initially and were transferred to the ICU. The literature reports higher mortality in patients with extensive Fournier's gangrene than those with local Fournier's gangrene. Patients with necrotizing fasciitis of the abdomen, groin and perineum have a mortality rate 20-30% higher than the average for local Fournier's gangrene.⁷ Death mainly occurs because of delayed diagnosis and treatment. The mortality rate has gradually decreased in recent years because of advances in antibiotic and HBO therapy. HBO increases the oxygen content in the tissues, inhibits toxin production, increases the bactericidal effect, reduces wound infection and reduces extensive tissue and organ damage,



Fig. 4. The scrotum and perineum after serial debridement and HBO therapy.

thereby increasing the survival rate.^{8,9} It also promotes neovascularization and thereby further increases oxygen in the tissues, decreases tissue necrosis and inhibits growth of anaerobic bacteria. The clinical efficacy of HBO has been affirmed with a statistically proven survival advantage for patients receiving adjuvant hyperbaric oxygen therapy for Fournier's gangrene.¹⁰ Patients who had HBO therapy had a proportionately lower mortality rate than those who did not receive it.¹¹ Our three patients all received surgical debridement and broad-spectrum antibiotics within 24 hours after admission. Two of the three patients received HBO therapy, and sepsis was quickly controlled and the wound improved. The first patient did not receive hyperbaric therapy because of his unstable hemodynamic status and refusal to undergo the procedure. When Fournier's gangrene is difficult to control, HBO therapy may be an effective modality to suppress sepsis and reduce mortality. In our experience, HBO therapy could improve wound healing and decrease the hospital stay.

Conclusion

There is physiologic rationale for the use of HBO in the treatment of Fournier's gangrene. Use of HBO therapy is not widespread, but it appeared to be valuable in our patients. The therapeutic rules for extensive Fournier's gangrene are as follows: 1. Early diagnosis; 2. Early radical excisional debridement, and if necessary, repeated debridement until all the necrotizing tissue is completely removed; 3. Broad-spec-

trum antibiotics to eradicate the bacteria; 4. HBO therapy as a helpful adjuvant modality. All these elements are useful in treating Fournier's gangrene.

Contributors

MC Hung was responsible for data management. MC Hung and MS Pan wrote the manuscript. MC Hung and MS Pan contributed equally to this work. CL Chou reviewed the report.

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病例報告**高壓氧治療應用於廣泛性的 Fournier's 壞疽**洪明嬋¹ 潘慕嵩² 鄭立勤² 田宇峯² 周家麟²¹奇美醫療財團法人 奇美醫院 外科部²奇美醫療財團法人 奇美醫院 一般及消化系外科

Fournier's 壞疽是位於會陰部及肛門附近爆發性的壞死性筋膜炎，且是一種高度致命的疾病。致病菌使皮下細小動脈產生閉鎖性內膜炎，造成了血流灌注不足狀態，進而發展成其附近皮膚及筋膜之壞疽。致病菌在此壞死的皮膚及筋膜中會迅速增生，造成皮膚及筋膜的嚴重感染及敗血症。廣泛性的 Fournier's 壞疽比局限性的 Fournier's 壞疽有較高的死亡率。年老，外傷，糖尿病，免疫抑制和慢性全身性疾病是誘發因素。敗血症是造成病患死亡最重要的因素。Fournier's 壞疽的治療原則包括消除病原和阻斷廣泛性 Fournier's 壞疽的進展。消除病原包含廣效性之抗生素治療、患處儘早而徹底的清創，引流和經常的換藥處理。阻止壞死性筋膜炎的進展可以通過增加組織氧合作用。高壓氧治療可增加血液含氧量，改善組織缺氧，因而改善預後。但是，高壓氧治療的臨床效果尚有爭議的。我們提出高壓氧治療應用在廣泛性 Fournier's 壞疽的臨床經驗。

關鍵詞 筋膜切開術、福耳尼埃氏壞疽、高壓氧、壞死性筋膜炎。