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Damage control surgery in a patient with cardiac arrest from necrotizing soft tissue infection

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CASE PRESENTATION

A man aged 53 years with uncontrolled type 2 diabetes was referred to our hospital in deteriorating condition following incision and drainage surgery for a perianal abscess. He developed delirium, high fever, tachycardia, tachypnea, hypotension, and oliguria. Examination revealed blackening and swelling in the scrotal and perineum regions, accompanied by mottled skin on the abdomen (figure 1). Key laboratory markers contributed to a Laboratory Risk Indicator for Necrotizing Fasciitis score of 11 and a Sequential Organ Failure Assessment score of 16 (table 1 and table 2). CT scans demonstrated the presence of gas within the scrotum, pararectal fascia, and bilateral abdominal walls (figure 2).

DIAGNOSIS

The patient was diagnosed with necrotizing soft tissue infection (NSTI) caused by a polymicrobial infection; the condition progressed to septic shock and multiple organ failure.

MANAGEMENT

Immediate fluid resuscitation was performed and broad-spectrum antibiotics (meropenem, linezolid, and clindamycin) were administered, followed by emergency surgery. However, approximately 20 min after debridement began, the patient experienced cardiac arrest and was resuscitated.

WHAT WOULD YOU DO NEXT?

1. Continue extensive and thorough debridement despite septic shock, multiple organ failure, and post-cardiopulmonary resuscitation
2. Recommend end-of-life care to the patient's family based on the poor prognosis.
3. Opt for damage control surgery by limiting the initial debridement and placing drainage tubes, while prioritizing patient stabilization before undertaking further surgical interventions.

WHAT WE DID AND WHY

To control sepsis, all infected necrotic tissue must be removed.[1] However, considering the patient's condition, additional surgical trauma and anesthesia could precipitate another cardiac arrest.[2] Therefore, we performed damage control surgery, suspending the debridement and inserting multiple dual-lumen tube suction and sump drains. The patient was transferred to the surgical intensive care unit (SICU) for further supportive organ management. Norepinephrine was administered (2.67 µg/kg/min) with fluid resuscitation guided by pulse indicator continuous cardiac output technology to maintain a mean arterial pressure of ≥65 mm Hg. Mechanical ventilation with a positive end-expiratory pressure of 16 cm H_2O was used to maintain a PaO_2 above 80 mm Hg. Continuous renal replacement therapy was used to clear the inflammatory mediators.

Meanwhile, 1.5% hydrogen peroxide and saline were used for irrigation and suction in the dual-lumen tubes. Due to ongoing circulatory, respiratory, and renal failures, as well as thrombocytopenia, bedside stage debridement was restricted to control the sepsis source. On the fourth day after the initial surgery, norepinephrine administration was discontinued, with decreased lactate (from 12.8 mmol/L to 5.4 mmol/L) and proBNP (from 33 370 pg/mL to 11 781 pg/mL) levels. The reduction in extravascular lung water and improved lung compliance contributed to an oxygenation index of 340. The platelet transfusion increased platelet levels (from 5×10^9/L to 40×10^9/L), and further debridement was performed in the operating room on the same day. However, owing to the extensive debridement area and wound surface oozing, thorough debridement was not achieved. On the seventh day, the rise in platelet count (52×10^9/L) facilitated thorough debridement surgeries (figure 3) combined with negative-pressure devices. The patient developed ventilator dependency due to diaphragmatic dysfunction, leading to a tracheotomy on the 16th hospital day. By the 18th day, the patient regained consciousness and was transferred out of the SICU. Finally, the patient was discharged after two skin grafts on the 59th day.

DISCUSSION

Diabetes greatly increases NSTI risk.[3] In this case, uncontrolled diabetes led to a perianal abscess rapidly evolving into Fournier's gangrene and extending to bilateral abdominal walls. On being referred to our hospital, the patient was experiencing septic shock, which is the most frequent cause of death associated with Fournier's gangrene.[4]

Figure 1 Blackening and swelling in the scrotal and perineum regions (panel A), abdominal skin mottling (panel B).

Table 1 Laboratory Risk Indicator for Necrotizing Fasciitis score

Variables, units	Results	Score
C reactive protein, mg/L	383	4
Total white cell count, 10^9/L	25.53	2
Hemoglobin, g/L	78.0	2
Sodium, mmol/L	135.7	0
Creatinine, µmol/L	338.2	2
Glucose, mmol/L	15.79	1

Table 2 The Sequential Organ Failure Assessment score

Organ system, measurement	Results	Score
Respiration PaO_2/FiO_2, mm Hg	112	3
Coagulation Platelets, $10^3/mm^3$	22.0	3
Liver Bilirubin, µmol/L	25.1	1
Cardiovascular Hypotension	Norepinephrine 2.67 µg/kg/min	4
Central nervous system Glasgow Coma Score	12	2
Renal Creatinine, µmol/L	338.2	3

Severe hyperlactatemia and widespread skin mottling indicate the patient's poor clinical outcome.[5]

NSTI is a surgical emergency requiring aggressive and exhaustive surgical debridement.[1] However, clinical decision-making becomes more challenging when NSTI advances to septic shock and cardiac arrest. Additionally, resuscitation from cardiac arrest precipitates postcardiac arrest syndrome.[6] In this case, the patient's severely compromised physiological reserves interfered with extensive debridement. Consequently, the damage control surgery (DCS) strategy was implemented, which involves a staged approach to surgery with initial focus on immediate life-threatening conditions.

Different from original DCS that involves three crucial phases: (i) initial abbreviated laparotomy, (ii) intensive ICU resuscitation, and (iii) definitive injury repair during a subsequent laparotomy,[7] DCS performed in this case entailed multiple tube placements for irrigation, drainage, and decompression of the cavity with septic necrotic tissue and gas, followed by ICU resuscitation and supportive treatment, and thorough debridement. This approach provided temporary infection containment, facilitating repeated debridement. However, incomplete debridement during the initial procedure necessitates delayed thorough debridement and an extended antibiotic regimen, likely facilitating the development of drug-resistant bacterial strains. Moreover, persistent and ongoing systemic inflammation due to residual infection can lead to a protracted state of persistent inflammation, immunosuppression, and catabolic syndrome, considerably lengthening ICU and hospitalization stays.[8] Hence, this clinical decision needs careful consideration and thorough debridement must be completed without delay once appropriate physiological conditions are achieved.

Patients with NSTI escalating to sepsis or septic shock have an increased mortality rate, even after extensive and thorough debridement during the primary surgery.[9 10] This successful case suggests that DCS may have potential as an effective treatment for patients with NSTI and physiological exhaustion. Further studies are needed to validate this approach for its potential integration into standard treatment protocols for managing severe NSTI.

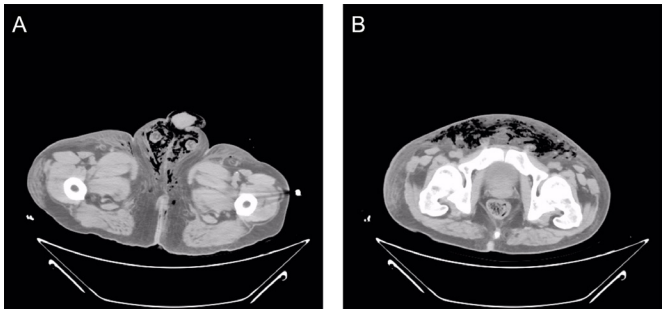

Figure 2 CT scans revealing extensive gas buildup: scrotum and perianal area (panel A), bilateral abdominal wall (panel B).

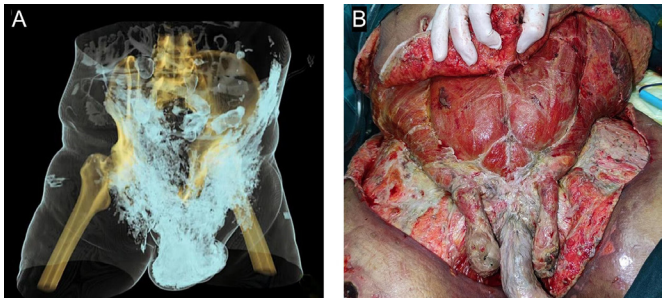

Figure 3 Range of necrotizing soft tissue infection in three-dimensional CT scan (panel A) and clinical thorough debridement (panel B).

CONCLUSION

In patients with NSTI complicated by septic shock, multiple organ failure, and cardiac arrest, DCS may offer a way to salvage those who are initially too critically ill to undergo thorough surgical debridement.

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Competing interests None declared.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study was approved by the Medical Ethics Research Committee of Huaqiao University Affiliated Strait Hospital (approval no. 97 (2024)). Participants gave informed consent to participate in the study before taking part.

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