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FOURNIER'S GANGRENE COMPLICATED BY DIABETIC KETOACIDOSIS AND POLYMICROBIAL SEPSIS IN AN ELDERLY PATIENT WITH PERIPHERAL VASCULAR DISEASE: A MULTIDISCIPLINARY THERAPEUTIC APPROACH

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Abstract:
Background: *Fournier's gangrene is a rapidly progressive necrotizing soft tissue infection of the perineal region associated with high morbidity and mortality, particularly in elderly patients with multiple comorbidities.*
Case Presentation: *A 69-year-old male with a known history of type 2 diabetes mellitus and peripheral vascular disease presented with an ulcer over the right scrotum, hematuria, and a chronic bed sore. On admission, the patient had uncontrolled hyperglycemia with a capillary blood glucose level of 300 mg/dL and was found to have metabolic acidosis with positive urine ketones, consistent with diabetic ketoacidosis. Clinical examination revealed necrotic lesions involving the scrotal region and pressure ulcers over bilateral trochanteric areas. Culture from the scrotal lesion isolated Escherichia coli sensitive to piperacillin-tazobactam, cefoperazone, and meropenem.*
Intervention: *The patient was managed with aggressive fluid resuscitation, insulin therapy for glycemic control, correction of electrolyte imbalance, and broad-spectrum intravenous antibiotics (piperacillin-tazobactam and metronidazole). Supportive measures including human albumin infusion, anticoagulation, and nutritional supplementation were also initiated as part of coordinated multidisciplinary management.*
Outcome: *Gradual clinical improvement was observed, with stabilization of blood glucose levels, resolution of ketoacidosis, and control of infection.[8] The patient was transitioned to oral medications on discharge, with advice for regular follow-up.*
Conclusion: *This case highlights the importance of early recognition, prompt broad-spectrum antimicrobial therapy, and multidisciplinary management in improving outcomes in Fournier's gangrene complicated by diabetic ketoacidosis and multiple comorbid conditions.*
Keywords: *Fournier's gangrene, Diabetic Ketoacidosis, Peripheral Vascular Disease, Polymicrobial Sepsis, Necrotizing Fasciitis, Broad-Spectrum Antibiotics, Multidisciplinary Management*

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INTRODUCTION:

Fournier's gangrene is a rapidly progressive necrotizing soft tissue infection involving the perineal and genital regions, characterized by fulminant tissue destruction and a high risk of systemic toxicity. It is considered a surgical and medical emergency, with mortality rates remaining significant despite advances in antimicrobial therapy and critical care management. The condition is typically polymicrobial in nature, involving a synergistic combination of aerobic and anaerobic organisms that contribute to rapid disease progression and septic complications.[1]

Several predisposing factors have been identified, among which diabetes mellitus is the most common. Poor glycemic control impairs host immune response, promotes microbial proliferation, and delays wound healing, thereby increasing susceptibility to severe infections. Additional risk factors such as advanced age, peripheral vascular disease, malnutrition, and immunocompromised states further contribute to disease severity and poor clinical outcomes.

An important yet less frequently reported complication in such patients is the coexistence of diabetic ketoacidosis, which further exacerbates the clinical condition by inducing metabolic derangements, dehydration, and electrolyte imbalance. Early initiation of broad-spectrum antimicrobial therapy, aggressive fluid resuscitation, glycemic control, and timely surgical intervention are critical in improving patient prognosis.[2] This report presents a clinically significant case of Fournier's gangrene in an elderly patient with uncontrolled diabetes mellitus, complicated by diabetic ketoacidosis and peripheral vascular disease.

CASE STUDY:

Demographics:

- **Age:** 69 years
- **Sex:** Male
- **Weight:** 70 kg
- **Height:** 168 cm
- **BMI:** 24.8 kg/m²
- **Occupation:** Farmer
- **Residence:** Rural Area
- **Marital Status:** Married
- **Education Level:** Graduate
- **Socioeconomic Status:** Middle class

Chief Complaint:

- Ulcer over the right scrotal region for one week
- Hematuria for four days
- Chronic bed sore of one month's duration

History of Present Illness:

The patient, a known case of type 2 diabetes mellitus for the past 10 years maintained on oral hypoglycemic agents, presented with an ulcer over the right scrotal region of one week's duration, hematuria for four days, and a chronic bed sore of one month's duration. His medical history was significant for peripheral vascular disease with left-sided femoropopliteal occlusion and a left below-knee amputation performed two and a half years prior. He also had a history of chronic alcohol consumption and smoking. On admission, the patient was conscious but drowsy and oriented, with stable vital signs.

Past Medical History:

- **Type 2 Diabetes Mellitus:** Known for the past 10 years; managed on oral hypoglycemic agents
- **Peripheral Vascular Disease:** Left-sided femoropopliteal occlusion
- **Left below-knee amputation:** Performed two and a half years prior

Medication History:

- **Metformin**: 500 mg twice daily for glycemic control
- **Glimepiride**: 2 mg once daily for glycemic control
- No over-the-counter drugs, herbal supplements, or recent changes in prescribed medications
- Adherent to prescribed medications with no missed doses reported

Allergies:

- No reports of allergy

Family History:

Father had a history of diabetes mellitus

Social History:

- **Tobacco:** History of smoking
- **Alcohol:** History of chronic alcohol consumption

Psychosocial Assessment:

No signs of depression, anxiety, or recent psychological stress. Patient had normal sleep patterns and social functioning prior to symptom onset.

Vaccination & Preventive Care:

Up-to-date with routine vaccinations; last general health check-up was 3 months ago.

CLINICAL EXAMINATION:

General Examination:

- **General Appearance:** Conscious, drowsy, oriented
- **Local findings:** Necrotic ulcer over the right scrotal region, with slough and necrotic patches, the largest measuring approximately 6 × 4 cm over the inferior surface of the scrotum; pressure ulcers over bilateral trochanteric areas
- **Amputation stump:** Left lower-limb amputation stump appeared healthy, with no signs of active infection
- Pallor: Absent
- Icterus: Absent
- Cyanosis: Absent
- Clubbing: Absent
- Edema: No pedal edema
- Hydration Status: Dehydration present

Figure 1 shows the necrotic lesion over the scrotal region.

FIGURE 1: A necrotic lesion over the scrotal region

Vital Signs (on admission):

Parameter	**Value**	**Normal range**
Temperature	36.8°C (oral)	36.5–37.5°C
Blood pressure	130/80 mmHg	90/60 – 140/90 mmHg
Heart rate	88 beats per minute	60–100 bpm
Respiratory rate	18 breaths per minute	12–20 breaths per minute
Oxygen saturation	98% on room air	>95%
BMI	24.8 kg/m²	18.5–24.9 kg/m²

Systemic Examination:

Abdominal / Imaging finding: Ultrasound imaging of the abdomen and pelvis demonstrated mild hepatomegaly and soft tissue edema in the perineal region.

Central Nervous System (CNS):

Mental Status: Drowsy but responsive to verbal stimuli

Orientation: Disoriented to time and place; oriented to person
Speech: Slurred
Cranial Nerves: Intact
Motor System: Normal tone and power in all four limbs (5/5)
Reflexes: Normal deep tendon reflexes; plantar reflexes flexor bilaterally
Sensory System: Grossly intact
Cerebellar Function: Mild ataxia, unsteady tandem gait
Signs of Meningeal Irritation: Absent
No focal neurological deficits

Cardiovascular System (CVS):
Heart Sounds: Normal S1 and S2, no murmurs or extra sounds
Jugular Venous Pressure (JVP): Not elevated
Peripheral Pulses: All palpable, regular rhythm

Respiratory System:
Inspection & Palpation: Symmetrical chest expansion
Percussion: Resonant throughout
Auscultation: Vesicular breath sounds, no added sounds (e.g., rales, wheezes)

Gastrointestinal System:
Inspection: Abdomen soft, no distention
Palpation: No organomegaly or tenderness
Bowel Sounds: Present, normal frequency
No signs of hepatic encephalopathy

Genitourinary System:
No suprapubic tenderness or flank pain
Bladder palpable, non-tender

LABORATORY INVESTIGATIONS:
Initial laboratory investigations showed uncontrolled hyperglycemia with a capillary blood glucose level of 300 mg/dL. Arterial blood gas analysis revealed metabolic acidosis with a pH of less than 7.3 and bicarbonate levels below 18 mEq/L. Urine ketone testing was positive, confirming the diagnosis of diabetic ketoacidosis. Hematological parameters indicated anemia, leukocytosis, and hypoalbuminemia. Renal and liver function tests were within acceptable limits, although mild electrolyte imbalance was noted.[3]

Table 1: Laboratory Investigation Trend (Day 1 – Day 3)

Parameter	D1	D2	D3	Units	Reference Range	Interpretation
Hemoglobin (Hb)	9.0	9.0	8.0	g/dL	12–16	Decreased – anemia
Total Leukocyte Count (TLC)	7200	12700	8300	cells/mm³	4,000–11,000	Elevated on D2 – infection
Neutrophils	64	61	61	%	40–75	Normal
Lymphocytes	23	34	30	%	20–45	Normal
Eosinophils	13	5	9	%	1–6	Elevated
Packed Cell Volume (PCV)	28	49	25	%	36–46	Low
Platelet Count	458	452	319	x10³/mm³	150–450	Mild thrombocytosis
Total Bilirubin	0.4	0.2	0.2	mg/dL	0.3–1.2	Normal
Direct Bilirubin	0.1	0.1	0.1	mg/dL	0–0.3	Normal
Indirect Bilirubin	0.3	0.1	0.1	mg/dL	0.2–0.8	Normal
AST (SGOT)	6	8	10	U/L	10–40	Slightly low
ALT (SGPT)	9	9	11	U/L	7–56	Normal
Prothrombin Time (PT)	12.0	–	–	sec	11–13.5	Normal
INR	1.2	–	–	ratio	0.8–1.2	Normal
ALP	63	64	59	U/L	44–147	Normal
Total Protein	6.2	6.3	5.8	g/dL	6–8	Low (D3)
Albumin	3.1	2.3	2.0	g/dL	3.5–5.0	Hypoalbuminemia
Globulin	3.1	4.0	3.8	g/dL	2–3.5	Elevated
Random Blood Sugar (RBS)	206	151	125	mg/dL	<140	Hyperglycemia
Blood Urea	28	16	14	mg/dL	15–40	Normal
Serum Creatinine	0.9	0.8	0.6	mg/dL	0.6–1.2	Normal
Sodium (Na^+)	134	135	130	mEq/L	135–145	Hyponatremia
Potassium (K^+)	3.7	4.0	3.5	mEq/L	3.5–5.0	Normal
Fasting Blood Sugar (FBS)	150	–	–	mg/dL	70–100	Elevated
Postprandial Blood Sugar (PPBS)	220	–	–	mg/dL	<140	Elevated

Parameter	D1	D2	D3	Units	Reference Range	Interpretation
HbA1c	7.1	–	–	%	<5.7	Poor glycemic control

Table 2: Urine Examination

Parameter	Value	Units	Reference Range	Interpretation
Acetone	Positive	–	Negative	Ketosis (DKA)
Deposits	4–6	/HPF	0–2	Infection
Microalbuminuria	6–8	mg/dL	<3	Nephropathy

IMAGING AND MICROBIOLOGY:
Ultrasound imaging of the abdomen and pelvis demonstrated mild hepatomegaly and soft tissue edema in the perineal region. Microbiological culture from the scrotal lesion isolated Escherichia coli, which was sensitive to piperacillin-tazobactam, cefoperazone, and meropenem, and resistant to ciprofloxacin.

DIAGNOSIS:
Based on the clinical presentation of a necrotic scrotal ulcer with associated bed sores, uncontrolled hyperglycemia, metabolic acidosis with positive urine ketones, and microbiological confirmation of E. coli infection, the patient was diagnosed with Fournier's gangrene complicated by diabetic ketoacidosis and polymicrobial sepsis, in the setting of long-standing type 2 diabetes mellitus and peripheral vascular disease.

CLINICAL COURSE AND TREATMENT:
The patient was initiated on aggressive management including intravenous fluids, insulin therapy for glycemic control, and correction of electrolyte imbalance. Broad-spectrum intravenous antibiotics, including piperacillin-tazobactam and metronidazole, were administered based on clinical suspicion and later guided by culture and sensitivity reports. Supportive therapy included administration of human albumin, anticoagulation with low molecular weight heparin, proton pump inhibitors, and nutritional supplementation with vitamins and trace elements.[4]

Serial monitoring (summarized in Table 1 above) showed gradual improvement in glycemic status, with resolution of ketoacidosis and stabilization of electrolyte levels. The infection was controlled with appropriate antimicrobial therapy and supportive care. The patient's clinical condition improved over the course of hospitalization, and he was transitioned to oral medications upon discharge, with advice for regular follow-up.

MULTIDISCIPLINARY TEAM INTERVENTIONS:

- **Reviewing antimicrobial therapy** and supporting culture-guided selection of antibiotics based on the sensitivity report.
- **Monitoring glycemic control** and supporting insulin therapy for the management of diabetic ketoacidosis.
- **Monitoring electrolyte status**, particularly sodium and potassium, during fluid resuscitation and correction of metabolic abnormalities.
- **Monitoring medication safety** related to broad-spectrum antibiotics, anticoagulation, proton pump inhibitor therapy, and supportive medications.
- **Providing medication and disease education** regarding diabetes management, medication adherence, wound care, and recognition of signs of recurrent infection.
- **Supporting nutritional management** through coordination of vitamin, trace-element, and nutritional supplementation.
- **Ensuring continuity of care** by reinforcing follow-up for glycemic control, wound healing, infection status, and medication adherence.

DISCHARGE PLAN AND FOLLOW-UP:
Medications on Discharge :
Metformin: 500 mg twice daily (BID) for glycemic control
Glimepiride: 2 mg once daily (OD) for glycemic control
Amlodipine: 5 mg once daily (OD) for blood pressure control
Pantoprazole: 40 mg once daily (OD) for gastric protection
Antibiotic: Continued as prescribed based on culture and sensitivity
Nutritional supplements: Vitamins and trace elements as advised
Anticoagulant: Low-molecular-weight heparin as clinically indicated

Follow-up Schedule :
1-week follow-up: Blood glucose, renal function and wound assessment

Diabetes review: Monitor glycemic control and adjust oral antidiabetic therapy as required
Surgical review: Assess wound healing and recurrence of infection
Pharmacist follow-up: Monitor medication adherence, adverse effects and reinforce patient education

Patient Counseling :
Advised to maintain good glycemic control and adhere strictly to prescribed medications.
Educated regarding wound care and early signs of recurrent infection.
Advised to avoid smoking and alcohol and maintain adequate nutrition.
Emphasized the importance of regular follow-up and laboratory monitoring.

OUTCOME:
Following discontinuation of the offending process and initiation of targeted management, the patient showed gradual clinical improvement with stabilization of blood glucose levels, resolution of ketoacidosis, and control of infection. No further complications were reported during the course of hospitalization.

DISCUSSION:

Fournier's gangrene represents a fulminant form of necrotizing soft tissue infection that predominantly affects the perineal and genital regions, with rapid progression that can lead to systemic toxicity and high mortality if not promptly managed. The condition is typically polymicrobial, involving both aerobic and anaerobic organisms acting synergistically to produce extensive tissue destruction and septic complications. In the present case, the isolation of Escherichia coli from the infected site is consistent with the commonly reported microbial profile of this condition.

Diabetes mellitus is recognized as one of the most significant predisposing factors for Fournier's gangrene. Chronic hyperglycemia impairs neutrophil function, reduces host immune response, and promotes an environment favorable for bacterial proliferation. In this patient, long-standing uncontrolled diabetes likely contributed to both the onset and progression of infection. Additionally, the presence of peripheral vascular disease further compromised tissue perfusion, thereby impairing wound healing and facilitating the spread of infection.

A notable feature of this case is the coexistence of diabetic ketoacidosis, which adds a layer of metabolic complexity to the clinical presentation. This dual pathology of severe infection and metabolic derangement necessitates a coordinated therapeutic approach, as each condition can exacerbate the other.[5] Early recognition and simultaneous management of both infection and ketoacidosis are crucial to prevent further deterioration.

The management of Fournier's gangrene requires a multidisciplinary approach involving prompt initiation of broad-spectrum antimicrobial therapy, aggressive fluid resuscitation, glycemic control, and supportive care. In this case, empirical antibiotic therapy was initiated with broad-spectrum agents and later tailored according to culture and sensitivity results.[6,7] The addition of metronidazole provided adequate anaerobic coverage, essential in polymicrobial infections. Supportive measures, including albumin supplementation, anticoagulation, and nutritional support, played a vital role in improving the overall clinical status of the patient.

This case underscores the importance of individualized treatment strategies, especially in elderly patients with multiple comorbidities, and reinforces the need for early clinical suspicion, timely initiation of appropriate therapy, and multidisciplinary coordination in the management of Fournier's gangrene complicated by diabetic ketoacidosis.[9,10]

CONCLUSION:

Fournier's gangrene remains a life-threatening condition requiring early recognition and prompt multidisciplinary intervention. This case emphasizes the significant impact of uncontrolled diabetes mellitus and associated comorbidities, such as peripheral vascular disease, in predisposing patients to severe infections and adverse clinical outcomes. The coexistence of diabetic ketoacidosis further complicates the clinical course, necessitating simultaneous management of both metabolic and infectious processes. Timely initiation of broad-spectrum antimicrobial therapy, guided by culture sensitivity, along with aggressive glycemic control, fluid resuscitation, and supportive care, plays a crucial role in improving patient outcomes.

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