

Testicular Necrosis as an Uncommon Complication of Uncontrolled Diabetes Mellitus

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Abstract

Background: Testicular necrosis is an extremely rare complication in patients with diabetes mellitus and is seldom reported outside the context of torsion or severe infection. Chronic hyperglycemia may predispose to microvascular compromise leading to testicular ischemia.

Aim: To highlight testicular necrosis as a rare complication of uncontrolled diabetes mellitus and emphasize the importance of early diagnosis and prompt management.

Material and Methods: A descriptive case series of three patients with poorly controlled diabetes mellitus presenting with acute scrotal symptoms and diagnosed with testicular necrosis based on clinical, radiological, and surgical findings.

Results: All patients had long-standing uncontrolled diabetes and imaging evidence of compromised testicular blood flow. Two patients required orchiectomy, while one was managed conservatively. All patients recovered with appropriate medical and surgical management.

Conclusion: Testicular necrosis should be considered in diabetic patients presenting with acute scrotum. Early recognition, strict glycemic control, and timely intervention are crucial to prevent testicular loss.

Keywords: Diabetes mellitus; Testicular necrosis; Acute scrotum; Microangiopathy.

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Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder marked by persistent hyperglycemia due to absolute or relative insulin deficiency and/or resistance, affecting millions globally and continuing to rise in prevalence in both developed and developing nations [1]. Poor glycemic control in DM leads to widespread vascular endothelial damage, microangiopathy, and heightened oxidative stress, which underlie many of its well-recognized complications including retinopathy, nephropathy, and neuropathy [1,2]. Beyond these classical complications, mounting evidence indicates that diabetes also exerts deleterious effects on the male reproductive system, impairing hormonal balance, spermatogenesis, and vascular integrity [2,3]. The deleterious impact of hyperglycemia on testicular function is multifactorial, involving microvascular dysfunction, chronic inflammation, and oxidative stress that disrupt the blood-testis barrier and endocrine milieu, ultimately compromising testicular perfusion and spermatogenic processes [3,4]. These mechanisms form the

pathophysiological backdrop for rare yet severe testicular complications in diabetic patients, where impaired blood flow secondary to vascular injury can precipitate ischemia and tissue necrosis. Although male reproductive dysfunction — including erectile dysfunction and compromised sperm parameters — is relatively common in poorly controlled diabetics, testicular necrosis remains an exceedingly rare and understudied event [2,3]. Case literature shows that acute scrotal infections, such as epididymo-orchitis, are more prevalent in diabetic patients due to immunocompromise and urinary tract colonization by gas-forming organisms like *Escherichia coli*, and these can, in exceptional circumstances, progress to emphysematous infection and subsequent tissue ischemia or necrosis [5,6]. Emphysematous epididymo-orchitis, for instance, is a rare but life-threatening manifestation in poorly controlled DM, emphasizing the potential for catastrophic local sequelae when host defenses are compromised [6,7]. Similarly, severe epididymo-orchitis can cause compression of the spermatic

cord and vascular flow disruption, acting as a precursor to testicular infarction and necrosis [8,9].

Despite these rare reports, the literature on testicular necrosis as a direct or indirect complication of poorly controlled diabetes mellitus independent of classic causes such as torsion is virtually nonexistent, with only sporadic case reports identifying microangiopathy as a putative etiological factor [10]. This underscores the need for heightened clinical awareness and further exploration of the vascular mechanisms by which chronic hyperglycemia might compromise testicular integrity.

Material and Methods

This study was designed as a descriptive case series conducted in a tertiary care hospital to document the clinical profile and outcomes of testicular necrosis in patients with poorly controlled diabetes mellitus. Due to the rarity of the condition, a total of three patients diagnosed with testicular necrosis in the background of uncontrolled diabetes mellitus were included in the study. The study period extended over the time during which these cases presented to the hospital and were managed according to standard clinical protocols.

Patients were included based on the presence of acute scrotal symptoms, a known history of diabetes mellitus with evidence of poor glycemic control, and a confirmed diagnosis of testicular necrosis established through clinical examination, radiological findings, and intraoperative or histopathological confirmation where applicable. Patients with a history of testicular torsion, scrotal trauma, malignancy, or recent urological surgery were excluded to avoid confounding etiologies of testicular ischemia.

Detailed clinical data were collected for each patient, including demographic characteristics, duration and type of diabetes mellitus, glycemic status at presentation, presenting symptoms, laboratory parameters, and imaging findings. Scrotal ultrasonography with color Doppler was performed in all cases to assess testicular vascularity and differentiate necrosis from other causes of acute scrotum. Additional imaging and laboratory investigations were carried out as clinically indicated.

All patients received appropriate medical and surgical management based on clinical severity, including glycemic control, broad-spectrum antibiotics, and surgical intervention when indicated. Surgical findings were documented, and excised specimens were subjected to histopathological examination to confirm testicular necrosis. Patients were followed up during the hospital stay and post-discharge to assess clinical

outcomes and recovery. As this was a descriptive study involving a small number of cases, data were analyzed qualitatively and presented as individual case descriptions focusing on clinical presentation, diagnostic challenges, management strategies, and outcomes. Ethical clearance was obtained from the institutional ethics committee, and informed consent was secured from all patients prior to inclusion in the study.

Results

The present case series included three patients with poorly controlled diabetes mellitus who presented with acute scrotal symptoms and were subsequently diagnosed with testicular necrosis. All patients were middle-aged to elderly males with a long-standing history of diabetes and evidence of poor glycemic control at presentation. The baseline demographic characteristics and diabetic profile of the patients are summarized in Table 1. The duration of diabetes ranged from 8 to 15 years, and all patients had markedly elevated HbA1c levels, indicating chronic uncontrolled hyperglycemia.

The clinical presentation and examination findings are detailed in Table 2. All patients presented with acute scrotal pain and swelling, with associated local signs of inflammation. Fever was present in two patients, while one patient reported severe pain without systemic symptoms. On physical examination, the affected testis was tender and enlarged in all cases, with loss of normal consistency noted in two patients, raising suspicion of ischemic pathology.

Radiological and laboratory findings are presented in Table 3. Scrotal ultrasonography with color Doppler demonstrated absent or significantly reduced intratesticular blood flow in all three patients, confirming the diagnosis of testicular ischemia and necrosis. Laboratory investigations revealed poor glycemic control in all cases, along with elevated inflammatory markers. Leukocytosis was observed in two patients, while one patient had normal leukocyte counts despite extensive local pathology.

Management strategies and outcomes are summarized in Table 4. All patients received intensive glycemic control and broad-spectrum intravenous antibiotics. Surgical intervention in the form of orchiectomy was required in two patients due to extensive necrosis, while one patient was managed conservatively with close monitoring and supportive care.

Histopathological examination of excised specimens confirmed coagulative necrosis of testicular tissue. All patients showed clinical improvement following treatment, with no mortality reported during the hospital stay.

Table 1: Demographic characteristics and diabetic profile of patients

Patient No.	Age (years)	Duration of Diabetes (years)	Type of Diabetes	HbA1c (%)	Associated Comorbidities
1	52	10	Type 2	9.8	Hypertension
2	61	15	Type 2	10.6	Hypertension, Dyslipidemia
3	47	8	Type 2	9.2	None

Table 2: Clinical presentation and examination findings

Patient No.	Presenting Symptoms	Duration of Symptoms (days)	Fever	Scrotal Swelling	Testicular Tenderness
1	Pain, swelling	3	Yes	Yes	Yes
2	Severe pain, fever	5	Yes	Yes	Yes
3	Pain only	2	No	Mild	Yes

Table 3: Laboratory and radiological findings

Patient No.	Fasting Blood Sugar (mg/dL)	Total Leukocyte Count (cells/mm ³)	CRP (mg/L)	Doppler USG Findings
1	268	14,200	38	Absent blood flow
2	312	16,800	52	Severely reduced flow
3	241	9,600	24	Absent blood flow

Table 4: Management and outcomes

Patient No.	Treatment Given	Surgical Intervention	Histopathology Result	Hospital Stay (days)	Outcome
1	Antibiotics, insulin therapy	Orchiectomy	Testicular necrosis	7	Recovered
2	Antibiotics, insulin therapy	Orchiectomy	Testicular necrosis	9	Recovered
3	Antibiotics, insulin therapy	No	Not applicable	6	Recovered

Discussion

Testicular necrosis is an exceptionally rare clinical entity and is most commonly associated with testicular torsion, severe epididymo-orchitis, trauma, or vascular compromise. Its occurrence in patients with poorly controlled diabetes mellitus represents an uncommon but clinically significant manifestation of diabetic microvascular disease. Chronic hyperglycemia is known to induce endothelial dysfunction, capillary basement membrane thickening, and impaired tissue perfusion, which together predispose diabetic patients to ischemic complications in various organs [11]. The findings of the present case series support the hypothesis that long-standing uncontrolled diabetes can compromise testicular vascularity sufficiently to result in ischemia and subsequent necrosis.

Diabetes-related microangiopathy has been extensively studied in the retina, kidneys, and peripheral nerves; however, its impact on testicular microcirculation has received comparatively little attention. Experimental and clinical studies have demonstrated that sustained hyperglycemia leads to reduced nitric oxide bioavailability, increased oxidative stress, and vascular inflammation, all of which impair blood flow to end-organs [12]. In the testis, which is highly sensitive to hypoxia due to its metabolic demands, even transient reductions in perfusion may result in irreversible tissue damage.

This pathophysiological mechanism likely underlies the development of testicular necrosis in diabetic patients without evidence of torsion or traumatic injury.

Infective processes may further exacerbate ischemic injury in diabetic individuals. Poor glycemic control is associated with impaired immune responses, increased susceptibility to infection, and delayed tissue healing [13]. Severe epididymo-orchitis or localized scrotal infections in diabetics can lead to vascular compression, thrombosis, or endothelial injury, thereby precipitating testicular infarction. In the present case series, elevated inflammatory markers and imaging findings of reduced or absent blood flow suggest a synergistic role of inflammation and microvascular compromise in the evolution of necrosis.

The diagnostic challenge of testicular necrosis lies in its clinical overlap with other causes of acute scrotum. Prompt differentiation from testicular torsion is essential, as management strategies differ significantly. Color Doppler ultrasonography remains the imaging modality of choice, allowing assessment of testicular perfusion and guiding timely surgical decision-making [14]. Delayed diagnosis may result in extensive necrosis necessitating orchiectomy, as observed in two of the present cases. Management of testicular necrosis in diabetic patients requires a

multidisciplinary approach, emphasizing rapid glycemic control, aggressive treatment of infection, and early surgical intervention when indicated. While orchiectomy is often unavoidable in cases of extensive necrosis, early recognition may allow conservative management in select patients with partial ischemia [15]. The favorable outcomes observed in this case series highlight the importance of early diagnosis and comprehensive metabolic stabilization. Increased awareness of this rare complication among clinicians may facilitate prompt intervention and prevent testicular loss in susceptible diabetic patients.

Conclusion

Testicular necrosis represents a rare but serious complication of poorly controlled diabetes mellitus, likely resulting from diabetic microangiopathy compounded by inflammatory and ischemic processes. This case series underscores the need for heightened clinical vigilance in diabetic patients presenting with acute scrotal symptoms.

Early imaging, strict glycemic control, and timely intervention are essential to improve outcomes and minimize morbidity. Recognition of this uncommon presentation expands the spectrum of diabetic complications and reinforces the importance of optimal long-term metabolic control.

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