Cavernous blood gas analysis in the diagnosis of priapism

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ABSTRACT

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The significance of blood gas analysis in the rapid and accurate diagnosis of priapism, enabling the distinction between low-flow and high-flow types deserves to be highlighted. It is a valuable tool in the clinical setting to guide timely intervention, especially in emergencies, and enhance patient outcomes, thereby reducing the risk of complications such as erectile dysfunction and penile fibrosis. We present a case of a 69-year-old male patient who developed priapism. Cavernosal blood gas analysis provided conclusive evidence of low-flow priapism, confirming veno-occlusive pathophysiology based on abnormal pH, pO_2 and pCO_2 values. The patient underwent venous blood aspiration from the *corpora cavernosa*, leading to complete penile detumescence and rapid resolution of the priapism. Laboratory medicine, through the analysis of cavernous blood gases, plays a pivotal role in accelerating the diagnostic path and the clinical management of priapism.

Key words: *priapism, low-flow priapism, gas analysis*

CASE REPORT PRESENTATION

A 69-year-old male patient, diagnosed with a well-differentiated, grade 2, bifocal neuroendocrine tumor in the pancreatic neck (5.5 cm) and tail (1 cm), presented with a six-hour history of priapism following awakening from Endoscopic Retrograde Cholangiopancreatography (ERCP) after undergoing a distal pancreatectomy and splenectomy. Physical examination revealed a painless erection involving both *corpora cavernosa* with no glans involvement.

The patient underwent diagnostic testing to rule out potential causes of priapism with a primary focus on performing a Complete Blood Count using the Sysmex XN automatic analyzer (Sysmex Corporation Inc., Kobe, Japan) which showed normal values. Hemoglobin electrophoresis was not conducted as hemoglobinopathies were not suspected and it was unfeasible in emergency situations. Screening for drugs and urine toxicology was also omitted since there was no suspicion of psychoactive drugs as potential triggers.

A puncture of the *corpora cavernosa* was performed, yielding venous blood. Penile blood gas parameters were obtained using the GEM® Premier™ 5000 analyzer (Werfen, Spain). The results of pO_2, pCO_2 and pH were consistent with a diagnosis of low-flow or veno-occlusive priapism due to reduced pO_2 levels (15 mmHg), elevated pCO_2 levels (63 mmHg) and pH markedly acidic (7.25). This case report highlights the usefulness of cavernous blood gas analysis in situations of medical urgency, as a valuable tool to help determine the underlying cause of priapism and guide appropriate treatment.

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CASE DISCUSION

Priapism is a medical condition characterized by an abnormally prolonged and often painful erection that occurs independently of sexual stimulation (1). While it is relatively uncommon (2,3), priapism necessitates immediate medical attention due to the potential for complications and permanent damage if not promptly addressed. Priapism can be categorized into two primary types: low-flow and high-flow priapism, each presenting distinct characteristics and underlying causes and having specific management (4).

Low-flow priapism, also referred to as ischemic priapism, represents the more prevalent and severe form of the condition (1,4). It manifests as a prolonged and painful erection resulting from restricted or obstructed blood flow within the penis. This occurs when there is impaired drainage of blood from the erectile tissues, typically due to disruption or blockage of venous outflow. Low-flow priapism is considered an urological emergency since the persistence of this condition can lead to tissue damage and long-term erectile dysfunction (1).

In this context, the hematologic stasis within the *corpora cavernosa* results in a gradually increasing acidic environment that activates nociceptors. This acidity is primarily caused by a lack of oxygen (hypoxia) and an excess of carbon dioxide (hypercarbia) (1,5).

Conversely, high-flow priapism, known as non-ischemic or arterial priapism, is a less frequent type of priapism. It involves excessive arterial blood flow into the penis without obstruction of normal venous drainage, ensuring that the cavernous environment maintains the right balance of pH and oxygen levels (1). High-flow priapism usually arises from penile injury or trauma, which creates an abnormal connection known as a fistula between the arterial and venous systems. This fistula allows arterial blood to directly flow into the erectile tissues, resulting in a prolonged but painless erection (4).

Ischemic priapism is frequently associated with conditions such as sickle cell disease, recreational drug use, or the use of specific medications such as PDE5 inhibitors (usually used for the treatment of erectile dysfunction), hypertensives, neuroleptics and intracavernous injections (6). On the other hand, non-ischemic priapism is often linked to penile trauma or injury (1).

In the course of the ERCP procedure, multiple medications and anaesthesia were administered. However, priapism, as a rare side effect of ERCP, is not commonly linked to the medications or anaesthesia specifically utilized in this particular endoscopic intervention. However, it is crucial to consider that abdominal surgeries may induce physiological responses and circulatory changes that could potentially contribute to the onset of priapism.

Understanding the distinctions between low-flow and high-flow priapism is vital for accurate diagnosis and appropriate treatment. Both conditions require immediate medical intervention to relieve the erection and restore normal blood flow, although non-ischemic priapism does not require emergency intervention. Neglecting timely management of ischemic priapism can lead to complications such as penile fibrosis, erectile dysfunction, and even penile tissue necrosis (1).

Laboratories play a crucial role in the diagnosis of priapism. While the diagnosis is primarily based on clinical evaluation and medical history, laboratory tests can provide valuable information to aid in the diagnosis and determine the underlying cause.

In patients with priapism, the main objective is to determine the type of priapism in order to distinguish cases that require immediate medical attention (low-flow) from those that can be treated later (high-flow). A checklist for priapism has been suggested to assist urologists and emergency room personnel, which is presented in Table 1 (7).

In all cases, the diagnosis should be confirmed through cavernosal blood gas analysis, which allows for the evaluation of pH, pO_2, and pCO_2 values to assess oxygenation and pH status in penile tissues during a priapism episode (8). Ischemic priapism, as outlined in Table 2, exhibits profound hypoxemic acidosis, frequently characterized by a pO_2 measurement <30 mmHg and a pCO_2 >60 mmHg.

Table 1
Checklist for Priapism (modified from reference 1).

Finding	Low-flow / Ischemic	High-flow / Non-ischemic	Case report
Complete firmness of the *corpora cavernosa*	Frequent	Sometimes	Yes
Pain in the penile area	Frequent	Sometimes	No
Reduced pO_2 levels and elevated pCO_2 levels in cavernosal blood gas analysis	Frequent	Rare	Yes
Recent administration of penile injections	Frequent	Sometimes	No
Chronic erection without achieving full rigidity	Rare	Frequent	No
Injuries to the perineal region	Rare	Frequent	No

Table 2
Cavernosal blood gas analysis (modified from reference 8).

Source	pH	pO_2 (mmHg)	pCO_2 (mmHg)
Non-ischemic blood	7.4	>90	<40
Mixed venous blood	7.35	40	50
Ischemic blood	<7.25	<30	>60
Case report	7.25	15	63

The pH in such cases turns markedly acidic, often falling below 7.25. On the contrary, in non-ischemic priapism the pH generally stands at around 7.4 and sustains a pO_2 level >90 mmHg while keeping the pCO_2 <40 mmHg (4,9).

Based on the obtained gas analysis results, and following the actual guidelines (8,9), venous blood aspiration from the *corpora cavernosa* was performed to remove the excess blood, resulting in complete penile detumescence. To manage ischemic priapism, a stepwise approach is crucial (9). The procedure started with the insertion of a large-bore needle connected to a Luer-lock syringe at the base of the penis, specifically at the 3 and 9 o'clock positions. During the insertion, the plunger was retracted to minimize needle depth and reduce the risk of urethral injury. Blood was aspirated bilaterally until the penis was fully flaccid.

In conclusion, laboratory medicine, with its ability to analyze cavernous blood gases, occupies a central and indispensable position in enhancing the diagnostic accuracy and clinical management of priapism. Priapism, a rare but potentially serious medical condition, requires meticulous evaluation and targeted treatment to avoid complications and preserve patient well-being. Laboratory medicine, in synergy with other clinical assessments, not only aids in the diagnosis but also plays an essential role in monitoring the progress of priapism management. The timely and accurate assessment of blood gases allows healthcare providers to adjust treatment strategies as needed, ensuring that patients receive in due time the most appropriate care.

CONFLICT OF INTEREST

None

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