

Case Series: Early Malleable Penile Prosthesis Implantation via a Mid-Shaft Ventral Incision for Delayed, Refractory Ischemic Priapism Exceeding 72 Hours

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Abstract

Background: Ischemic priapism lasting beyond 48 - 72 hours causes irreversible cavernosal smooth muscle necrosis, severe corporal fibrosis, and profound erectile dysfunction (ED). At this delayed stage, traditional conservative management and distal shunting carry high failure rates and risks of severe tissue loss, prompting consideration of alternative prosthetic options. **Case Presentation:** We present a case series of two patients presenting with prolonged ischemic priapism (one at 4 days, the other at 7 days post-onset) managed with primary malleable penile prosthesis (PP) implantation. One case was iatrogenically induced by an intracavernosal injection of prostaglandin E1 (PGE₁) during a diagnostic penile duplex ultrasound. Both procedures were executed utilizing a mid-shaft ventral incision. **Conclusion:** In these cases, early malleable implantation within the acute/subacute window resolved the ischemic event, relieved severe ischemic compartment pain, and bypassed the severe technical difficulties associated with delayed prosthetic surgery in a heavily fibrotic penis. The mid-shaft ventral approach offered noted proposed anatomical advantages.

Keywords

Ischemic Priapism, Delayed Presentation, Malleable Penile Prosthesis, Ventral Mid-Shaft Incision, Corporal Fibrosis

1. Introduction

1.1. Pathophysiology and Clinical Emergency

Ischemic priapism, or low-flow priapism, is a critical, time-dependent urological

emergency defined as a persistent, painful erection lasting longer than four hours that is entirely unrelated to sexual stimulation [1]. Pathophysiologically, the condition represents an acute closed-loop compartment syndrome within the paired corpora cavernosa, characterized by an absolute failure of the cavernosal venous outflow mechanism [2]. This stasis of sinusoidal blood leads to a rapid depletion of local oxygen reserves, profound hypoxia, hypercapnia, and a subsequent shift from aerobic metabolism to anaerobic glycolysis [1]. The resulting metabolic environment is characterized by profound tissue acidosis, typically presenting with a cavernosal blood gas profile of a pH less than 7.25, a pCO₂ exceeding 60 mmHg, and a pO₂ falling below 30 mmHg [1]-[3].

1.2. Cellular and Ultrastructural Degradation

On a microscopic and ultrastructural level, the cellular architecture of the corpora cavernosa undergoes an inexorable, predictable sequence of degradation [1] [2].

1.2.1. Early Ischemic Phase (0 - 24 Hours)

Within 12 hours of vascular stasis, electron microscopy reveals significant endothelial cell edema, swelling of the smooth muscle mitochondria, and the formation of microvascular microthrombi within the sinusoidal spaces [2].

1.2.2. Intermediate Necrotic Phase (24 - 72 Hours)

By 24 to 48 hours, prolonged cellular starvation and progressive acidosis trigger irreversible autolytic processes, culminating in widespread cavernosal smooth muscle necrosis and denudation of the endothelial lining [4].

1.2.3. Late Fibrotic Phase (>72 Hours)

If this profound ischemic crisis remains unresolved beyond 72 hours, the destroyed sinusoidal architecture undergoes intense structural remodeling [1]. The necrotic smooth muscle matrix is replaced by an aggressive fibroblast proliferation, which initiates dense, unyielding collagenous deposition and pan-corporal fibrosis [4] [5].

1.3. Role of Conservative Measures and Evolving Paradigm

When patients present in this delayed subacute phase (duration > 72 hours), the preservation of native erectile tissue viability and physiological erectile function is severely compromised, making recovery highly unlikely [1] [5]. Subjecting these late-presenting patients to traditional conservative measures—such as high-volume aspiration, intracavernosal alpha-adrenergic irrigation (e.g., phenylephrine), or surgical distal shunting procedures (e.g., Winter, Ebbehøj, or Al-Ghorab shunts)—carries high failure rates and clinical risks when tissue necrosis is already established [1] [6]. Because shunts rely entirely on the vascular compliance and recoil of healthy cavernosal tissue to propel stagnant blood, they may rapidly clot in a necrotic, structurally compromised phallus, failing to achieve sustained detumescence while significantly heightening the risks of local tissue sloughing, cavernosal gangrene, and

severe infectious morbidity [6].

Consequently, contemporary guidelines from the American Urological Association (AUA), the Sexual Medicine Society of North America (SMSNA), and the European Association of Urology (EAU) acknowledge a definitive role for early penile prosthesis (PP) implantation in late-stage presentations [1] [3]. For ischemic priapism exceeding 72 hours, primary, immediate penile prosthesis insertion is widely considered a highly viable first-line management consideration to discuss during individualized patient counseling and guideline-based decision-making [1] [3] [5] [7]. Implanting a malleable prosthesis early serves as an immediate internal mechanical scaffold or “splint” [8]. This approach concurrently resolves the acute compartment syndrome, evacuates the toxic cellular debris, eliminates excruciating ischemic pain, prevents severe phallic retraction and loss of length, and safely provides a definitive long-term solution for erectile function before the onset of dense, mature corporal calcification and fibrosis makes future surgical dilation hazardous [5] [8].

2. Case Presentation

2.1. Diagnostic Criteria and Preoperative Context

In this case series, “prolonged and neglected” ischemic priapism was defined by an erection duration exceeding 72 hours without previous clinical resolution. The diagnosis of acute ischemic priapism was confirmed based on clinical presentation and objective criteria:

- 1) Complete rigidity of the corpora cavernosa with sparing of the glans penis.
- 2) Severe phallic pain.
- 3) Diagnostic cavernosal blood gas (CBG) profiles showing severe ischemia (pH < 7.25, elevated pCO₂, and depressed pO₂).

Because both patients presented late in the subacute phase with definitive features of established corporal ischemia, bedside interventions (aspiration/sympathomimetics) and distal shunting were omitted. Given the advanced duration, first-line shunting was omitted due to the clinical determination of smooth muscle necrosis. Following individualized counseling regarding the loss of native erectile tissue viability, the patients proceeded directly to primary malleable penile prosthesis implantation to address the acute compartment syndrome and inevitable erectile dysfunction simultaneously.

2.2. Clinical Vignettes

2.2.1. Case 1: 4-Day Delayed Idiopathic Presentation

A 32-year-old male presented to the emergency department with a painful, fully rigid erection lasting approximately 96 hours (4 days). The diagnostic workup was negative for systemic hematological pathologies (e.g., sickle cell disease, leukemia, or thalassemia), rendering the episode idiopathic. Physical examination revealed highly rigid, tender corpora cavernosa with a spared glans penis. Cavernosal blood gas analysis confirmed severe ischemia (pH < 7.2, elevated pCO₂, depressed pO₂).

Given the 4-day duration, first-line shunting was omitted due to the absolute certainty of smooth muscle necrosis. The patient was taken directly to the operating room for early penile prosthesis implantation.

2.2.2. Case 2: 7-Day Delayed Iatrogenic Presentation

A 47-year-old male presented with a persistent, painful erection of 7 days (168 hours) duration. The episode was triggered iatrogenically following an intracavernosal injection (ICI) of prostaglandin E₁ (PGE₁/Alprostadil) administered at an outside facility for a diagnostic penile duplex Doppler ultrasound examination. Examination revealed a severely tender, rock-hard penile shaft. Duplex ultrasound confirmed absent cavernosal arterial inflow and stagnant corporal volumes. The patient was counseled regarding the complete loss of native erectile tissue viability. He consented to primary surgical intervention via early penile prosthesis insertion.

We can summaries these cases in the **Table 1** below:

Table 1. Summary of the two cases.

Clinical feature	Case 1	Case 2
Age	32 years old	47 years old
Etiology	Idiopathic (Workup negative for sickle cell, leukemia, thalassemia)	Iatrogenic (PGE ₁ intracavernosal injection at an outside facility)
Ischemia duration	~96 hours (4 days)	~168 hours (7 days)
Baseline erectile function	Documented baseline status	Documented baseline status/prior ED history
Comorbidities & medications	None reported; no regular medication use	Controlled hypertension; on regular anti-hypertensive therapy
Prior priapism history	None	None
Preoperative CBG values	pH < 7.2, elevated pCO ₂ , depressed pO ₂	Confirmed severe ischemia pH < 7.25, elevated pCO ₂ , depressed pO ₂
Diagnostic imaging	Physical exam: highly rigid, tender corpora	Penile duplex: absent cavernosal arterial inflow & stagnant volumes

3. Surgical Technique

3.1. Perioperative Infection-Prevention Protocol

To mitigate the risk of device infection within an ischemic environment, a strict antimicrobial protocol was implemented for both patients:

- **Systemic Preoperative Prophylaxis:** Broad-spectrum intravenous antibiotic coverage administered prior to skin incision.
- **Intraoperative Corporal Irrigation:** Aggressive, high-pressure irrigation of the corporal spaces using a multi-drug antibiotic solution to decontaminate the local environment.
- **Postoperative Antimicrobial Therapy:** Patients were maintained on a course

of systemic oral postoperative antimicrobial treatment following discharge.

3.2. Operative Approach and Exposure

Both patients underwent surgery under appropriate anesthesia using an identical technical protocol. A mid-shaft ventral incision was performed, providing direct, symmetric anatomical access to both corpora cavernosa. Following layer-by-layer dissection, parallel bilateral corporotomies were executed.

3.3. Corporal Preparation and Dilation

Intraoperatively, the corporal tissue in both cases demonstrated advanced ischemic changes, characterized by the evacuation of dark, thick, stagnant, and malodorous blood. In the 7-day presentation case, early fibrous organization and dense resistance were encountered within the corporal spaces. Sequential dilation was performed meticulously using Hegar dilators. In both cases, proximal and distal dilation required careful tactile feedback to avoid accidental urethral cross-over or tunical perforation through the edematous tissue.

3.4. Hardware Deployment and Closure

Following aggressive antibiotic irrigation of the corporal spaces, appropriately sized malleable (semi-rigid) prosthesis rods (Regicon) were securely deployed bilaterally. The corporotomies were closed with absorbable sutures, and the ventral skin incision was closed anatomically. Immediate detumescence and excellent anatomical alignment were achieved intraoperatively in both patients. Total operative times were 45 minutes (Case 1) and 55 minutes (Case 2), respectively, with minimal estimated blood loss.

4. Postoperative Follow-Up and Outcomes

Both patients were followed postoperatively to evaluate recovery, safety, and device function:

- **Wound Healing and Tissue Integrity:** The ventral skin incisions healed anatomically with satisfactory primary closure. There were no documented instances of superficial wound infections, deep device infections, or mechanical erosion of the rods through the tunica albuginea or glans.
- **Pain Resolution:** The excruciating preoperative compartment pain resolved immediately postoperatively. Postoperative pain was managed successfully, resulting in complete pain resolution.
- **Device Position and Configuration:** Clinical follow-up confirmed excellent anatomical device alignment and stable position of the malleable hardware without displacement.

Patient Satisfaction and Function: Both patients reported a high level of satisfaction with the surgical outcome, achieved functional rigidity, and experienced no adverse events or revision surgeries during the follow-up period.

5. Discussion

5.1. The Penile Compartment Syndrome Challenge

Ischemic priapism demands rapid diagnosis and intervention to prevent irreversible structural damage [2]. While contemporary protocols are highly effective when initiated early, management becomes exceptionally complex when presentation is severely delayed [5]. The two cases described in this series—presenting at 4 and 7 days post-onset, respectively—highlight the critical utility of early malleable penile prosthesis (PP) implantation via a mid-shaft ventral incision as a definitive, primary treatment paradigm for late-stage, refractory ischemic priapism [5] [8].

5.2. Pathophysiological and Histological Realities of Late Presentation

The timeline of ischemic priapism dictates its cellular outcomes [1]. Within 12 hours of venous occlusion, histological evaluations demonstrate progressive endothelial cell edema and microvascular thrombi formation [2]. By 24 to 48 hours, the deprivation of oxygen and essential nutrients triggers widespread cavernosal smooth muscle necrosis [4]. If the ischemic state remains unresolved beyond 72 hours, the necrotic architecture undergoes an intense, irreversible fibroblastic proliferation [1] [4]. At the 4-day and 7-day marks seen in our patients, the corpora cavernosa no longer contain viable contractile or erectile tissue. Instead, they contain a mixture of necrotic debris, organizing thrombi, and early collagen deposition. Attempting standard conservative strategies at this stage is physiologically futile [6].

5.3. The Landmark Shift: Early vs. Delayed Implantation

Historically, the classical urological approach to late-presenting priapism was conservative management during the acute phase, accepting the inevitability of profound erectile dysfunction (ED), followed by an elective penile prosthesis implantation 3 to 6 months later [7] [8]. However, landmark data pioneered by Ralph *et al.* [7] and validated by Zacharakis *et al.* [5] fundamentally dismantled this approach [5] [7] [8].

5.3.1. Morbidity of Delayed Implantation

When prosthesis surgery is delayed by several months, the subacute inflammatory process transitions into dense, extensive, and unyielding corporal fibrosis [5]. This fibrotic remodeling causes profound penile shortening, caliber loss, and structural distortion [8]. From a technical standpoint, managing a severely fibrotic penis is notoriously difficult. Dilation of the calcified and scarred corpora cavernosa frequently requires specialized cavernotomes (e.g., Mooreville or Rossello dilators) or extensive, multi-staged corporotomies. The literature indicates that delayed implantation carries an unacceptably high complication rate—frequently exceeding 40% [5] [7]. These complications include corporal perforation, urethral

injury, device malposition/erosion, and severe loss of length resulting in profound patient dissatisfaction [7].

5.3.2. Advantages of Early Implantation

By contrast, implanting the prosthesis early (within the acute or subacute window, up to 2 - 3 weeks post-onset) capitalizes on a unique surgical window [5]. During this phase, although the smooth muscle is necrotic and non-viable, it remains soft, compliant, and easily dilatable [5] [7]. The early insertion of prosthetic rods acts as an immediate internal scaffold or “splint” [8]. This constant mechanical expansion preserves the baseline length and girth of the penis, actively preventing the cicatricial contracture that would otherwise permanently disfigure the phallus [5]-[8]. Furthermore, evacuating the entrapped, toxic blood elements and decompressing the rigid corpora provides immediate, profound relief from agonizing ischemic pain [8].

5.4. Strategic Selection of a Malleable Device

While inflatable penile prostheses (IPP) are often preferred for standard erectile dysfunction, a malleable (semi-rigid) device offers distinct, critical advantages in the setting of acute, delayed ischemic priapism [8] [9]:

1) Continuous Mechanical Resistance: Malleable rods exert a continuous, unyielding outward force. This constant expansion is vital to counteract the fierce, subacute fibrotic contraction forces that immediately begin during the healing phase of a necrotic cavernous space [8].

2) Reduced Surface Area and Complexity: Malleable devices are completely self-contained within the corpora, devoid of fluid reservoirs, connection tubing, or scrotal pump mechanisms [9]. Minimizing foreign body surface area is clinically crucial when deploying hardware into an ischemic environment with compromised local microvascular perfusion and impaired immune clearance [4] [9].

3) Minimized Operative Time: The straightforward preparation and deployment of malleable rods significantly shorten total anesthesia and operative times. This limits the duration that vulnerable, ischemic tissues are exposed to the ambient operating room environment, directly reducing infectious risks.

5.5. Biomechanical Advantages of the Mid-Shaft Ventral Incision

The selection of the surgical approach is paramount when performing an early implant for delayed priapism. Many standard implants utilize a penoscrotal or infrapubic incision. However, for late-presenting priapism with early fibrous organization, the **mid-shaft ventral incision** offers distinct biomechanical and anatomical advantages:

- **Direct Central Access:** A mid-shaft ventral incision places the corporotomies precisely at the longitudinal midpoint of the penile shaft. When pushing through resistant, organizing clots or early fibrous bands, the surgeon is not blind to the distal or proximal extremes.

- **Symmetric, Controlled Dilation:** This central vantage point provides equal tactile feedback and physical leverage during both proximal dilation (downward toward the crural attachments at the ischial tuberosity) and distal dilation (upward toward the glans penis).
- **Enhanced Safety Margin:** Visualization is optimized, allowing the surgeon to maintain a strictly parallel plane to the septum. This significantly minimizes the risks of an accidental medial crossover into the urethra or a lateral blowout through the edematous tunica albuginea—risks that are heavily amplified when trying to drive dilators purely from a proximal penoscrotal approach through resistant tissue.

While these findings are promising, they represent observations from a small two-patient series and cannot prove generalized superiority or safety over established penoscrotal or infrapubic approaches. Larger comparative trials are necessary to formally evaluate the comparative safety profile of this incision.

5.6. Addressing and Mitigating the Risk of Infection

A primary concern regarding immediate prosthetic insertion in an ischemic environment is the theoretical risk of device infection due to compromised local tissue vascularity [5] [9]. However, contemporary data demonstrate that infection rates remain low and entirely manageable when appropriate surgical principles are applied [4] [5]. In our series, aggressive, high-pressure intraoperative irrigation of the corporal spaces using a multi-drug antibiotic solution was performed. Removing the stagnant, toxic, and potentially colonized dark blood elements from the corpora effectively decontaminates the local environment. Furthermore, because these patients did not undergo multiple failed, prior shunting procedures, the anatomical integrity of the tunica and glans remained intact, preventing the creation of multi-compartmental tracts that could harbor bacterial pathogens [6].

6. Conclusion

6.1. Summary of Surgical Paradigm

For cases of ischemic priapism presenting beyond 72 hours, early penile prosthesis implantation using a malleable device via a mid-shaft ventral incision represents a highly effective, safe, and definitive standard of care. Managing patients at the 4-day and 7-day marks requires immediate recognition that native tissue preservation is no longer a viable clinical objective. At this advanced timeline, traditional shunting strategies are counterproductive, routinely culminating in tissue necrosis, unmanaged pain, and delayed fibrotic contractures that make subsequent revisions technically hazardous.

6.2. Clinical Implications and Anatomical Preservation

By intervening acutely within the subacute surgical window, urologists can exploit the relative compliance of necrotic smooth muscle before the establishment of mature, unyielding collagen deposition. The primary placement of malleable rods

provides continuous, active mechanical expansion. This functions as a permanent internal structural splint that prevents catastrophic phallic shortening and corporal narrowing. Simultaneously, the evacuation of stagnant, deoxygenated blood provides immediate resolution of agonizing compartment syndrome pain, bypassing weeks of patient distress.

6.3. Final Technical Recommendations

Furthermore, the utilization of a mid-shaft ventral incision optimizes surgical safety during this acute window. This approach secures central anatomical visualization, allowing for balanced physical leverage and highly accurate tactile feedback during both proximal and distal corporal dilations. Consequently, it minimizes the specific, elevated risks of urethral perforation or lateral tunical blowout associated with driving rigid dilators blindly from a proximal entry point through edematous tissue. In conclusion, this dual approach—combining early malleable hardware deployment with mid-shaft central corporal access—successfully mitigates the extensive surgical morbidity, elevated complication profiles, and dramatic anatomical loss associated with delayed fibrotic revisions. It establishes an elegant, primary clinical pathway that concurrently manages the acute urological crisis while providing a definitive, long-term solution to the inevitable post-priapism erectile dysfunction.

Ethics Approval and Consent to Participate

Informed consent was obtained from both patients for the surgical procedures and the publication of this anonymous case series. Institutional Review Board (IRB) exemption was granted due to the retrospective, de-identified nature of the report.

Conflicts of Interest

The authors declare no competing financial or personal interests regarding the choice of prosthetic devices used in these cases.

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