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Case Report

Interventional radiology: Diagnosis and treatment of post-traumatic nonischemic priapism: A case report ☆,☆☆,★

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ABSTRACT

Priapism is defined as a form of erectile dysfunction characterized by a prolonged and involuntary penile erection, either partial or complete, occurring without sexual stimulation and lasting for more than 4 hours. Its incidence is estimated to be 0.5-0.9 cases per 100,000 people per year.

The most frequent form is ischemic priapism, results from paralysis of the cavernous smooth muscles, which are unable to contract, leading to the stagnation of hypoxic blood within the sinusoidal spaces. Characterized by a painful rigid and sustainable erection.

Non-ischemic priapism constitutes a rare entity, unlike the former, this type is typically painless. It is caused by an excessive influx of blood into the penis without a concomitant increase in outgoing blood flow. Blunt trauma is the most commonly reported etiology.

And finally, recurrent priapism is characterized by recurrent episodes of prolonged erection and can be challenging to treat, often requiring long-term management to prevent recurrences.

We report a case of high-flow priapism in a 10-year old child, secondary to a cavernous arterial fistula following a straddle injury during sports activity. It was suspected clinically and confirmed by ultrasound-Doppler, then successfully treated radiologically with highly selective embolization, with very satisfactory postoperative outcomes.

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Introduction

Priapism is defined as a pathologic condition characterized by a persistence of erection of the penis that lasts more than 4 hours and occurs in the absence of sexual stimulation [1,2]. We distinguish 3 kinds of priapism, first: ischemic priapism (veno-occlusive, low flow) represents more than 95% of cases [3]. It is related often to sickle cell disease (SCD) by stagnation of blood within the sinusoids of the corpora cavernosa during physiologic erection and sickled erythrocytes obstructing venous outflow from the corporal bodies, leading to a painful rigid erection [4]. It is an emergency situation and classically treated by a combination of aspiration followed by the intracavernosal injection of sympathomimetic drugs [5].

The second is stuttering priapism (intermittent) characterized by a recurrent unwanted and painful erections in men with sickle-cell disease (SCD), that persists for several hours and becomes progressively painful secondary to ischemia. Unfortunately, those patients may experience stuttering priapism from childhood [3].

And the third is the nonischemic priapism (arterial, high flow) much rarer, clinically it presents as post traumatic painlessness non rigid erection. The mechanisms include: straddle injury, coital trauma, kicks to the penis or perineum, pelvic fractures, birth canal trauma to the newborn male [3]. Their managements especially in children is conservative (watchful waiting) [6], angiography with selective arterial embolization is an alternative treatment which was used in our case.

Color Doppler ultrasonography (CDU) is the gold standard exam to make diagnosis, in the case of ischemic priapism no blood flow in the cavernous arteries, distinct from nonischemic priapism which shows an arteriolar-sinusoidal fistula and high blood flow velocities detectable in the cavernous arteries.

Penile arteriography should be reserved for the management of high-flow priapism, when embolization is undertaken

We describe the diagnosis and the management of a 10-year old child presented with post traumatic non-ischemic priapism.

Case presentation

A 10-year-old child, victim of lower genitourinary trauma without immediate consequences, presented with painless priapism 24 hours later. Faced with the persistence of priapism the child's parents to bring him to a pediatric surgery consultation 1 week later.

Clinical examination revealed partial rigidity of the penis, with slight sensitivity to palpation, and a rather flaccid glans. The diagnosis of high-flow priapism was immediately suspected and confirmed by Doppler ultrasound, which showed a focal area of characteristic turbulence in color mode, indicative of an arteriovenous fistula involving the left cavernous artery at the base of the penis with high-velocity and turbulent flow (Fig. 1).

The parents of our patient were not found to have any history of SCD. Although we performed a blood test to eliminate this possibility, the results were negative.

The patient was treated by local pressure and ice application, however, after 3 weeks this treatment did not result in detumescence. The case of the young patient was then presented to us for a super-selective embolization of the pathological artery.

In the angiography room, on a biplane GE-type table, under local anesthesia at the puncture site, via a right femoral approach. Following a puncture of the right common femoral artery using Seldinger technique, and placement of a valve introducer 4F then crossing over and catheterization of the anterior trunk of the left internal iliac artery using a Cobra catheter 4F carried on a hydrophilic guide. At this stage, opacification immediately allowed us to locate the fistulous point distally,

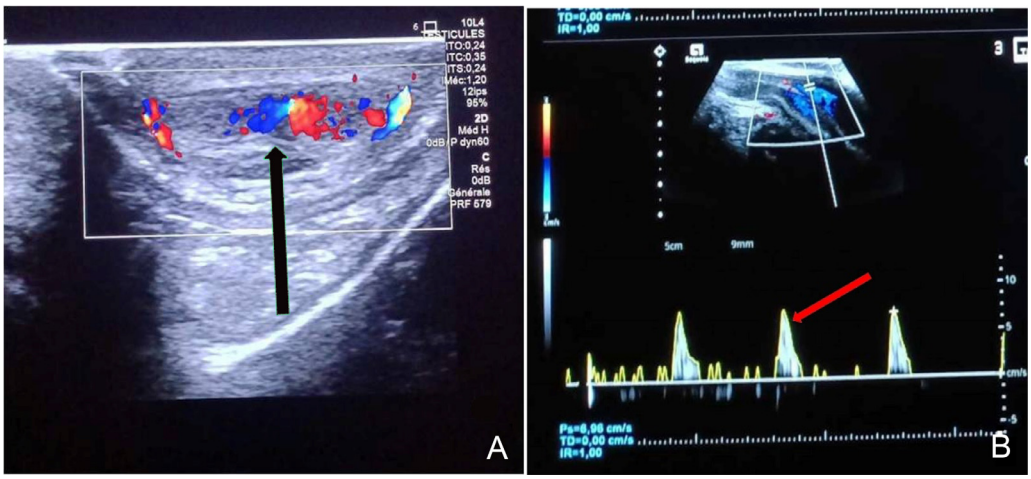

Fig. 1 – Color ultrasound Doppler shows an abnormal increased color flow in focal zone of the left corpora cavernosa and adjacent soft tissues (black arrow) (A). (B) Dilated vascular lake with turbulent flow and high flow velocity characteristic of arteriovenous fistula with high peak systolic velocity, PSV = 9.3 cm/sec (red arrow).

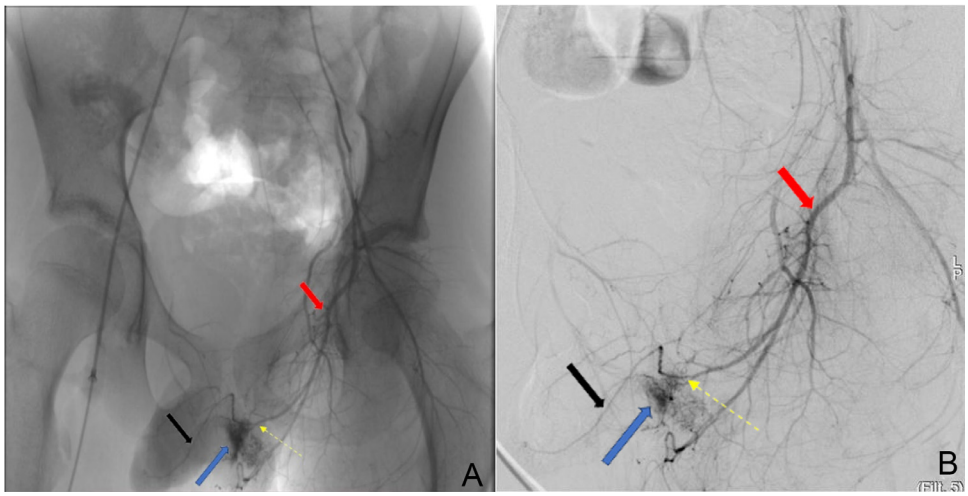

Fig. 2 – (A) Non-subtracted arteriography, (B) Subtracted arteriography performed from the anterior trunk of the left internal iliac artery, reveals contrast extravasation into the corpus cavernosum (blue arrow) through a breach in the left cavernous artery (yellow arrow), a terminal branch of the internal pudendal artery (red arrow). The integrity of the deep dorsal artery (black arrow) is maintained.

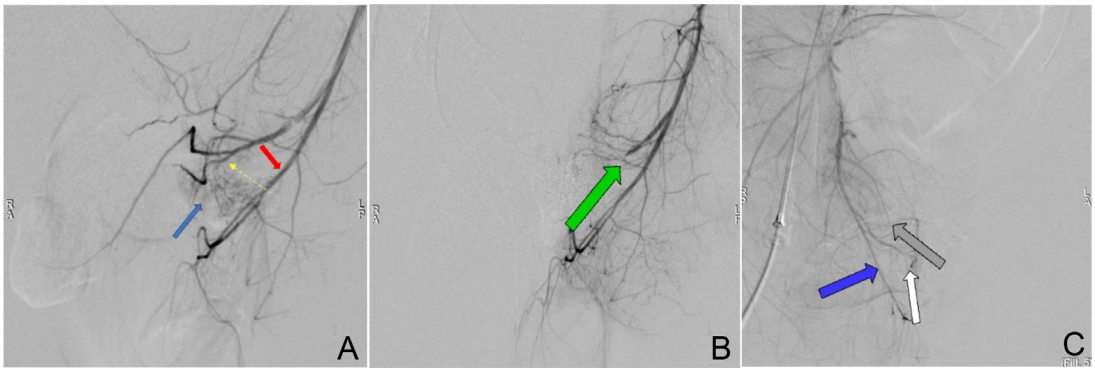

Fig. 3 – Subtracted supra-selective arteriography: (A) left penile artery: opacification refluxing into the perineal artery (red arrow), demonstrating contrast extravasation into the corpus cavernosum (blue arrow) through a breach in the left cavernous artery (yellow arrow). (B) occlusion of the left cavernous artery and the deep dorsal artery using Spongel (green arrow). (C) Right internal iliac artery: demonstrating normal nonpathological opacification of the penile and perineal vasculature. Cavernous artery (white arrow), deep dorsal artery (gray arrow), perineal arteries (blue arrow).

eliminating the need for further 3D cone beam CT imaging (Fig. 2A).

Therefore, we progressed with the assistance of a road mapping, performing supra-selective embolization using a 2.7 F microcatheter guided by a 0.018 microguide, until reaching the left cavernous artery, which is the terminal branch of the internal pudendal artery (formerly known as the hypogastric artery).

The injection revealed contrast extravasation, suggesting a traumatic fistulous rupture of the artery (Fig. 2B), and led us to perform a highly selective embolization using resorbable gelatine (Spongel®) (Fig. 3A).

The follow-up examination revealed occlusion of the cavernous artery and complete attenuation of the contrast extravasation (Fig. 3B).

Contralateral opacification did not reveal any abnormalities regarding the vascularization of the right penile region (Fig. 3C).

Postoperative clinical examination upon the child's awakening revealed a penile tumescence decreasing 40 minutes after artery occlusion. On postoperative day 1, we noted penile edema, which was relieved by cryotherapy. By the fifth day, flaccidity was nearly complete, the edema had resolved.

One month later, we reviewed the patient for a clinical follow-up. The examination was entirely reassuring. His erections were completely normal and painless. No urinary difficulties were reported by the child or his parents. Ultrasound with color Doppler control shows a permeabilization of the left cavernous artery and no recurrence of the fistula (Fig. 4).

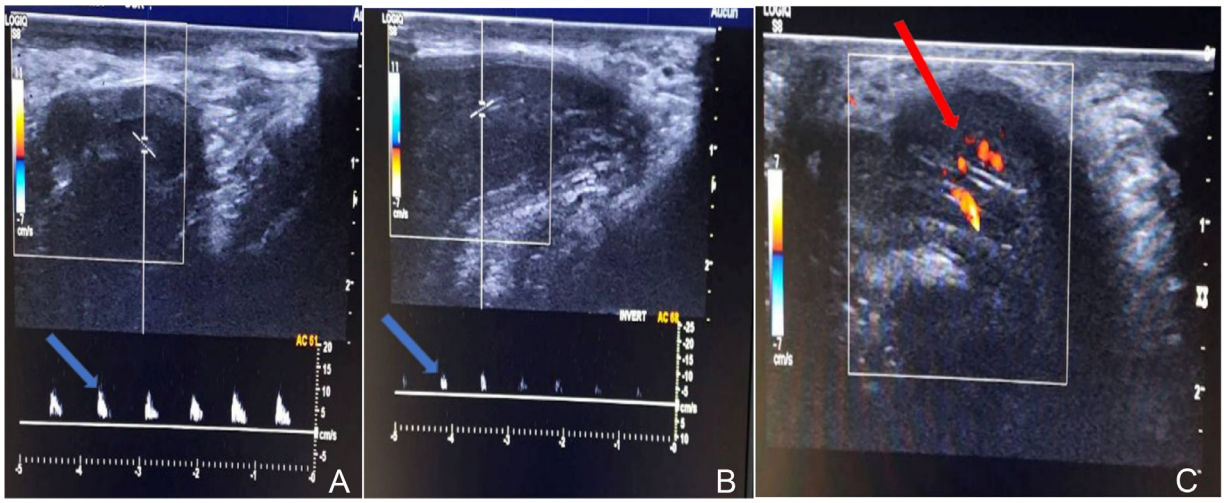

Fig. 4 – Ultrasound with Color Doppler control shows a permeabilization of the left cavernous artery (A and B) (blue arrow) and no recurrence of the fistula (C) (red arrow).

Discussion

The erectile system is composed of several anatomical structures that work together to enable and maintain an erection. The main ones include the corpora cavernosa, surrounded by a fibrous membrane called the tunica albuginea. The corpus spongiosum, less dense than the corpora cavernosa, surrounds the bulbous urethra and helps maintain the penis in an upright position. Penile arteries supply oxygenated blood to the corpora cavernosa and corpus spongiosum, while penile veins allow drainage during and after erection. Finally, the erectile nerves transmit signals of sexual stimulation from the brain to the penis, triggering the relaxation of smooth muscles in the penile arteries, thereby promoting blood flow and erection [7].

High-flow priapism, also known as non-ischemic priapism, is a rare condition about 5% of all cases of priapisms [8]. It is characterized by a prolonged and often painless erection of the penis (except in certain cases where pain may be induced by palpation) [9], caused by an excessive influx of blood into the corpora cavernosa.

Unlike low-flow priapism (ischemic priapism), where the prolonged erection is due to inadequate blood circulation and can lead to tissue hypoxia and permanent damage, high-flow priapism is typically painless and is associated with normal or increased incoming blood flow [10,11].

High-flow priapism is often caused by arteriovenous malformations, arteriovenous fistulas, or other vascular anomalies of the penis or urogenital system, most commonly following direct penile or perineal trauma as was the case in our situation [2,9]. In these conditions, an abnormal arteriovenous shunt allows excessive arterial blood flow into the penis bypassing the normal regulatory mechanisms of erection [10]. This can lead to a prolonged and persistent erection without the involvement of triggering factors such as sexual stimulation.

High-flow priapism is generally less common than low-flow priapism [2,12], but it can be associated with pelvic trauma, iatrogenic causes, or underlying medical conditions such as sickle cell disease [13]. The diagnosis of high-flow priapism relies on contextual evaluation, physical examination (perineal compression test) [12], and imaging studies, notably penile Doppler ultrasound, which nowadays serves as the gold standard diagnostic tool, superseding the previously used internal pudendal arteriography for etiological investigation, which is now reserved for therapeutic purposes.

The management of high-flow priapism offers several therapeutic options, each with its own advantages and disadvantages: Conservative treatment aims to induce vasospasm of the cavernous artery through manual or mechanical compression and perineal icing, promoting clot formation and thereby excluding the fistula. Studies show a moderate success rate of nearly 50%, with a post-procedure erectile dysfunction rate of 6.7%. However, this approach may be limited by its variable effectiveness and potential side effects [14].

Medical treatment involves androgen blockade over a period of 2-6 months to abolish spontaneous erections and promote fistula healing. While this method can be effective, it is associated with numerous side effects such as erectile dysfunction, hot flashes, and fatigue [2].

An alternative surgical option involves ligating the cavernous artery at it is entry into the corpora cavernosa or a specific ligature of the injured artery, assisted by Doppler ultrasound. Although the success rate is high, postoperative erectile dysfunction can reach nearly 50% [2,15].

Hyper-selective embolization has become the gold standard at present, offering a success rate between 61.7% and 80%. This procedure, performed with temporary or permanent agents, often allows for an immediate return to penile flaccidity. The use of temporary materials such as absorbable gelatin is more common as it provides safety in terms of preserving sexual function [9]. In case of failure, additional embolization procedures can be considered, offering a combined success

rate of approximately 85%. Encouragingly, erectile function often remains unchanged after this intervention [2,11].

Conclusion

High-flow priapism represents a rare subtype among all priapism cases. Its diagnosis relies on a series of criteria, typically observed in patients experiencing painless, non-rigid erections following pelvic trauma. Doppler color ultrasound, which detects high-velocity and turbulent flow within an arteriovenous fistula of the cavernous artery, stands as the gold standard for diagnosis.

In the treatment realm, hyper-selective embolization utilizing resorbable gelatin, particularly in pediatric cases, emerges as a promising therapeutic for high-flow priapism. This approach offers notable advantages, including the preservation of erectile function and higher success rates compared to alternative therapeutic modalities.

Patient consent

Complete written informed consent was obtained from the patient for the publication of this study and accompanying images.

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