

## Review

# Presentation, Management, and Outcomes of Penile Fractures

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## Abstract

**Background:** Penile fractures are due to a traumatic rupture of the penile tunica albuginea of the corpus cavernosum and may result from numerous etiologies. The purpose of our review is to describe the etiology, management, and outcomes of penile fractures. **Methods:** A literature review was performed. **Results:** The diagnosis of penile fractures is usually made clinically but can also be made with the assistance of ultrasound or MRI (magnetic resonance imaging) imaging when unclear. Cystoscopy should be performed when urethral involvement is suspected. Surgical management should be initiated promptly after the diagnosis, and within 24 hours of presentation. Surgical management can include the subcoronal or penoscrotal approach, although the penoscrotal approach is preferred when imaging confirms the location of the injury to be ventral and proximal, due to the reduced morbidity of this technique. Complications following penile fractures include erectile dysfunction, penile curvature, and voiding symptoms, but the incidence of complications is reduced if surgical intervention is performed promptly after fracture presentation. A rare cause of penile fractures is collagenase clostridium histolyticum injection, and these cases should predominantly be managed conservatively. **Conclusions:** Penile fractures can present in various ways and must be managed surgically and promptly after the diagnosis is made.

**Keywords:** penile fractures; rupture of corpus cavernosum; collagenase clostridium histolyticum; immediate vs. delayed management of penile fracture

## 1. Introduction

Penile fractures are defined as the traumatic rupture of the penile tunica albuginea of the corpus cavernosum while the penis is erect. It commonly occurs as a result of sexual intercourse. Penile fractures are usually diagnosed clinically and managed surgically. Delay in surgical management of penile fractures can lead to sexual dysfunction and anatomical deformities, therefore penile fractures are considered a urologic emergency [1]. This review will describe the etiology, management, and outcomes of penile fractures.

## 2. Materials and Methods

A literature review of articles regarding the etiology, diagnosis, management, and outcomes of penile fractures was performed on PubMed. Articles from 1994 to the current day were used to describe the history of penile fracture management and how it has changed. Publications with information on ultrasound and magnetic resonance imaging (MRI) for penile fractures were included as well to specify requirements for penile fractures diagnosis. Articles not related to penile fracture presentation and management were excluded.

## 3. Etiology

The incidence of penile fractures is reported to be 1.02 per 100,000 men per year in the United States and can reach up to 10.4 per 100,000 men per year in other countries such as Iran [2,3]. The tunica albuginea is an important struc-

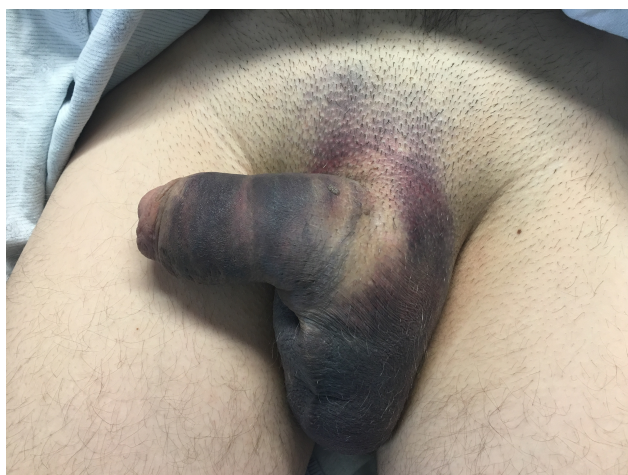
ture for maintaining an erection and surrounds the corpora cavernosa of the penis and is made up of tough fibrous connective tissue. When the penis is flaccid, the tunica albuginea measures 2 mm long. However, once erect, the tunica albuginea decreases in size to 0.25–0.5 mm, leaving the penis more vulnerable to traumatic injury. Rupture and injury can occur when the penis is exposed to abnormal bending and intracavernosal pressure surpasses 1500 mm Hg, exceeding the tensile strength of the tunica albuginea [3,4]. The ventral and proximal parts of the tunica albuginea are the thinnest and therefore the weakest, making these points frequent areas of injury [5]. Rupture of the tunica is usually unilateral, and more commonly right-sided. In the United States, penile fractures occur most frequently due to sexual intercourse involving women-dominant and “doggy style” positions that allow for the penis to slip out and forcefully strike the perineum or pubic bone with abnormal angulation [6]. Other causes include masturbation, rolling over on the erect penis, and blunt trauma from physical violence [7]. In Middle Eastern countries such as Iran, the practice of “Taqaandan” is responsible for up to 75% of all penile fractures. This involves a patient “snapping” the erect penis to achieve rapid detumescence in inopportune situations [8]. Injuries to the corpus spongiosum and urethra are more common with sexual intercourse compared to penile manipulation due to the lower energy trauma of penile manipulation [9]. The incidence of urethral injury is around 20% in unilateral penile fractures but increases to 80% if the fracture is bilateral [10]. While the average age of pa-



tient's reporting penile fractures in North America is approximately 38.7 years, the demographic of patients in the Middle East was significantly younger (26 years old) due to the Taqaandan maneuver being more popular amongst adolescents [11].

#### 4. Presentation and Diagnosis

The diagnosis of a penile fracture is made predominantly based on history and physical exam findings [7,9,12,13]. Patients commonly present with an audible and loud popping sound (69%) followed by swelling (86%), detumescence (79%), and pain in the genitalia (79%). Pain from penile fracture is variable and has been reported mild to severe, without any correlation to fracture severity [9]. If the urethra is involved, patients can also present with urethral bleeding (14%) and acute urinary retention (7%) [10]. However, recent data suggests that up to 50% of urethral injuries were not clinically detected, and were instead detected incidentally with ultrasound or intraoperatively [11]. On physical exam, a hematoma is observed in nearly all cases (97%), and angulation of the penis may also be observed [1,11,14]. When the presentation of a penile fracture is delayed, the edema is improved, and the Buck's fascia is intact, the physician can observe a "rolling sign", or a localized clot over the injury site which can be felt as an immobile lump, when rolling a finger over the area [6]. An "eggplant deformity" may also develop when the Buck's fascia remains intact, in which hemorrhage produces swelling and bruising of the penis similar to the shape and color of an eggplant. If the Buck's fascia is disrupted, then a "butterfly sign" can be observed as the hematoma expands to the scrotum, perineum, and suprapubic region [6,15,16] (Fig. 1).



**Fig. 1. Clinical Presentation of Patient with Penile Fracture.** Adapted from Ory *et al.* [15]. Copyright CUA. Reprinted with permission. Swelling and ecchymoses of the shaft is referred to as "eggplant deformity".

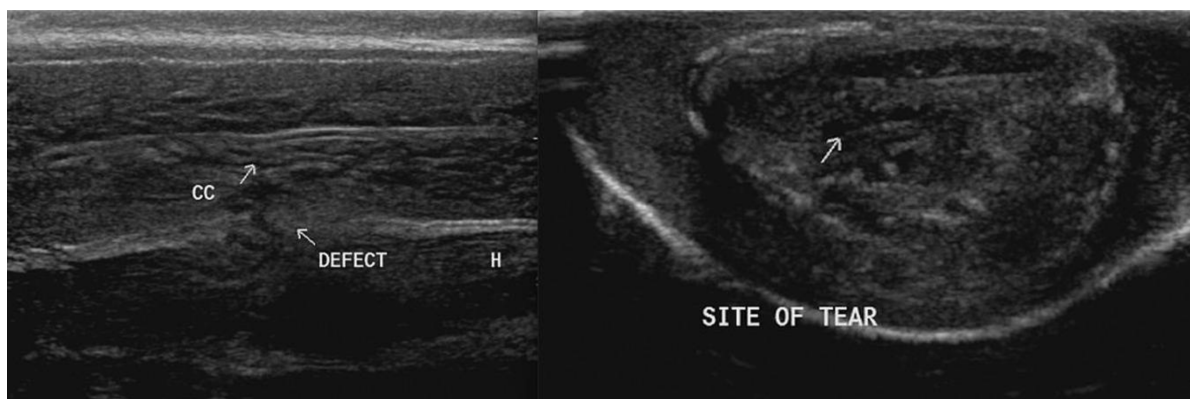
False penile fracture is an extremely rare entity that

constitutes approximately 4–6% of patients who were operated on with the clinical suspicion of penile fractures. They present clinically similar to penile fractures, with a popping noise, hematoma, and penile pain during similar mechanisms of sexual intercourse, penile manipulation, and blunt trauma. Surgical exploration can determine the etiologies of false penile fractures, which are usually due to an avulsed superficial dorsal vein or nonspecific dartos bleeding [17,18].

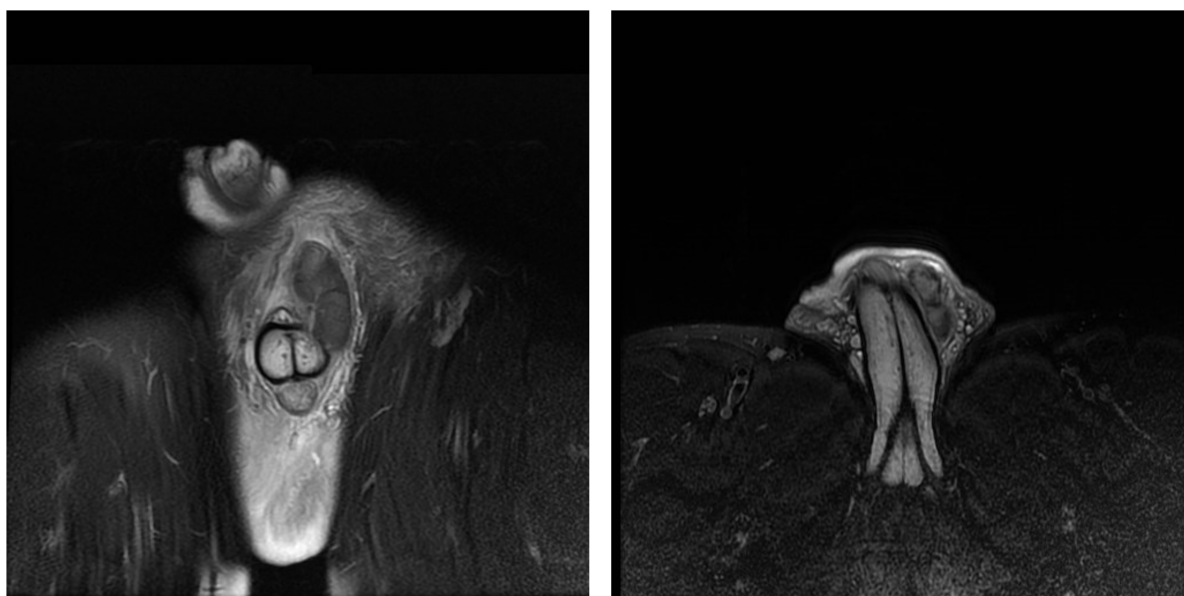
While penile fractures are predominantly diagnosed clinically, American Urological Association (AUA) and European Association of Urology (EAU) guidelines recommend imaging for suspected fracture when the diagnosis is unclear. Ultrasound is a quick and relatively inexpensive imaging modality that is preferred in these cases. It is used to visualize the hematoma and localize the area of rupture, which aids in surgical planning and management [19] (Fig. 2). This method is highly operator-dependent and has a sensitivity of up to 88% and specificity of up to 100% [6,20–25]. To accurately diagnose a penile fracture via ultrasound, it is important to view the shaft in both the transverse and horizontal planes to look for either an intracavernosal hematoma or discontinuity of the tunica albuginea [26]. MRI imaging is less accessible in emergencies and is more expensive than ultrasonography. It may be used as a complement to ultrasound for patients in whom it is difficult to visualize the defect in the tunica albuginea (Fig. 3) [21,27]. The sensitivity of MRI in diagnosis of penile fractures is 100%, while the specificity is up to 87.5% [28,29]. MRI imaging should include T3 sequences in three orthogonal planes along with a T1 sequence in one plane, either axial or sagittal, without the injection of contrast [30]. To detect suspected urethral involvement, which can occur in up to 3–30% of penile fracture cases, AUA and EAU guidelines recommend performing either a retrograde urethrogram or flexible cystoscopy [6,7]. Retrograde urethrograms are useful for pinpointing the lesion site by identifying the site of contrast leakage, however it is associated with a high false negative rate of up to 28.5%. For this reason, flexible cystoscopy is often preferred to directly visualize the site of urethral injury [31–34]. Ultrasound is less reliable in detecting urethral rupture. While MRI is sensitive for detecting tunical tears, its sensitivity (60%) and specificity (78.3%) are significantly lower for detecting urethral lesions [35].

#### 5. Management

Penile fractures were traditionally managed conservatively with bed rest, elastic bandages, ice compresses, non-steroidal anti-inflammatory drugs, prophylactic antibiotics, fibrinolytics, foley catheters, and sedatives [9]. Conservative management quickly fell out of favor due to significant complications and increased hospital stay. Sixty percent of men managed conservatively had at least one long-term complication, which included erectile dysfunction, painful erections, and/or penile curvature [4,36,37]. Conservative



**Fig. 2. Ultrasound Finding of Penile Fracture.** Adapted from Chahal *et al.* [19]. Copyright BMJ Publishing Group. Reprinted with permission. Ultrasound images showing ventral haematoma (H) and defect in the wall of the right corpus cavernosa (CC).

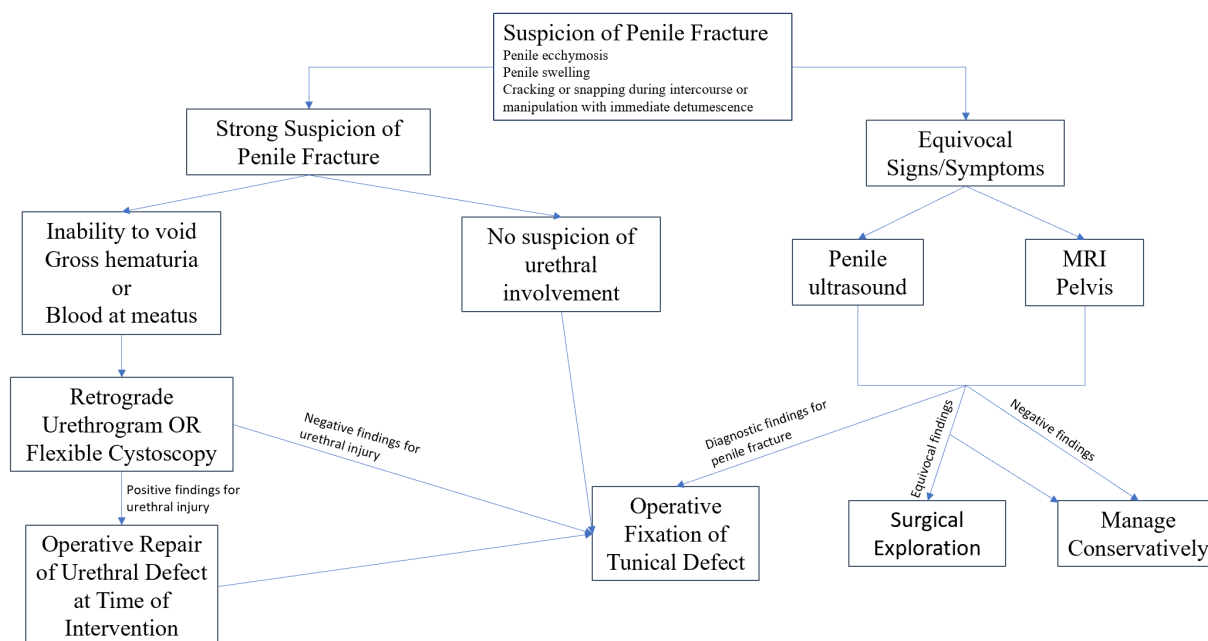


**Fig. 3. MRI Finding of Penile Fracture.** Adapted from Ory *et al.* [15]. Copyright CUA. Reprinted with permission. 5 mm defect of left tunica albuginea and overlying hematoma on 1.5T MRI imaging.

management can lead to plaque formation, corporeal fibrosis, and secondary shaft deformation that necessitates secondary penile plication [11]. Despite the shift away from conservative management, a recent study describing emergency department visits for penile fractures in the United States found that approximately 64% were treated non-surgically or discharged from the ED. This could be due to disparities in health care access, misdiagnosis, or under-reporting in the community [38].

Surgical intervention for penile fractures was first described in 1936 and became more prevalent as patients whose penile fractures were managed surgically had significantly fewer complications compared to those who refused surgery [9,39]. According to the EAU and AUA, the current management of penile fractures requires immediate surgical repair to reduce the likelihood of long-term complications such as erectile dysfunction. Al Ansari *et al.* [39]

found that surgical repair should be performed in the first 24 hours after the incidence of fracture to minimize complications. Erectile dysfunction occurred in 4.1% of patients who received surgical intervention within the first 24 and in 18.2% of patients who received delayed surgical intervention of up to 1 to 7 days. However, there is some dispute as to whether surgical management must be further expedited to no more than 8 hours after incidence of penile fracture for improved outcomes. Kozacıoğlu *et al.* [40] argues that there is no statistical difference in erectile dysfunction or penile deformities in patients surgically managed at 0–6 hours, 6.1–12 hours, and 12–24 hours after incidence of fracture. In contrast, Bozzini *et al.* [41] argues that the International Index of Erectile Function (IIEF-5) was worse for patient's whose surgical intervention was over 8.23 hours after the emergency room admission at 1 and 3 months, compared to those whose surgical interven-



**Fig. 4. Penile fracture diagnostic and therapeutic flowchart.**

tion was sooner. Another meta-analysis showed overall fewer complications and fewer cases of penile curvature and painful erections with immediate surgery compared to delayed intervention, but no differences in erectile dysfunction or plaque formation between the two groups [7]. Still others have noted that there is no difference in long term complications in groups that received immediate surgical intervention compared to delayed, unless urethral injury is present [42]. However, this may be more telling of the extent of injury, as penile fractures involving the urethra tend to be more complex and extensive, thereby inherently lending itself to worse outcomes unless acted upon in an expedited manner. If urethral injury can be excluded, then surgical exploration may be delayed to within 36–48 hours post-injury (Fig. 4) [43].

Prior to surgery, if there is no concern for urethral injury, catheterization is recommended in the operating room to allow identification of the urethra and prevent unnecessary trauma secondary to surgical exploration. Following the surgery, the catheter may be immediately removed if no urethral injury was repaired [44]. After urethral repairs, the duration of urethral catheterization postoperatively depends on the complexity of the injury. It is commonly left in place for 7–14 days following a partial urethral injury, and 14–21 days following a complete urethral injury [45].

There are many potential surgical approaches used to manage a penile fracture, including the circumferential subcoronal approach and the penoscrotal approach. The surgical approach most often used for penile fractures is the subcoronal approach with degloving, which allows for maximum exposure and visualization of all three corporal bod-

ies. This is necessary if imaging was not done prior to surgery as it allows precise location of the tunica albuginea tear [46,47]. However, the subcoronal approach can be more challenging and lead to complications because of the extensive dissection that is necessary. Complications include decreased sensation, infections, post-operative edema and occasionally, skin necrosis. Sawh *et al.* [48] attribute the complications to the unnecessary trauma of degloving as well as the edema secondary to regloving the penis. Patients who are uncircumcised can be circumcised for the subcoronal surgical approach to prevent complications such as postoperative phimosis, paraphimosis or avascular necrosis. The penoscrotal approach can be used for injuries that are proximal, ventral, and unilateral, and is generally less morbid because it requires less dissection and degloving. Imaging can confirm the fracture in the proximal and ventral areas necessary for a penoscrotal approach, and consequently can reduce the morbidity of surgical intervention. Most penile fracture injuries are located ventrolaterally and proximally, since this is the location that the tunica albuginea is the weakest. Therefore, the penoscrotal approach can replace the subcoronal approach in the majority of cases [6,11,43]. If the injury location is known to be in the appropriate location, most surgeons prefer to use the penoscrotal approach for uncircumcised men to avoid this problem [43].

Following proper dissection, the surgeon must expose and evacuate the hematoma and debride appropriate tissue. Intraoperatively, surgeons can assess for urethral injuries through visual inspection or by injecting lubricant gel or betadine directly into the urethra to identify any points of leakage [11]. Closure of the tunica albuginea can be done



in an interrupted or running fashion using either absorbable or non-absorbable sutures. A majority of surgeons use absorbable vicryl or PDS sutures over non-absorbable sutures because there are no palpable knots felt by the patient post-operatively. Additionally, non-absorbable sutures come with the risk of suture site granuloma and subsequent discomfort during sexual intercourse [9]. A commonly reported suture size is 3-0 but ranges from 2-0 to 4-0. No research has proven the benefit of one suture over the other [11,49].

If stability of the repair is of concern after surgery, or if missed corporal injuries are found, then penile tumescence should be induced by looping a Penrose drain around the base of the penis and securing it with a clamp, simulating a tourniquet. Next, a mixture of saline and indigo carmine should be injected into one corporal body using a 22 G butterfly needle. The subsequent tumescence after these steps should allow evaluation of the repair and identification of other corporal injuries [44].

Urethral ruptures must be repaired to maintain normal voiding and preserve sexual potency. Complete circumferential urethral tear requires management with a tension-free, watertight, end-to-end urethral anastomosis. Some surgeons recommend suprapubic cystostomy in cases of complete urethral injury. Partial urethral tears can be repaired over a urinary catheter using either absorbable or nonabsorbable suture material with equally acceptable outcomes [22,32]. To prevent fistula formation, a sub-dartos flap between the corpora cavernosa and corpus spongiosum may be required [44]. Raheem *et al.* [50] found that only 1 in 10 patients reported abnormal urinary flow following surgical management of complete urethral tears. In the event of urinary flow abnormalities, a retrograde urethrogram can diagnose urethral strictures and, aid with surgical planning for future urethral reconstruction. Other complications of urethral injury and repair include urethrocutaneous fistulas. Small fistulas may be managed conservatively with a urethral catheter for 30 days [32].

Postoperative length of stay ranged from 1 to 7 days. Patients managed conservatively stayed an average of 5.6 days longer than those managed surgically [49]. In some cases, penile tumescence after surgical repair was found to be associated with dehiscence and as a result, some physicians recommend antiandrogen medications or sedatives to prevent an erection. Others suggest that the postoperative pain is enough to prevent significant penile tumescence [44]. Similarly, Zargooshi *et al.* [8] found no complications with early intercourse (7–25 days) after surgical penile fracture repair, but physicians typically recommend abstinence from sexual intercourse anywhere from 4–8 weeks [49].

## 6. Outcomes

Short-term complications of penile fracture repair are predominantly related to surgical wound dehiscence, which is treated conservatively [10]. Some studies have reported

long-term complications of penile fractures including mild erectile dysfunction in 12% of patients and severe erectile dysfunction in 9% of patients [11,51,52]. Other meta-analyses report erectile dysfunction rates ranging from 0–30% of patients [7]. These rates are lower in patients managed surgically, and higher in those managed conservatively. Older age and larger tunical tears may be predictors of increased rates of erectile dysfunction following surgical management of penile fractures [53]. Additionally, part of the sexual dysfunction after penile fractures may be related to anxiety and trauma from the event, and a desire to prevent future events. Barros *et al.* [54] reported up to 30% of patients demonstrated sexual performance anxiety following a previous penile fracture and up to 77.5% reported fear of recurrent fracture. Fifteen percent of patients reported significant penile curvature. Additionally, 10% of patients experienced voiding symptoms, and 3% of penile fractures involving the urethra resulted in urethral strictures. Urethral fistulas were rare complication of repair [11].

## 7. Corporal Rupture with Collagenase Clostridium Histolyticum

A very rare cause of penile fractures is collagenase clostridium histolyticum (CCH) injection for Peyronie's disease, comprising 0–4.9% of patients who receive CCH [31,55]. A survey given to attendees of the 2015 Sexual Medicine Society of North America (SMSNA) found that 1/3 of providers had encountered at least one patient with corporal rupture after CCH injection [56]. Penile fractures in patients with CHH treatment occur most commonly near the site of plaque injection and the mechanism of injury is theorized to be due to a combination of the ongoing degradation of the tunica along with applied external force. No research has been done to suggest that the rate of fracture increases with increasing number of CCH treatments [31]. After CCH injection, it is difficult to make the diagnosis of penile fracture clinically, due to the hematomas and swelling normally associated with the procedure. For this patient population, if penile fracture is suspected, MRI is useful for a definitive diagnosis [31]. However, cases have been described in which an MRI depicts a tear in the tunica albuginea, but after surgical exploration, none was found. This may be due in part to the difficult anatomy post-CCH injection that obscures appropriate diagnosis [57].

Due to the rarity of these cases, there is no consensus on the management of penile fractures in patients after CCH injection. In the survey distributed to SMSNA attendees, about 67% of providers reported preferring surgical intervention in these cases, however other physicians have been leaning toward conservative management [56,58]. Some providers opt for a conservative approach if the patient is hemodynamically stable without suspicion of urethral injury but prefer to operate if the patient presents within 24 hours of injury [59]. Conservative management of penile fractures due to CCH injection has been shown to have no

difference in worsening erectile function compared to patients with CCH injection who did not experience a penile fracture. It is hypothesized that the initial preference for a surgical approach in this situation may be due to the default preferred surgical approach in penile fractures not related to CCH injection. However, as the two are dissimilar reasons for penile fracture, they must also be managed individually. Conservative management has been preferred by some in part due to the poor quality of surrounding tissue that may necessitate a graft for proper repair. Additionally, it is possible that the tunical defects leading to penile fractures from CCH injection are smaller and achieved in a more controlled manner compared to the tunical defects achieved from trauma. Since tunical defect size has been shown to be related to severity of subsequent erectile dysfunction, this may be a reason why CCH-related penile fractures can and should predominantly be treated conservatively [60]. Should surgery be necessary and desired, delayed surgery may be more beneficial to avoid closure of skin that has been enzymatically degraded by CCH [31].

## 8. Conclusions

Penile fracture is a rare urological emergency that requires prompt surgical exploration and repair. The diagnosis is predominantly clinical, but ultrasound and MRI imaging can assist in confirmation for uncertain cases. Lower rates of complications and long-term negative outcomes are associated with expedited diagnosis and surgical management of penile fractures. CCH injection is a unique cause of penile fractures, and surgeons have been leaning towards conservative management of these cases due to the poor quality of tissue surrounding the fracture site.

## Abbreviations

AUA, American Urological Association; EAU, European Association of Urology; CCH, collagenase clostridium histolyticum.

## Author Contributions

MP and GFP performed a literature review and compiled the manuscript. AA provided help and advice on the direction of the study. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

## Ethics Approval and Consent to Participate

Not applicable.

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## Conflict of Interest

The authors declare no conflict of interest.

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