

Complications and outcomes in penile abscess cases: A systematic review

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Abstract. Penile abscess is a rare condition typically presenting with penile discomfort and localized swelling. Despite the risk of developing post-operative complications, surgical debridement and antibiotic therapy are the primary treatment approaches. The present study systematically reviewed the literature to provide a comprehensive understanding of the disease and its often underreported sequelae. A thorough search of PubMed, ScienceDirect, Web of Science, Cochrane and CINAHL databases was conducted for studies on penile abscess published up to December 10, 2023. The present systematic review compiled demographic characteristics, etiologies, clinical features, treatment modalities, outcomes and complications reported in the included studies. A total of 21 case reports involving 21 patients were identified. The majority of cases were treated with systemic antibiotics, surgical incision and drainage. MRI and ultrasonography were the most commonly used imaging modalities. The most frequent post-operative complications were erectile dysfunction (11/21) and penile deviation (5/21). However, two studies reported complete resolution without complications (2/21). Early diagnosis and prompt treatment are essential for favorable outcomes. Although surgical drainage and debridement remain the standard approach, less invasive image-guided

aspiration methods exhibit promise in minimizing complications. Given the rarity of penile abscess, the findings of the present study should be interpreted with caution. Further comparative studies are recommended to determine the most effective treatment strategies.

Introduction

Penile abscess is a rare and uncommon urological condition with various known etiologies, including idiopathic causes, complications from endourologic procedures such as cavernoscopy, penile injections, instrumentation, trauma, gonorrhea, tuberculosis, priapism and the hematogenous spread of distant infections (1). Clinically, penile abscesses typically present with painful erections and localized swelling, potentially leading to severe complications. The most frequently reported microorganisms include *Bacteroides*, *Fusobacteria*, *Streptococci* and *Staphylococcus aureus* (2). Complications associated with penile abscess include penile curvature, fibrosis and the spread of infection to adjacent or distant anatomical regions, potentially resulting in fistula formation. Prompt identification and timely intervention are essential for preventing these complications, even in the absence of clearly identifiable precipitating factors (3).

Several imaging modalities, including computed tomography (CT), magnetic resonance imaging (MRI), cavernosography and ultrasonography (US) ARE utilized to diagnose and manage penile abscesses (4). Treatment strategies are typically determined by the severity and etiology of the infection. While systemic antibiotic therapy and surgical incision and drainage remain the mainstays of treatment, some studies suggest successful outcomes using aspiration techniques guided by imaging, particularly MRI and US (2,5). Two previous studies demonstrated favorable outcomes in the treatment of penile abscess, emphasizing the importance of understanding its etiologies, clinical presentation, and management options (1,6). The present systematic review aimed to provide a comprehensive overview of penile abscess and its complications, topics that were seldom discussed in the existing literature, and to enhance clinical knowledge among healthcare professionals involved in diagnosing and managing this rare urologic condition.

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Abbreviations: CINAHL, Cumulated Index to Nursing and Allied Health Literature; CT, computed tomography; JBI, Joanna Briggs Institute; MRI, magnetic resonance imaging; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; US, ultrasonography

Key words: early diagnosis, erectile dysfunction, image-guided aspiration, penile abscess, post-operative complications

Data and methods

The present systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (7).

Database search. A comprehensive electronic search was performed using the PubMed, ScienceDirect, Web of Science, the Cochrane Central Register of Trials (CENTRAL) databases, and the Cumulated Index to Nursing and Allied Health Literature (CINAHL) using the following key words: 'penile' OR 'penis' OR 'corpus cavernosum' AND 'abscess' OR 'suppuration' OR 'infection'. The search included studies published up to December 10, 2023. Only peer-reviewed studies involving adult human subjects (aged ≥ 18 years of age) and published in the English language were considered. All identified articles were imported into Mendeley Reference Manager, and duplicates were removed through both digital and manual processes. The resulting articles were then exported to Microsoft Excel for title and abstract screening, followed by full-text review.

Study selection. The present systematic review primarily focused on case report analyses. A total of two independent reviewers screened the titles and abstracts to determine their eligibility. Studies were included if they met all of the following criteria: i) Reported cases of corpus cavernosum or penile abscess; ii) described either conservative or surgical treatment; iii) detailed complications, treatment methods and clinical outcomes; iv) were published in peer-reviewed journals; and v) were available in English. Studies were excluded if they were non-English, lacked full-text access, were review articles, letters to the editor, or conference abstracts, or had irrelevant content. Abstracts without sufficient methodological or clinical details were also excluded. Disagreements during the selection process were resolved through discussion.

Data extraction. Data from each included study were independently extracted by two authors (FFP and RN) using a standardized data extraction form. Extracted variables included the first author's name, year of publication, study location, study design, patient demographics, etiology of the abscess, clinical features, treatment modalities, outcomes and reported complications. Any disagreements between reviewers were resolved through discussion, with a third author acting as an arbitrator if necessary.

Integration of results. The extracted data were synthesized qualitatively due to the limited number of cases and the heterogeneity of study designs, underlying etiologies, clinical presentations, interventions, diagnostic approaches, and outcome measures. A quantitative meta-analysis was not feasible under these conditions.

Evaluation of the risk of biases. Each included study was assessed for quality using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Reports (8). Two independent reviewers (FFP and RN) performed the assessments, and any discrepancies were resolved through discussion. The

checklist consisted of eight items, and studies meeting at least five criteria were deemed to be of acceptable quality and included in the final synthesis.

Results

Record inclusion. A total of 4,699 records were identified through the initial database search. Following the removal of 186 duplicate entries, 4,513 studies remained for screening. After reviewing 1,780 entries, 1,702 titles and 17 abstracts were excluded. In addition, 17 articles were not retrievable due to inaccessible full texts ($n=4$) or non-English language ($n=13$). Subsequently, 44 articles were assessed for full eligibility, of which 21 case report studies were ultimately included in the present systematic review. The PRISMA flow diagram (Fig. 1) illustrates the selection process and reasons for exclusion.

Evaluating risk of bias. The initial criterion assessed was patient demographics, which included sex, age, and in some cases, race, all of which were reported in the included studies. However, three studies omitted patient histories and chronological timelines. All 21 studies fulfilled the third criterion, which required a clear description of the patients' clinical presentation. Of note, two studies lacked sufficient details regarding diagnostic procedures and their findings. The fifth criterion assessed the explanation of intervention and treatment procedures; all studies addressed this, although some only briefly.

A total of 18 studies provided sufficient post-treatment follow-up, reporting pain relief and abscess resolution, while three studies lacked such information. Unexpected events or complications were not described in two of the case reports, which constituted the seventh criterion. The final criterion evaluated whether the case report included lessons learned or clinical implications; 14 studies fulfilled this requirement. Overall, the majority of case reports contained adequate information on patient demographics, clinical history, diagnostic approaches and outcomes. Based on the JBI checklist, all 21 studies were determined to be of acceptable quality and were included in the present systematic review (2,4,9-27) (Table I).

Evidence synthesis. Table II summarizes the characteristics of the 21 included case reports, each involving one adult patient diagnosed with corpus cavernosum or penile abscess. The studies were distributed across five continents: Europe ($n=7$), Asia ($n=7$), USA and South America ($n=5$), Africa ($n=1$) and Australia ($n=1$). The age of the patients ranged from 19 to 75 years. In general, the most prevalent presenting symptoms mentioned in the included studies were penile pain and edema. The included studies reported several etiologies for penile abscess. As regards the cause of penile abscess, five included studies indicated either spontaneous or idiopathic penile abscesses (4,10,11,22,23), whereas other studies reported the association of penile abscess with a different etiology, including priapism (14,26), penile injection (15,17,24), oral sex and periodontal abscess (9), genital trauma (18), immunocompromised condition (16,20,25), erectile dysfunction (2), hematological spread of distal infections (12), or other pathologies in the urethra and corpus cavernosum (13,19,27). The most common causal organisms were *Staphylococcus*

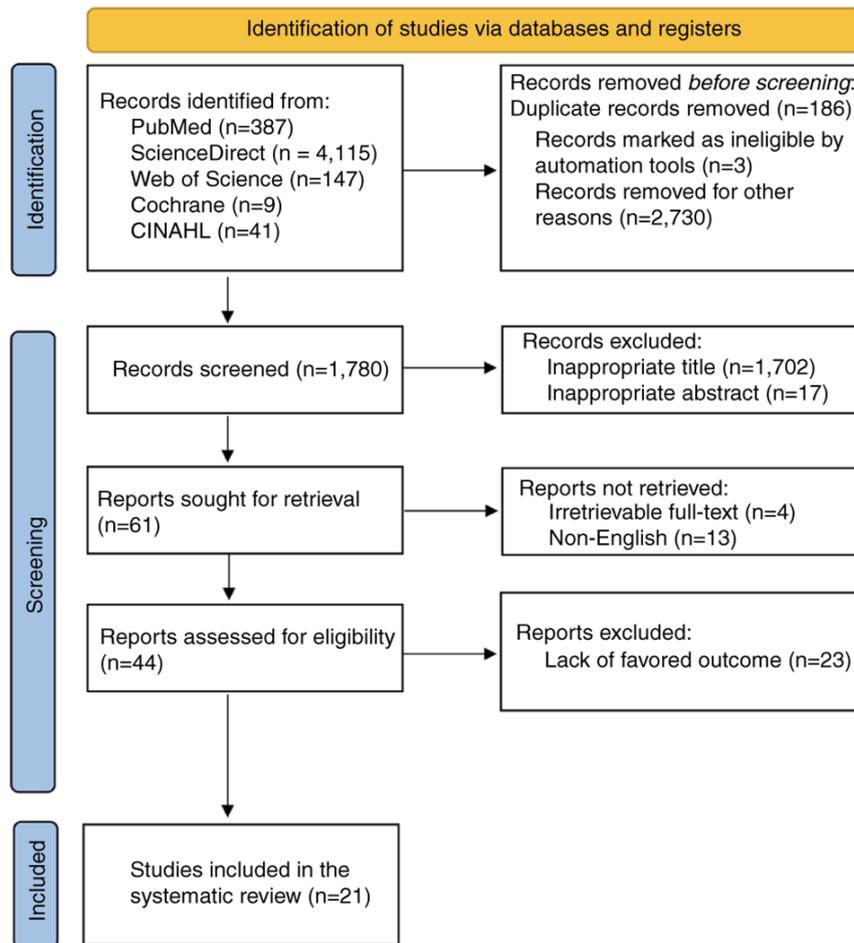


Figure 1. PRISMA literature flow chart.

and *Streptococci*. Negative culture was reported in several studies (10,14,19,27), whereas one case report did not mention the causative organisms (23).

In addition to CT scan imaging, the majority of the included studies reported the use of MRI and US as imaging modalities to assess penile abscess cases. However, due to resource limitations, two studies assessed the condition based solely on clinical presentation (14,22). As regards treatment options, the majority of cases were managed with surgical incision and drainage accompanied by systemic antibiotics, although the duration of treatment varied. Furthermore, two studies described the use of ultrasound-guided drainage and puncture for penile abscesses (16,20), while one study reported a case of percutaneous drainage guided by CT scan (19).

Overall, during the follow-up period, all studies documented positive therapeutic outcomes, defined by abscess resolution and the alleviation of clinical symptoms. Erectile dysfunction was reported as the most frequent complication following incision and drainage, as shown in 19 patients that exhibited post-operative complications (9,10,12-14,17-19,21,23,26). This condition often necessitated prosthesis insertion. In addition to ED, 5 patients reported the occurrence of chordee or penile deviation following surgery (4,22,24,25,27), followed by recurrent abscess (2,11,12,26), urethrocutaneous fistula (15) and painful penile symptoms (19). However, two studies found that the penile abscess resolved without any complications,

indicating that ultrasound-guided aspiration drainage may have been beneficial in reducing postoperative risks (16,20). Detailed information of the characteristics of the included studies is provided in Table II.

Discussion

The most prevalent symptoms of penile abscess, a rare urological illness, are painful erections and localized penile swelling. Although the causes of penile abscess vary, they are often linked to injections, disseminated infections and penile trauma. Furthermore, numerous occurrences of spontaneous penile abscess are described without an underlying cause or inciting event. Primary, secondary and idiopathic penile abscesses are distinguished based on their etiology. While secondary abscesses are associated with perianal, perineal, or intra-abdominal abscesses and/or hematogenous diffusion, primary abscesses were associated with intracavernosal injection, penile trauma and iatrogenic causes (2). Physical examinations occasionally reveal inguinal lymphadenopathy or scrotal abscesses. As the etiology of penile abscess could be linked to perianal abscess, digital rectal examination are recommended to be performed methodically (28). Additionally, the presentation of tuberculosis-related penile abscess is typically more progressive and 'silent' (the presentation of tuberculosis-related penile abscess is not easily

Table I. Quality assessment of the included studies based on JBI criteria.

First author, year of publication	Criteria										Overall appraisal (Refs.)
	Patient demographic characteristics	Patient history presented as timeline	Current clinical condition	Diagnostic tests or assessment methods and the results	Intervention(s) or treatment procedure(s)	Post-intervention clinical condition	Adverse events (harms) or unanticipated events	Takeaway lessons			
Dugdale, 2013	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (2)
Brennan, 2013	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (4)
Charles, 2009	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (9)
Dempster, 2013	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (10)
Ehara, 2007	✓	-	✓	✓	✓	✓	✓	✓	✓	-	Include (11)
Frank, 1999	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	Include (12)
Gore, 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (13)
Hidaka, 2022	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	Include (14)
Jinga, 2012	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (15)
Kachare, 2022	✓	-	✓	✓	✓	✓	✓	-	✓	-	Include (16)
Kızılkın, 2018	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	Include (17)
Lazarou, 2019	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (18)
Minagawa, 2015	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	Include (19)
Moussa, 2019	✓	✓	✓	✓	✓	✓	✓	-	✓	-	Include (20)
Paladino, 2014	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (21)
Sagar, 2005	✓	✓	✓	-	✓	✓	✓	✓	✓	-	Include (22)
Sater, 1989	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	Include (23)
Shamloul, 2006	✓	-	✓	✓	✓	✓	✓	✓	✓	-	Include (24)
Tüzel, 2015	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	Include (25)
Wang, 2023	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (26)
Yamagishi, 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Include (27)

Table II. Description of the characteristics of the included studies.

First author, year of publication	Country	Study design	Age, years	Etiology	Imaging	Pathogenic bacteria	Treatment	Outcomes/complications (Refs.)
Dugdale, 2013	USA	Case report	48	Erectile dysfunction	CT scan	<i>Streptococcus anginosus</i> and <i>Streptococcus constellatus</i>	Surgical incision and drainage + systemic antibiotic	Recurrent abscess, erectile dysfunction (2)
Brennan, 2013	Ireland	Case report	56	Idiopathic	MRI	<i>Streptococcus constellatus</i> and <i>Streptococcus intermedius</i>	Surgical incision and drainage + systemic antibiotic	Penile deviation (4)
Charles, 2009	France	Case report	46	Oral sex, periodontal abscess	US and MRI	<i>Streptococcus constellatus</i> and <i>Peptostreptococcus</i>	Surgical incision and drainage + systemic antibiotic	Erectile dysfunction (9)
Dempster, 2013	UK	Case report	32	Idiopathic	US	Negative culture	Open cavernostomy and debridement + systemic antibiotic	Erectile dysfunction, need for implantation of prosthesis (10)
Ehara, 2007	Japan	Case report	54	Idiopathic	MRI	Methicillin-resistant <i>Staphylococcus aureus</i>	Surgical incision and drainage + systemic antibiotic	Recurrent abscess leading to total penectomy and perineal urethrostomy (11)
Frank, 1999	USA	Case report	59	Intraabdominal abscess	CT scan	<i>Enterococcus sp.</i>	Bilateral corporotomy + systemic antibiotic	Recurrent abscess, pubic osteomyelitis, erectile dysfunction (12)
Gore, 2020	USA	Case report	34	Perforation of urethral diverticulum	CT scan	<i>Peptoniphilus asaccharolyticus</i> and <i>Corynebacterium sp.</i>	Bilateral corporal cavernostomies + systemic antibiotic	Necrotic tissue development, erectile dysfunction (13)
Hidaka, 2022	Brazil	Case report	42	Ischemic priapism	-	Negative culture	Surgical incision and drainage + systemic antibiotic	Erectile dysfunction, need for implantation of prosthesis (14)
Jinga, 2012	Romania	Case report	49	Papaverine injection	US	<i>Klebsiella sp.</i>	Surgical incision and drainage + systemic antibiotic	Urethrocutaneous fistula (15)
Kachare, 2022	India	Case report	40	Type 2 diabetes mellitus	US	<i>Acinetobacter sp.</i>	US-guided puncture and drainage + systemic antibiotic	Resolution of penile abscess (16)
Kızılkın, 2018	Turkiye	Case report	45	Papaverine injection	MRI	<i>Staphylococcus aureus</i>	Surgical incision and drainage + systemic antibiotic	Erectile dysfunction, need for implantation of prosthesis (17)
Lazarou, 2019	Greece	Case report	37	Sexual trauma	US and MRI	<i>Streptococcus intermedius</i> , <i>Prevotella bivia</i> , <i>Peptostreptococcus micros</i> , <i>Fusobacterium spp.</i> , and <i>Actinomyces meyeri</i>	Surgical incision and drainage + systemic antibiotic	Erectile dysfunction (18)

Table II. Continued.

First author, year of publication	Country	Study design	Age, years	Etiology	Imaging	Pathogenic bacteria	Treatment	Outcomes/complications (Refs.)
Minagawa, 2015	Japan	Case report	75	Xantho-granulomatous granuloma in the corpus cavernosum	US and CT scan	Negative culture	CT-guided percutaneous drainage + systemic antibiotic total penectomy and urethral perineal fistula formation	Painful penile symptoms (19)
Moussa, 2019	Lebanon	Case report	60	Type 2 diabetes mellitus	MRI	<i>Staphylococcus aureus</i>	US-guided aspiration drainage + systemic antibiotic	Resolution of penile abscess (20)
Paladino, 2014	Brazil	Case report	23	After Winter's procedure	CT scan	Multisensitive coagulase-negative <i>Staphylococci</i>	Needle aspiration puncture drainage + systemic antibiotic	Erectile dysfunction, need for implantation of prosthesis (21)
Sagar, 2005	UK	Case report	19	Idiopathic	-	<i>Staphylococcus aureus</i>	Surgical incision and drainage + systemic antibiotic	Penile deviation (chordee) (22)
Sater, 1989	Belgium	Case report	38	Idiopathic	CT scan	Not reported	Surgical incision and drainage + systemic antibiotic	Erectile dysfunction, penile deviation (23)
Shamloul, 2006	Egypt	Case report	53	Intracavernous injection of PGE1	US	<i>Bacteroides sp.</i>	Drainage and debridement of cavernous body + systemic antibiotic	Penile deviation (24)
Tüzel, 2015	Turkiye	Case report	38	Chronic anabolic androgenic steroid abuse	US	<i>Staphylococcus epidermidis</i>	Surgical incision and drainage + systemic antibiotic	Penile deviation (25)
Wang, 2023	Australia	Case report	50	Ischemic priapism	US and MRI	<i>Prevotella bivia</i> and <i>Streptococcus anginosus</i>	Surgical incision and drainage + systemic antibiotic	Recurrent abscess, erectile dysfunction (26)
Yamagishi, 2021	Japan	Case report	64	Urethral stricture, catheter placement	MRI	Negative culture	Surgical incision and drainage + systemic antibiotic	Penile deviation (27)

CT scan, computed tomography; MRI, magnetic resonance imaging; US, ultrasonography.

noticeable or symptomatic until the condition becomes more severe or advanced. It typically progresses without clear or prominent symptoms until it reaches a more critical stage) (29,30).

The variety of organisms cultivated from abscess swabs reflect the diverse etiologies of penile abscess. The following organisms have been isolated in various case reports: *Staphylococcus aureus*, *Escherichia coli*, *Mycobacterium tuberculosis*, *Prevotella bivia*, *Streptococcus anginosus*, *Streptococcus constellatus* and *Streptococcus intermedius*. The most frequently implicated species in penile abscess, as reported by Dugdale *et al* (2) are *Staphylococcus aureus*, *Streptococcus*, *Bacteroides* and *Fusobacteria* (2). Apart from infection, penile abscesses are also associated with diabetes mellitus (16,20) and other forms of immunosuppression due to steroid abuse (25). As demonstrated in a previous study, it remains unclear whether the corpora cavernosa is resistant to the hematogenous spread of infection (22). However, there have been a few accounts, including one regarding a case in which the hematogenous dispersion of dental caries was reported to result in penile abscess (9,31). Of note, two distinct microbiological scenarios have been identified. When abscesses have a localized origin, the causative organisms are usually skin-related (*Staphylococcus aureus*, *Staphylococcus epidermidis*). Under certain conditions, these microbes act as opportunistic pathogens, despite being part of the normal microflora (2,5). By contrast, when no clear portal of bacterial entry is identified, the primary pathogens originate from dental commensal flora (9).

In the past, aspiration and clinical examination served as the primary diagnostic methods for penile abscess. However, with the advancement of medical technology, various imaging modalities, such as CT scans, US and MRI, are utilized to confirm the diagnosis (32). The majority of studies included in the present systematic review reported that MRI and US were used to evaluate penile abscess cases. Among these, US served as the main imaging technique (33), given its noninvasive nature and the ability to perform bedside procedures including simultaneous abscess drainage. When moderate cases were assessed with extracranial doppler with color US, findings included significant hyperemia of the cavernous bodies, thickened mucosa, increased echogenicity of subcutaneous tissues and heterogeneous hypoechoic areas. In severe cases, B-mode US has revealed anechoic or hypoechoic collections with sediment and poorly defined margins (34). CT scans, although less frequently used due to radiation and low soft tissue contrast, assist in drainage guidance, abscess localization and the evaluation of adjacent structure involvement. When contrast agents are administered, CT scans reveal fluid accumulation, occasional air bubbles, perilesional fat edema and wall hyperemia. MRI, when available, provides superior soft tissue contrast and allows for surgical planning, tissue plane characterization, and the exclusion of other pelvic or perineal infection foci. On an MRI, penile abscesses exhibit a low signal intensity on T1-weighted images and high signal intensity on T2-weighted images, with rim enhancement following gadolinium administration (35). CT or MRI assess disease extension to the perineum, abdominal wall, fascial planes and buttocks. Nonetheless, it is suggested that the selection of

imaging modality should be tailored to individual cases due to the lack of consensus on the most appropriate approach for this rare presentation.

Management options for penile abscess consist of intravenous antibiotic therapy combined with either open surgical incision and drainage (11) or radiologically guided needle aspiration (32). Antibiotic therapy is ideally based on culture and sensitivity results, although empirical therapy is frequently initiated. Despite the appeal of conservative treatment, the surgical approach, although invasive and associated with complications, remains the primary choice due to the risk of recurrence with incomplete evacuation (2). Surgical drainage is performed in cases that develop spontaneously or are exacerbated by trauma, disseminated infection, or failed conservative therapy. This approach enables the simultaneous treatment of the abscess and its underlying cause. Additionally, it allows surgeons to assess anatomical damage (1).

Several studies reported the use of broad-spectrum antibiotics as first-line therapy, particularly ceftriaxone, vancomycin and piperacillin-tazobactam (2). These were often administered intravenously and were selected based on either empirical judgment or microbial culture results. Treatment duration ranged from 7 to 14 days in the majority of cases. However, due to the nature of case reports, detailed dosing information was inconsistently provided, limiting standardized interpretation of efficacy across cases. However, some cases were successfully managed using less invasive interventional techniques, such as image-guided aspiration and antibiotics (16,20). Image-guided needle aspiration, performed under local anesthesia, minimizes tissue trauma and reduced the risk of postoperative complications like fibrosis (32). Among these, US-guided coaxial puncture and rinsing has emerged as a promising method (3), owing to its simplicity, cost-effectiveness and minimal equipment requirements. The real-time monitoring capability of US enables the accurate visualization of the abscess cavity throughout treatment. The coaxial aspiration/flushing technique has proven to be particularly effective for superficial subcutaneous abscesses. However, in cases involving deep abscesses seen in preoperative imaging, this method is deemed insufficient for complete evacuation and washout. Thus, open incision and drainage remain the gold standard for thorough debridement and concurrent pathology assessment (3,16,33). Close post-operative monitoring is emphasized regardless of the treatment method. For instance, Ehara *et al* (11) reported a case of a 54-year-old patient who underwent open surgical drainage for a cavernosal abscess; however, 3 weeks later, the patient developed a recurrent abscess caused by methicillin-resistant *Staphylococcus aureus*, requiring total penectomy.

In addition to therapeutic strategies, several underlying risk factors have been observed to increase patient susceptibility to penile abscess. These include diabetes mellitus, long-term immunosuppressive therapy, poor hygiene, sexually transmitted infections and intracavernosal injections. Conditions, such as uncontrolled diabetes and systemic immunosuppression may compromise host defense mechanisms, allowing bacterial invasion and abscess formation. The awareness and management of these risk factors are essential for both prevention and early intervention (1-4,6,12,15).

Post-operative complications, such as penile curvature, fibrosis and erectile dysfunction have been reported, although

the majority of patients have been shown to regain normal anatomy and erectile function. The present systematic review identified secondary fibrosis and resultant penile deviation, as well as erectile dysfunction as the most common sequelae. Compared to US-guided aspiration, these complications occurred more frequently following open surgical drainage. Consequently, some patients required penile prosthesis or further surgical intervention to manage these issues (22). In one case of cavernositis, the patient presented within 36 h of symptom onset and did not experience erectile dysfunction after drainage. This case, as reported by Shamloul *et al* (24), suggested that early intervention may preserve erectile function by limiting cavernosal necrosis and fibrosis.

Erectile dysfunction remains a potential complication, particularly in cases of delayed treatment or surgical trauma (20). Although its precise pathogenesis remains unclear, it is considered to involve multiple mechanisms including fibrosis, penile curvature and impaired vascular supply. In the majority of cases, fibrosis and curvature do not require correction, although they could significantly affect erectile quality (1). Additional contributors to erectile dysfunction include impaired blood flow, nerve injury, hormonal disturbances and tissue pathology (36). Venous occlusion and endothelial dysfunction also play a role (37). Given the complex integration of neurologic, vascular and hormonal systems required for erectile function, further investigations are warranted to clarify the exact mechanisms linking penile abscess to erectile dysfunction (38). Thus, further research and clinical assessment are necessary to fully understand the specific mechanisms of erectile dysfunction following a penile abscess.

The present systematic review represents, to the best of our knowledge, the first comprehensive synthesis of complications and outcomes associated with penile abscess. Nonetheless, it was limited by the nature of the included literature, which consisted entirely of case reports and case series. Additionally, the restriction to English-language studies reduced the pool of eligible publications. Conducting multicenter research in this field remains challenging due to the clinical complexity and rarity of such cases. The limited sample size also constituted a major limitation of the present systematic review.

In conclusion, in the present systematic review, case reports on the clinical outcomes and complications of penile abscesses were synthesized and analyzed. Although several complications were reported, as reported in the included studies generally demonstrated favorable clinical outcomes, despite the inherent risk of postoperative complications. Early diagnosis and prompt treatment remained the key to successful management.

Given the predominance of systemic antibiotics and surgical drainage in current management, these modalities continue to serve as a reliable therapeutic backbone. Broad-spectrum antibiotics, such as ceftriaxone, vancomycin and piperacillin-tazobactam are commonly used, either empirically or guided by culture results. In the majority of the reported cases, antibiotics were administered intravenously with a duration ranging from 7 to 14 days, depending on the clinical response. However, detailed information on dosage was inconsistently reported across case studies, limiting definitive conclusions on optimal therapeutic regimens. These modalities continue to serve as a reliable therapeutic backbone. However, less invasive techniques, such as image-guided

aspiration, have exhibited encouraging results in reducing postoperative complications and preserving erectile function. Therefore, incorporating these approaches into clinical decision-making may enhance patient outcomes and reduce the need for extensive interventions. Patients should be closely monitored post-operatively for adverse effects, particularly erectile dysfunction and penile deviation, which were the most commonly reported complications. These findings should be applied with caution in clinical practice. As regards adverse effects, erectile dysfunction and penile deviation were the most commonly reported complications.

Additionally, the awareness of patient-specific risk factors, such as diabetes mellitus, immunosuppressive conditions and a history of intracavernosal injection, may help clinicians identify vulnerable individuals and implement early preventative or therapeutic measures.

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Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

FFP, SS and RN conceived and designed the study. BS, DHH and MHW were involved in the methods (search and selection). FFP, RN and MHW were involved in the analysis of the results and conclusions. SS and DHH were involved in manuscript preparation. FF and RN confirm the authenticity of all the raw data. All authors have read and approved the final manuscript.

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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