



Case report

Recurrent renal abscess complicating *Staphylococcus saprophyticus* infection in an immunocompetent young female patient: A case report and review of literature



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ABSTRACT

Staphylococcus saprophyticus is second only to *Escherichia coli* as the most frequent causative organism of uncomplicated urinary tract infections (UTIs) among the sexually active female population. However, it is considered a rare cause of complicated UTIs in immunocompetent hosts with no identifiable risk factors for the occurrence of a complicated urinary tract infection. We report an exceedingly rare case of a 20-year-old otherwise healthy female patient, with no identifiable risk factors for complicated UTIs, who presented with a recurrent renal abscess secondary to *S. saprophyticus*. Serial cultures from multiple sources were negative, and the culprit organism was identified by a polymerase chain reaction (PCR) analysis of the drained pus that identified the 16 s rDNA sequences of *S. saprophyticus* on serial occasions. To our current date, similar cases have been rarely reported in the available literature.

Our case also highlights the diagnostic value of molecular biology techniques in the identification of causative pathogens in cases of culture-negative infections when conventional microbiologic tests fail to isolate the culprit organisms. Clinical microbiology studies are needed to further explore the exact possible interactions between bacterial-specific characteristics and host-related factors that may explain the occurrence of the complicated UTIs that are associated with *S. Saprophyticus* among patients who are not considered to have certain risk factors that would usually predispose to complicated UTIs.

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Introduction

Staphylococcus saprophyticus is a Gram-positive, coagulase-negative species of *Staphylococci*. It is second only to *Escherichia coli* as the most frequent causative organism of uncomplicated UTIs in the sexually active female population [1]. *S. saprophyticus* are generally low-virulent organisms, but some strains have acquired unique urotropic characteristics that enabled these organisms to colonize the urogenital tracts of the young female population [1–3]. The reviewed literature reported that *S. saprophyticus* colonized the genitourinary tracts of 6.9% of the sexually active young females [2], and they have been isolated in 42% of uncomplicated cystitis among the same population [2]. Nevertheless, complicated UTIs due to *S. saprophyticus* remain a rare occurrence, with only a handful of reported cases in the reviewed literature that were described predominantly among certain high-risk patients [4,5]. Herein, we report an unusual case of a recurrent renal

abscess complicating an infection with *S. saprophyticus* in an otherwise healthy young female patient. Interestingly, serial cultures from multiple sources (i.e., urine, blood, and pus) were negative, and the causative organism was identified by the PCR analysis of the drained pus on serial occasions.

Case Presentation

A 20-year-old Caucasian female patient was admitted to our department with a five-day history of fevers, dysuria, and right flank pain. The patient completed a course of nalidixic acid prescribed for an uncomplicated cystitis diagnosed presumptively by a primary care physician one week prior to the index presentation. There were no urine culture results available for review. The systemic review was unremarkable. The patient has had no prior significant medical, surgical, or gynecological history. The patient disclosed no sexual activities for the recent six months prior to admission. Initial assessment revealed a toxic-looking patient with a temperature of 38.7 °C, pulse rate of 100 beats per minute, and blood pressure of

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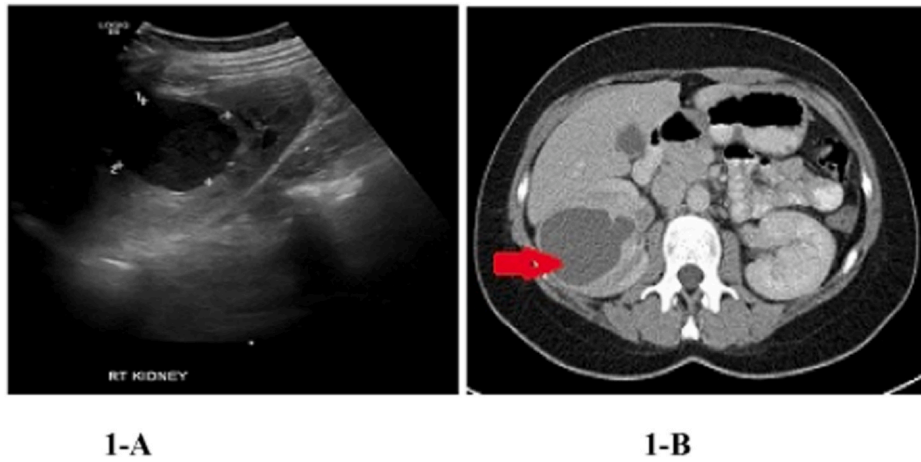


Fig. 1. A. Renal US demonstrating a large right renal mid-pole abscess (white arrows). B. Axial image of contrast-enhanced CT scan re-demonstrating right renal abscess (red arrow) confined to Gerota's fascia. For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.

100/70 mmHg. Abdominal examination was remarkable for tenderness over the right costophrenic angle. The systemic examination was essentially normal. Blood results revealed an elevated white cell count (WCC) to $14.5 \times 10^3/\text{ml}$ (>80% neutrophils) with a raised C-reactive protein (CRP) to 120 mg/dl. Random blood glucose was normal (7.2 mg/dl). Renal profile was normal. Urine microscopy depicted > 100/cmm WCCs and numerous RBCs. An empiric gentamicin and piperacillin/tazobactam antimicrobial regime was commenced. The choice of this regime was based on the local sensitivity patterns for the community-acquired UTIs while the microbiology results are pending. Notably, urine cultures and blood cultures were repeatedly negative. Renal ultrasonography scan (USS) demonstrated a large ($5.6 \times 4.7 \times 5$ cm) right renal mid-pole abscess with no evidence of nephrolithiasis or other renal tract abnormalities (Fig. 1-A). A contrast-enhanced computed tomography (CT) scan re-demonstrated a sub-capsular cortical renal abscess confined to Gerota's fascia (Fig. 1-B). No evidence of other renal tract pathologies was found. An 80 ml of pus was drained under US guidance and a pigtail drain was left in-situ for daily flushing. The drained pus grew no organisms in the standard culture after 3 days of incubation. As serial multiple-source cultures were negative for a causative organism; a 16s rDNA analysis of the pus was performed, and it identified the 16s rDNA sequences of *S. saprophyticus*. Parenteral antibiotics were switched to oral co-amoxiclav on Day 3 of admission, as the fever subsided, and the inflammatory markers were remarkably down-trending. The choice of co-amoxiclav was based on the sensitivity data of the isolated strain, which was also sensitive to ciprofloxacin, fosfomycin, gentamicin, piperacillin/tazobactam, cefazolin, and ceftriaxone. Repeat renal USS on Day 5 revealed no residual collections and the pigtail drain was subsequently removed. The patient was discharged after remaining afebrile for three days from starting the oral antibiotics. The patient completed a 10-day course of oral co-amoxiclav to have a total of 15 days of antibiotic therapy.

The patient was readmitted after 18 days of discharge with recurring fevers and right flank pain for four days with raised inflammatory markers (WCC of $15 \times 10^3/\text{ml}$ and CRP of 85 mg/dl). Renal USS scan revealed a 4.1×4.3 cm right hypo-echoic mid-pole focus in keeping with a recurrent right renal abscess (Fig. 2). Fasting blood glucose and Hemoglobin A1c (Hb A1c) were within the normal ranges. Serology screening for Human Immunodeficiency Virus (HIV) was negative. Gentamicin and piperacillin/tazobactam regimes were commenced based on the available results of the antibiotic sensitivities from the previous infection. The patient underwent a repeat imaging-guided aspiration of the recurrent renal abscess which



Fig. 2. Renal US showing a recurrent right renal mid-pole abscess (white arrows).

drained about 40 ml of frank pus. The cultures of the urine, blood, and the aspirated pus were negative for positive bacterial growth, and the PCR analysis of the drained pus once again detected 16s rDNA sequences of *S. saprophyticus*. The patient's clinical condition stabilized after three days post-drainage and continued parenteral antimicrobial therapy. The patient was switched to oral ciprofloxacin for 7 days as per the antibiotic sensitivities results of the later isolated strain. The patient was safely discharged after two days of starting oral therapy.

A 2-week follow-up renal USS revealed a significant interval resolution of the collection with no evidence of other renal tract pathologies. A 2-month follow-up renal USS depicted normal renal tracts, and the patient remained well on serial outpatient reviews with negative urine analyses. Outpatient urodynamic studies and post-void scans were recorded within the normal ranges.

Discussion

Staphylococcus saprophyticus is a common cause of uncomplicated UTIs, particularly among the young female population [1–3,6]. However, it is exceedingly rare to be associated with complicated infections with renal abscess and florid urinary sepsis [3,4,7,9,10]. In a series of 25 patients with renal and/or perinephric abscess who had positive culture yields; *S. saprophyticus* was isolated in one patient only (4%) [7]. In fact, renal and perinephric abscesses usually represent a consequence of untreated complicated UTIs that occur either in the setting of ascending infections with

obstructed pyelonephritis, which are mainly caused by Gram-negative enteric bacilli, or less likely, in the cases of disseminated bacteremia with haematogenous spread that often complicates invasive *S. aureus* sepsis from various infectious sources (especially skin and deep soft tissue infections) [7,8].

While the clinicopathological and epidemiological characteristics of uncomplicated UTIs caused by *S. saprophyticus* are well-established in the literature [3], the microbiological features of complicated UTIs remain poorly understood [6]. In general, complicated UTIs usually occur in certain groups of patients with specific underlying risk factors such as immunosuppression, uncontrolled diabetes mellitus, obstructive nephrolithiasis, indwelling urethral catheters, autonomic urinary bladder neuropathy, and congenital renal tract anomalies (i.e., vesicoureteric reflux) [6,7]. *S. saprophyticus* has been reported as a causative pathogen for complicated UTIs in a handful of cases with documented risk factors for a complicated UTI [4,9,10]. The reported complications were pyelonephritis and *S. saprophyticus* septicemia [4,9,10].

It was theorized that colonization of the uroepithelium by *S. saprophyticus* occurs via various types of adhesins that are anchored within the bacterial cell wall [11]. These adhesions include, for instance, hemagglutinins that have both autolytic and adhesive properties, as well as novel surface-associated lipases that form fibrin-like surface appendages, that help the bacteria to maintain a tight and effective adherence to the uroepithelium of the urinary bladder and ureters [11]. Furthermore, the high survivability of virulent strains of *S. saprophyticus* inside the urinary tracts is further augmented by the urease enzyme production, which also contributes to the persistent growth of the infection [11]. Some strains isolated from high-risk patients, particularly patients with long-term indwelling urethral catheters, have been found to acquire the ability to create an extra-cellular glycoproteins layer or biofilm, the latter is strongly associated with increasing virulence, persistence of infection, and resistance to many broad-spectrum antibiotics [11].

Moreover, it was postulated that the existence of a renal tract obstruction would favorably enable *S. saprophyticus* to ascend more proximally towards the renal pelvis. The obstruction-related changes within the urodynamics further aggravate the bacterial invasiveness, resulting in the occurrence of a complicated infection like abscess formation, and leading eventually to florid *S. saprophyticus* bacteremia [4,5,9]. Nevertheless, no single possible risk factor of complicated UTIs was recognized in our patient as per extensive diagnostic work-up (i.e., various renal tract imaging, urodynamic studies, and immunosuppression screening). Therefore, the authors consider the occurrence of a complicated UTI by *S. saprophyticus* in this reported patient as a clinical and microbiological rarity that was seldom reported in the reviewed literature.

Interestingly, *S. saprophyticus* has also been isolated concomitantly with other, more frequent and highly virulent uropathogens, from urine cultures in a cohort of patients with complicated UTIs [6]. It was, however, theorized that those isolated strains of *S. saprophyticus* in the latter cohort were deemed to represent a likely colonizer of the urinary tracts with complicated infections, rather than being considered a true pathogen causing the index urinary tract infections, based on a multitude of various clinical observations and laboratory findings [6]. However, no other organisms were isolated from multiple sources (blood, urine, and pus samples) in our patient, an observation that strongly supports a direct causal link between serial *S. saprophyticus* isolation from drained pus materials and the occurrence of recurrent renal abscess in the reported case.

S. saprophyticus is generally sensitive to most antibiotics that are commonly used to treat uncomplicated community-acquired UTIs, with the exception of nalidixic acid [3]. This would in part explain our patient's presentation with a complicated infection, as the

initial presumed uncomplicated infection was treated with nalidixic acid in the community with no clinical response. Furthermore, it was found that strains which were isolated from complicated UTIs were generally more resistant to broad-spectrum antibiotics than others isolated from uncomplicated infections [6]. The gentamicin-based regime employed in our patient had resulted in a remarkable initial clinical response, in keeping with a similar case of *S. saprophyticus*-associated pyelonephritis [5]. In fact, empiric gentamicin-based regimes have a better coverage of common uropathogens, including *E. coli*, *K. pneumoniae*, and *P. mirabilis* [5]. Percutaneous drainage is recommended for renal/perinephric abscesses which are larger than 5 cm, as in our reported patient [7]. The antibiotics treatment is advised to be continued during and after drainage for a total duration of at least two weeks, that is cautiously guided by the patient's clinical response and trends of the inflammatory markers [7].

Conclusion

The occurrence of a recurrent renal abscess due to *S. saprophyticus* in an immunocompetent young female patient without an identifiable risk factor for a complicated UTI is a clinical and microbiological rarity. Our case also highlights the true diagnostic value of molecular biology techniques in isolating culprit pathogens when conventional microbiology diagnostics fail to identify causative organisms.

Competing interests

The authors declare that no conflicts of interest regarding the publication of this case report.

Informed consent

Informed written consent was obtained from the patient to write and publish their case as a case report with all accompanying radiological images. No identifying information has been used in this article.

Ethical clearance

No ethical clearance deemed required for case reports writing as per our local Research Board.

Authors contribution

The authors contributed equally to conceptualization and designing of the report, writing first manuscript, and critical review. All authors reviewed last draft and agreed for submission.

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