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Research Article

Unusual Causes of Skin and Soft Tissue Infections: A Case Series

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ABSTRACT

Background: Skin and soft tissue infections (SSTIs) constitute a major infectious syndrome. SSTIs can arise from invasion of organisms through skin due to breach in the anatomical barrier or from the hematogeneous route, secondary to any systemic infections. The common causative micro-organisms are Staphylococcus aureus and Group A, Beta-hemolytic Streptococci (Streptococcus pyogenes). Many SSTIs respond predictably to the empiric treatment, whereas some of them pose a diagnostic as well as therapeutic dilemma, especially in immunocompromised patients or patients giving history of trauma, insect bite, marine contact etc. These cases simulate routine cellulitis clinically, but fail to respond. These SSTIs are usually caused by unusual pathogens like atypical bacteria, mycobacteria or fungi.

Aim and Objectives: We describe four cases of SSTIs due to rare etiologies encountered at a tertiary care hospital, aiming to illustrate clinical presentation, diagnostic strategies and management, thereby enhancing clinical awareness.

Methods: Study Design: Case series. **Study Setting:** Department of Surgery, Department of Microbiology, R.K. Damani Medical College, Dr. Hedgewar Rugnalaya, Chhatrapati Sambhajinagar, Maharashtra. **Study Population:** The cases were selected from the Microbiology laboratory database after identification. **Study Duration:** January 2024 to June 2025. **Sample Size:** 4

Results: Case 1, 82-year-old male farmer from rural Maharashtra with a one-week history of insidious, progressive right-sided scrotal swelling and pain diagnosed as pyocoele led to a left orchidectomy. Intraoperatively, a testicular abscess was noted. Bacterial Culture on Sheep Blood and MacConkey agar, identified via Vitek 2, confirmed Brucella melitensis. Case 2, 21-year-old female presented with high-grade fever, chills, and a painful perianal swelling that prevented sitting. The abscess was surgically drained; the cavity extended to the perivaginal region. Smears revealed gram-positive budding yeast cells identified as Candida guilliermondii, susceptible to Fluconazole. Case 3, a 61-year-old male with a 9-year history of diabetes presented with diffuse erythema, edema, and tenderness of the left leg. Debridement was performed, and empiric Cefoperazone-Sulbactam was started. Ziehl-Neelsen staining of pus aspirates revealed acid-fast filamentous branching bacilli. Cultures on Blood agar and Lowenstein-Jensen medium confirmed Nocardia species. Case 4, a 26-year-old male presented with fever and a painful swelling on the right thigh following a suspected insect bite. Multiple debridements were required. Systemic workups ruled out diabetes or immunosuppression. KOH mount revealed broad, aseptate, ribbon-like hyphae with wide-angle branching, characteristic of Mucorales.

Conclusions: This case series highlights four distinct instances of soft tissue infections—ranging from scrotal abscesses to lower limb cellulitis—caused by atypical pathogens including Brucella melitensis, Candida guilliermondii, Nocardia species, and Mucorales. These cases underscore the necessity of diligent microbiological investigation, especially when empiric antibiotic therapy fails or clinical presentations are insidious.

Keywords: SSTI, Etiology, Cellulitis, Atypical Pathogen.

INTRODUCTION

Skin and soft tissue infections (SSTI) represent a diverse spectrum of microbial invasions affecting the skin and underlying tisues ranging from mild superficial inections like impetigo to the severe and life-threatening cellulitis and necrotizing fasciitis, often presenting diagnostic challenges due to overlapping symptoms. The skin is colonized by microorganisms that have the potential to invade and cause infection. Staphylococcus aureus *and* β-haemolytic group A streptococci are the most important pathogens, but other organisms such as Gram-negative bacteria, anaerobic bacteria, viruses, fungi, or parasites can also cause infection., almost any organism is capable of causing inflammation within soft tissue. Community-acquired meticillin-resistant S. aureus *(*CA-MRSA*)* has become an important cause of skin and soft tissue infections (SSTI). Risk factors include any cause of skin barrier breakdown, such as skin injuries, surgical incisions, intravenous site punctures, fissures between toes, insect bites, animal bites, and other skin infections (1). Patients with comorbidities such as diabetes mellitus, venous insufficiency, peripheral arterial disease, and lymphedema are at higher risk of developing SSTI (2). SSTIs are common and can affect all age groups. Risk factors include any cause of skin barrier breakdown, such as skin injuries, surgical incisions, intravenous site punctures, fissures between toes, insect bites, animal contact, hospital visits, interventions, underlying disease like Diabetes mellitus, malignanacy, immune dysfunction, alcoholism (1) . SSTIs may occur as single or recurrent episodes, and may be mild and self-limiting or severe and progressive, leading to necrosis of adjacent tissues. Empirical antimicrobial therapy should be directed towards the likely organism(s) and subsequently tailored in the light of microbiological and clinical data. Prompt diagnosis and early surgical management along with appropriate antibiotic helps treat the SSTI.

Case 1: Genital Brucellosis

A 82 year old man, farmer by occupation from a rural area in Central Maharashtra, presented to the Surgical OPD with chief complaint of right-sided scrotal swelling and pain since a week. The swelling was insidious in onset and gradually progressive. It was not associated with trauma, or urinary complaints. Patient also gave history of cough, generalised weakness, mild fever, knee pain and reduced appetite since 15 days. On local examination, the right side of scrotum was erythematous, oedematous and tender with fluctuant swelling. The scrotal wall was tense and adherent to the testis. CBC revealed leucocytosis, while USG findings were suggestive of bilateral orchitis, left funiculitis and a heterogeneous hypoechoic area within left testis suggestive of abscess(Fig:1), along with well-defined collection in between two scrotal sac measuring 440 cc in size.. Empirically Intravenous Cefuroxime 1.5 gm was started 12 hourly and patient was posted for unilateral orchidectomy under spinal anaesthesia after pre-anaesthetic checkup. Pyocoele as confirmed by USG with left testicular abscess were noted intra-operatively, pus was drained and sent for culture and susceptibility testing. Left orchidectomy was done. Amoxyclav was started 1.25 gm 12 hourly intravenously. The primary pus smear revealed occasional gram-negative cocobacilli and pus cells. The sample was inoculated on Sheep Blood agar and Mackonkey's agar and kept for overnight incubation at 37◦c. Small translucent colonies were seen on Blood agar after 48 hours while tiny non-lactose fermenting colonies were seen on Mackonkey's agar (Fig:2). The colony smear showed coco-bacillary gram-negative bacilli (Fig: 3). the identification and antibiotic susceptibility test were put up as per CLSI guidelines on Biomerieux Vitek 2 compact. *Brucella melitensis* was identified as the organism which grew on culture. As per standard treatment guidelines, patient was started on Oral Doxycycline 100 mg twice daily for 6 weeks.

Outcome: The patient was treated with oral Doxycycline (100 mg BID) for six weeks and was symptom-free at a one-month follow-up.

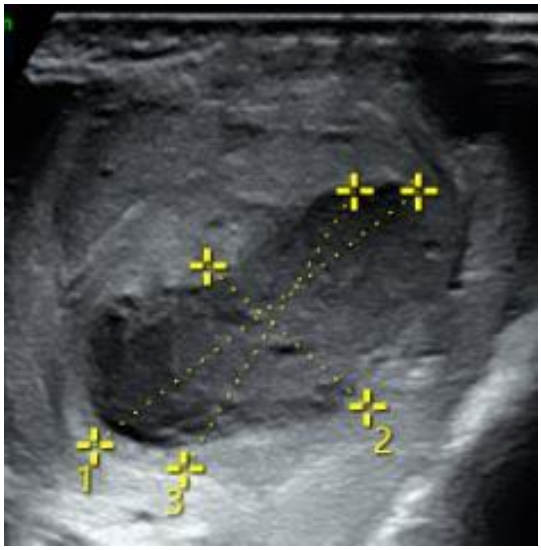

Fig: 1 USG Findings Showing Hypoechoic Area in Left Testis

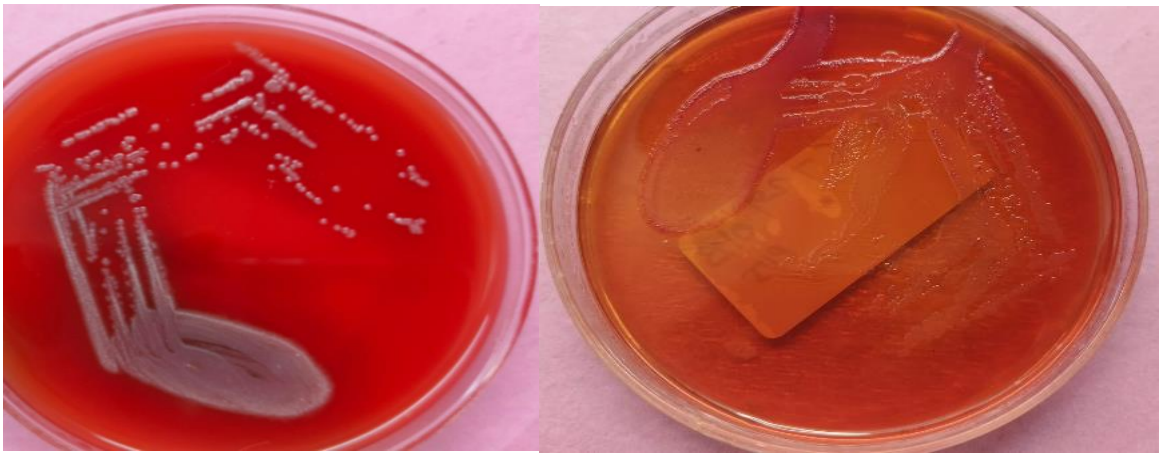

Fig: 2 Non-Lactose Fermenting, Tiny Transclucent Colonies of Brucella on Mackonkey's Agar and Blood Agar

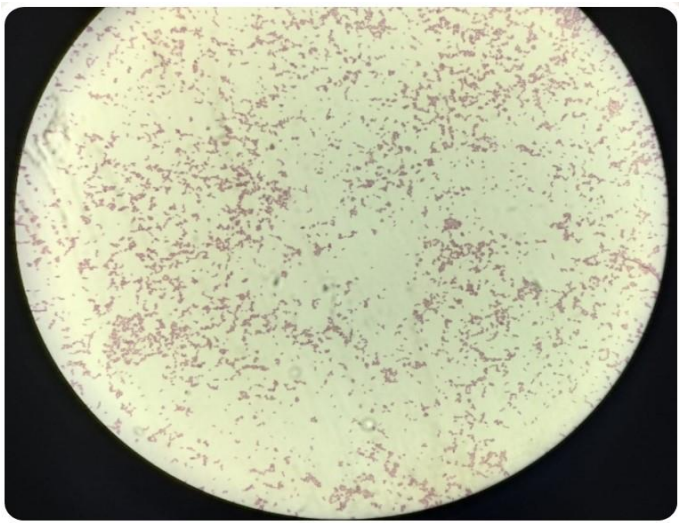

Fig: 3 Colony Smear of Brucella Melitensis Showing Faintly Stained Gram Negative Coccobacilli

Case 2: Perianal Abscess

A 21 year old female patient presented to the General Surgery OPD clinic with high grade fever with chills and painful swelling at the perianal region and inability to sit since 10 days. Local examination revealed tender swelling at right perianal region with pus discharging through the vagina. The swelling was associated with warmth and redness. The patient was posted for drainage of the perineal abscess after investigations required as per the pre-anaesthetic checkup were done. Other than leucocytosis, all other routine investigations like urine routine and blood sugar were normal. Under spinal anaesthesia, incision was taken at right perianal region, pus was noted and drained. The cavity extended till the right perivaginal region. The necrotic tissue was debrided, and wound was dressed with all sterile precautions. Piperacillin-Tazobactum 4.5 gm 8 hourly and clindamycin 600 mg 8 hourly were started as per the clinical examination empirically. The pus sample was sent in a sterile container to the Microbiology laboratory. It was processed as per CLSI guidelines and inoculated on Sheep Blood agar and Mackonkey's agar. The plates were incubated overnight under standard conditions and checked for growth the next day. Plates were further incubated due to inadequate growth. After 36 hours, white, creamy colonies were observed on Sheep Blood agar (Fig: 4). the colony smear was suggestive of gram-positive budding yeast cells. Accordingly, the colony was processed for identification and antimicrobial susceptibility on Vitek compact 2. Final report revealed *Candida guillermondii* susceptible to Fluconazole, Amphotericin B, Micafungin, Caspofungin, and Voriconazole. After the receipt of the culture and susceptibility report, Intravenous Fluconazole 200 mg 12 hourly was added to the empiric treatment regimen. Clinically the patient showed improvement, and after 7 days, the parenteral treatment was stopped and shifted to oral Augmentin 1000 mg 12 hourly and Tablet Fusys 150 mg 24 hourly for 5 days. Patient was symptom free on the follow-up visit to the OPD after two weeks.

Outcome: Treatment was adjusted to IV Fluconazole followed by oral Augmentin and Fluconazole. The patient recovered fully within two weeks.

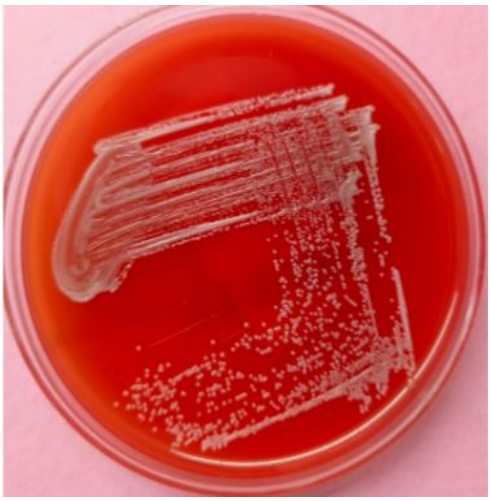

Fig: 4 Creamy White Colonies of Candida on Sheep Blood Agar

Case 3: Cutaneous Nocardiosis

A 61/year old male patient visited the Surgery OPD with chief complaint of swelling over left leg since 15 days and pain in both legs since 2 months. On general examination, the patient was afebrile and vital parameters were stable. Local examination showed diffuse erythema, oedema, warmth, and marked tenderness. The margins were ill-defined extending from ankle to mid-leg. There was no crepitus, blistering or any necrosis. The skin over the leg was tense. After local and systemic examination the patient was posted for debridement due to cellulitis after all relevant investigations were done as per pre-anaesthetic evaluation. Patient was a known case of Diabetes mellitus since 9 years. Cefoperazone-Sulbactum 1.5 gm 12 hourly in intravenous infusion was started. Representative pus sample was aspirated from the deeper parts of the infected tissue and sent to the Microbiology laboratory in a sterile

container. The direct smears showed presence of numerous pus cells. Few Gram-positive diplococcic and gram positive filamentous bacilli were seen. The Zeihl-Neelsen stain for acid-fast bacilli showed the presence of numerous acid-fact filamentous bacilli with branching. The staining process was repeated with 1% H2SO4 for confirmation (Fig: 5). Presence of acid-fast bacilli with typical features of filamentous,branching bacilli was confirmed. Preliminary report of *Nocardia* bacilli was conveyed to the treating surgeon. After 48 hours, yellowish-white dry colonies were observed on Sheep Blood agar and Chocolate agar. The specimen was inoculated on Lowenstein-Jensen medium too. Yellowish dry colonies were seen. The colony smear again confirmed the presence of filamentous bacilli after Ziehl Neelsen and Gram's staining (Fig: 6). Further speciation couldn't be done. Final confirmatory report of *Nocardia species* grown on culture was issued to the patient. The patient was referred to The Infectious Diseases OPD Clinic along with the reports. The antibiotic was switched over to Oral Cotrimaxozole (Tablet Bactrim DS) for 3 weeks along with regular follow-up visits for cleaning and dressing.

Outcome: The patient was switched to oral Cotrimoxazole. While healing had begun, the patient was unfortunately lost to follow-up.

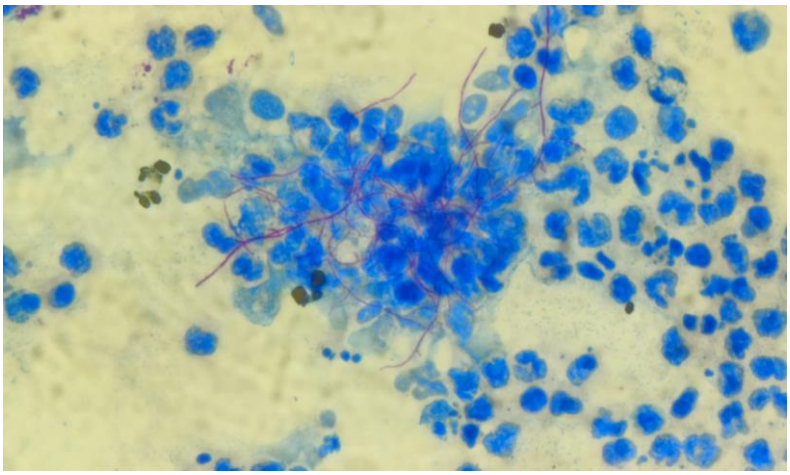

Fig: 5 Modified Ziehl Neelsen Stain Showing Filamentous Branching Acid Fast Bacilli

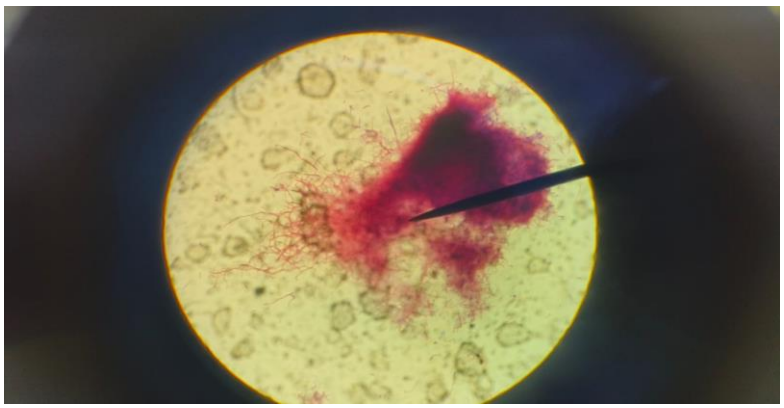

Fig: 6 Colony Smear of Nocardia Species Showing Acid-Fast Filamentous Branching Bacilli

Case 4: Cutaneous Mucormycosis

A 26-year-old male presented to the General Surgery outpatient department with high grade fever and a painful swelling over the anterior aspect of his right thigh since a week. The swelling was associated with pain, redness and local warmth. He had vague history of suspected insect bite at the site. On examination, the patient was febrile with stable vital signs. Local

examination revealed a tender, fluctuant, erythematous swelling which measured around 8 x 6 cm. Laboratory investigations revealed leucocytosis (WBC count: 21,000/mm³). The patient was admitted and started on intravenous Piperacillin-Tazobactam and analgesics. An emergency debridement was performed on the day of admission and purulent material along with necrotic tissue was removed. Sample was collected under sterile conditions and sent for bacterial culture and sensitivity, which did not yield growth of any micro-organisms. On postoperative day 2, wound inspection revealed a blackish necrotic patch (~3 × 4 cm) with surrounding inflammation, and fungal-mold like growth raising suspicion of fungal infection (Fig:7). A second debridement was performed, and tissue was sent for histopathological and fungal examination. The debrided tissue was cleaned with sterile saline solution and processed for microscopy with 10% KOH in the Microbiology laboratory. Microscopy revealed broad, aseptate, ribbon-like hyphae with irregular wide-angle branching, consistent with *Mucorales* (Fig: 8). However, fungal culture on Sabouraud's dextrose agar at both 25°C and 37°C remained sterile after three weeks of incubation. The patient received intravenous Isavuconazole 200 mg thrice daily for 2 days, followed by a maintenance dose of 200 mg once daily for 3 weeks. Subsequently, he was switched to oral Isavuconazole 200 mg once daily for 1 month. Simultaneously, the wound was managed with regular sterile dressings using povidone–iodine, hydrogen peroxide, and topical antifungals. Repeat debridements were done as needed until the wound was negative for evidence of fungal elements and growth on microscopy and culture respectively. Over the next six weeks, healthy granulation tissue developed (Fig: 9). Once the patient was clinically stable, split-thickness skin grafting was performed using an autograft from the contralateral thigh under spinal anaesthesia. There was good acceptance of the graft with a satisfactory outcome.

Outcome: The patient received IV and then oral Isavuconazole. Following the development of healthy granulation tissue, a split-thickness skin graft was successfully performed.

Fig: 7 Blackish Necrotic Patch with Mold like Growth

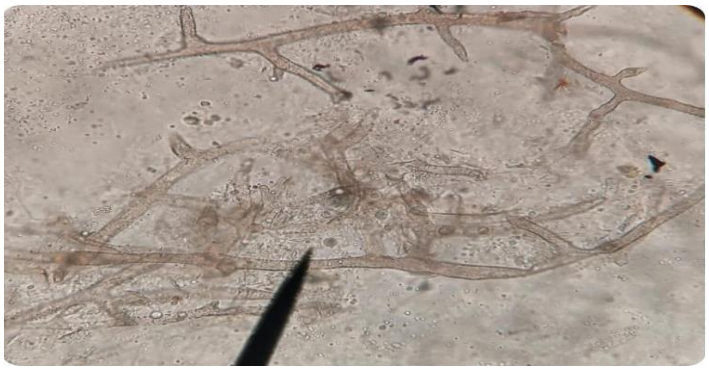

Fig: 8 KOH Microscopy Revealing Broad, Septate Hyphae

Fig: 9 Healthy Granulation Tissue

DISCUSSION

Skin and soft tissue infections (SSTIs) represent a common yet diagnostically challenging entity, particularly when caused by atypical pathogens as against conventional bacteria like staphylococci and streptococci. This case series presents four unusual manifestations, scrotal brucellosis, perineal abscess due to *Candida guillermondii* with vaginal extension, *Nocardia* cellulitis and subcutaneous mucormycosis in an immunocompetent individual- highlighting the diverse microbial spectrum.

Brucellosis is a well-known zoonotic disease. Consumption of unpasteurised milk and milk products is a common mode of transmission of brucella to humans. Brucellosis known for its diverse clinical presentations is a multisystemic disease which can affect all organs (3). The most common complication is osteoarticular involvement mainly spondylodiscitis followed by genitourinary involvement such as epididymo-orchitis, prostatitis, cystitis, pyelonephritis, renal and testicular abscess (4). Epididymo-orchitis is a frequent genitourinary complication, affecting 2% to 20% of males with brucellosis (5). The first case in current case series, *Brucella melitensis* was isolated from the pyocoele pus and testicular aspirate. A study by Mantur BG et al reports 5 cases of Brucella epididymo-orchitis, highlighting it as a complication of human brucellosis (6). This is the first report of bacteriologically proven cases of brucellar epididymoorchitis in the world literature. The current case, is the second reported case from India. The patient responded to the standard regimen of Rifampicin and Doxycycline. Similar case of testicular abscess proven bacteriologically has been reported byn Kazaz et al (7). A study by Gozdas and Bal et al presented epididymo-orchitis in 2.5% of male patients with brucellosis (8). Although the prognosis of brucellar epididymo-orchitis is usually good, delay in diagnosis or inappropriate management may result in serious complications, such as testicular abscess, that may then require orchiectomy (Yurdakul et al., 1995) (8).

The second case was a perineal abscess involving the perivaginal region due to Gram-positive budding yeast *Candida guilliermondii*, and responded to surgical management and intravenous Fluconazole and intravenous Piperacillin-Tazobactum. The pathophysiology likely involves vaginal colonization ascending to perianal tissues, facilitated by local trauma or altered flora. Perianal abscesses with *Non-albicans Candida* (NAC) are very rare, with few reports primarily in immunocompromised hosts. Chantzi et al reported a case of necrotizing soft tissue infection of labia majora due to *Candida glabrata*, initially mis-diagnosed as vulvovaginitis in a 58-year-old female diabetic patient (9). Surgical debridement along with intravenous Tigecycline and Anidulafungin were the mainstay of management. Unlike predominant bacterial perianal abscesses (Escherichia coli,anaerobes in 70-80 %) (10) ,the fungal etiology in the second case of the series evaded initial antibiotics ,highlighting the polymicrobial potential in reproductive age females. Surgical drainage complemented the antifungal and antimicrobial therapy leading to recovery as seen in follow-up. The response to azoles can be attributed to the fact that patient was immunocompetent, which is unlikely otherwise in case of NAC species. Thus,the case highlights importance of speciation of *Candida* SSTIs, to guide targeted therapy and prevent complications like necrotizing fasciitis. Ratna Shukla et al projected there is a significant epidemiological shift in candidiasis cases due to NAC species,which was 75% in their study (11).

Thus, it becomes essential to routinely identify Candida isolates up to species level, and detect evolving resistant strains by antifungal susceptibility testing wherever feasible.

The third case was diagnosed as Nocardiosis, with isolation of acid-fast branching filamentous *Nocardia* (N) species belonging to the order Actinomycetales, a group of aerobic, Gram positive, filamentous bacteria that comprises several species of clinical importance. Among these, *N. brasiliensis* is the main pathogenic organism for primary cutaneous infection, followed by *N. asteroides*, which usually causes fulminant systemic infection(12). Nocardiosis, an uncommon infection of the past, is being increasingly reported in recent years with rise of immunosuppressed patients (13). In India, very few centers have reported this disease. SSTIs due to *Nocardia species* ,though rare,pose a diagnostic challenge,particularly in diabetics ,mimicking routine bacterial cellulitis Comparable case reports include a 50 year old diabetic with left foot abscess yielding *Nocardia brasiliensis*, resolving on Cotrimaxozole and drainage documented by Singh et al (14) . Another case reported by Camozzota et al (15) involved a 55 year old type 2 diabetic female with hand cellulitis, treated successfully with prolonged Cotrimaxozole . This case highlights the importance of laboratory techniques which help in early diagnosis of Nocardiosis. Early microscopy prompts targeted therapy.

The fourth case of Primary Cutaneous Mucormycosis in an immunocompetent host. Cutaneous mucormycosis is primarily a disease of the immunocompromised, but rare cases have been documented in immunocompetent healthy individuals too, often linked to trauma (16). Diagnosis in this case was supported by repeated evidence of broad, aseptate hyphe on KOH microscopy, strongly suggestive of *Mucorales* infection. This can be attributed to the fact that *Mucorales* are fragile and lose their viability of the hyphal elements due to necrosis,during processing or due to technical limitations. A study by Mohanty et al (17) highlights the importance of KOH microscopy in the early diagnosis of fungal infection. A study by Rani Singh et al also showed a higher sensitivity of KOH microscopy than fungal culture (18). Thus, clinical judgement and repeated microscopic examinations remain critical, especially when culture results are not contributory. In this case, surgical debridement till wound margins became negative for fungal elements along with Isavuconazole were the mainstay of treatment. Patient follow-up was conducted upto 1 year,and no recurrence was seen. KOH mount microscopy is a sensitive and affordable method to make a rapid presumptive diagnosis.

CONCLUSION

This case series highlights atypical SSTI etiologies- *Brucella melitensis*, Candida *guilliermondii*, *Nocardia species* and *Mucorales* in varied hosts, where initial empiric therapy failed but targeted antimicrobials and surgery helped in resolution. These cases present with overlapping clinical features mimicking bacterial infections and pose diagnostic challenges. Early microbiologic evaluation is crucial in refractory cases, as it identifies pathogens and guides targeted therapy. Though limited in number, these findings promote high index of suspicion, prompt sampling and timely microbiological workup for better patient outcomes.

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