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Case Series

Microbiology Section

Post-surgical Infections Caused by Non-tuberculous Mycobacteria: A Case Series

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ABSTRACT

Non-Tuberculous Mycobacteria (NTM) are increasingly recognised as causes of chronic post-surgical infections, particularly following procedures involving prosthetic materials. Delayed diagnosis is common due to sterile routine bacterial cultures and negative routine Tuberculosis (TB) molecular tests. Three cases of postsurgical NTM infections were reported. The first case involved a 53-year-old diabetic male with chronic synovitis of the knee, necrotising myofasciitis of the thigh and osteomyelitis of the femur caused by *Mycobacterium intracellulare*. Diagnosis was established by automated Acid Fast Bacilli (AFB) culture BACTEC Mycobacteria Growth Indicator Tube (BACTEC MGIT) and species identification by MALDI-TOF. The patient was treated with clarithromycin, rifampicin, and ethambutol for one year with clinical improvement. The second case was a mesh infection following laparoscopic Trans-Abdominal Pre-Peritoneal (TAPP) hernia repair in a 46-year-old male. *Mycolicibacterium fortuitum* was grown in AFB culture. Management included mesh removal and combination therapy with amikacin, doxycycline, and levofloxacin for three months, resulting in complete recovery. The third case involved a 63-year-old diabetic female with mesh infection after laparoscopic hernioplasty. The bacterial isolate was identified as *Mycobacteroides abscessus*. Surgical mesh removal followed by multidrug therapy with clarithromycin, doxycycline and levofloxacin for four months led to successful resolution. NTM should be suspected in persistent postsurgical infections unresponsive to conventional antibiotics, especially when routine bacterial cultures are sterile. AFB culture, NTM species identification, and susceptibility-guided multidrug therapy combined with surgical removal of infected prosthetic material are essential for favorable outcomes. Strengthening infection control practices and appropriate sterilisation techniques for surgical instruments are crucial to prevent healthcare-associated NTM infections.

Keywords: Hernioplasty, Postoperative complications, Postoperative infection, Prosthesis-related infection, Surgical wound infection

INTRODUCTION

The NTM are a diverse group of organisms that include mycobacterial species other than *Mycobacterium Tuberculosis* (MTB) complex and *Mycobacterium leprae.* NTM are isolated from birds, animals and various environmental sources like soil, dust, water, lakes, rivers, etc. They are photochromogens, which include *Mycobacterium marinum* and *Mycobacterium kansasii*, scotochromogens like *Mycobacterium scrofulaceum* and *Mycobacterium gordonae*, non-chromogens like *Mycobacterium avium-intracellulare* complex and *Mycobacterium xenopi* and rapid growers like *Mycobacterium fortuitum, Mycobacterium chelonae,* and *Mycobacterium abscessus* [1]. NTM can cause mainly skin and soft-tissue infections, pulmonary infections, lymphadenitis, musculoskeletal infections like osteomyelitis, and disseminated infections. The risk factors of NTM include immunosuppression {Human Immunodeficiency Virus (HIV), organ transplantation, diabetes mellitus}, recent surgical or cosmetic procedures, tattooing, and skin trauma. NTM are acid-fast and will be positive in AFB culture, but will not be detected in the routine TB molecular assays [2].

The NTM show varying susceptibility to antimicrobials and surgical treatment will be needed in most of the extrapulmonary cases. Unlike *MTB*, these organisms are not commonly transmitted between individuals and are frequently associated with surgical procedures like hernioplasty and cosmetic procedures like liposuction [1,2]. Postoperative NTM infections often present with persistent inflammation, sinus formation, or abscess that fails to respond to conventional antibacterial therapy. Routine bacterial cultures may remain sterile, resulting in delayed diagnosis [2]. NTM infections are increasingly recognised worldwide, with a rising incidence reported across multiple regions, in some areas surpassing TB in prevalence. However, in resource-limited settings, the true burden remains underestimated due to inadequate laboratory infrastructure, limited access to advanced diagnostic techniques, and frequent misdiagnosis as TB, posing significant challenges to appropriate management [3].

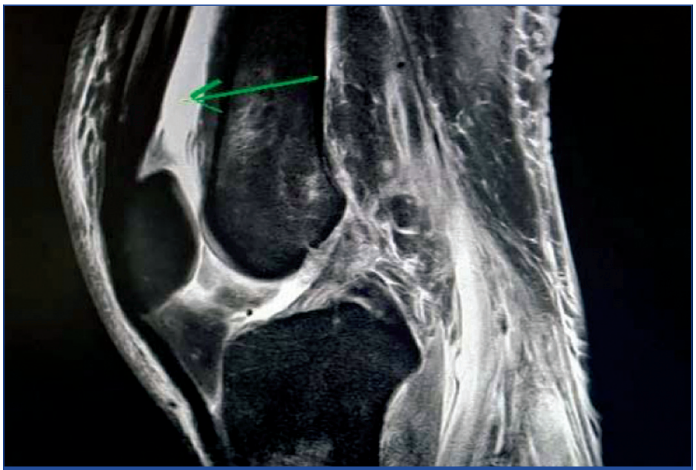
CASE SERIES

Case 1

A 53-year-old male patient, who is a known case of type 2 diabetes mellitus (diagnosed 15 years back), developed cellulitis over the lateral aspect of the right knee. Surgical debridement was done from another hospital, and after one month, he developed diffuse pain and swelling over the right knee around the surgical site. Diclofenac 100 mg was given orally twice daily for five days. Pain was not relieved, but aggravated with movements. There was minimal active pus discharge from the surgical wound. On local examination, an approximately 10 cm-sized wound was present over the lateral aspect of the knee. Knee effusion and mild tenderness were present. MRI right knee showed moderate fluid within the suprapatellar bursa and thickening of the femoral attachment of the lateral collateral ligament. A focal cartilage defect in the superior aspect of the medial patellar facet and the posterior aspect of the lateral femoral condyle was present [Table/Fig-1,2].

Provisional diagnosis was synovitis of the knee joint, necrotising myofasciitis of the thigh along with osteomyelitis of the femur which can be due to MTB, NTM or other bacterial infections.

Haemogram showed a total count of 8000/µL with 53% (40-80%) neutrophils, 35% (20-40%) lymphocytes, 8% (2-10%) monocytes and 4% (1-8%) eosinophils. Fasting blood sugar was 250 mg/dL (74-100 mg/dL) and Glycosylated Haemoglobin (HbA1c) was 11.4% (4-5.6%). C-Reactive Protein (CRP) was elevated and was



[Table/Fig-1]: MRI knee (sagittal view) showing fluid within the suprapatellar bursa.

[Table/Fig-2]: MRI knee (axial view) showing fluid within the suprapatellar bursa.

28.4 mg/L (<10 mg/L) and Erythrocyte Sedimentation Rate (ESR) was 70 mm/hr (<20 mm/hr).

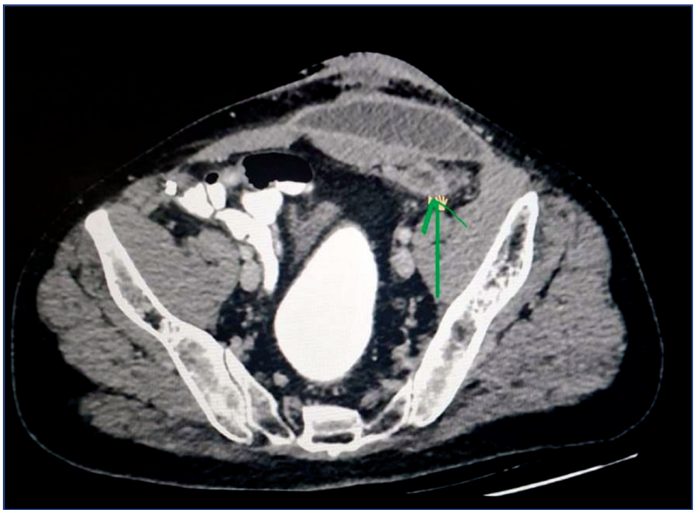
Wound debridement and knee arthrotomy were done. On knee arthrotomy, unhealthy underlying femoral bone, seropurulent fluid collection in the knee and infected fascia were seen. All the devitalised tissues were removed, and synovium was sent for aerobic and anaerobic bacterial culture and sensitivity, Tuberculosis Deoxyribonucleic Acid Polymerase Chain Reaction (TB DNA PCR), Acid-Fast Bacilli (AFB) stain, and AFB culture. Synovium and a portion of the distal part of the right femur were sent for histopathological examination. Aerobic and anaerobic bacterial culture and sensitivity were sterile. AFB stain and TB DNA PCR (CBNAAT) of the synovium were negative. Automated AFB culture (BACTEC MGIT) of the synovium flagged positive after 21 days, and the AFB stain done from the broth was positive for AFB. MPT64 antigen test by immunochromatography (SD Bioline) done from the broth was negative, ruling out MTB. Lowenstein Jensen (LJ) medium showed growth of slow-growing NTM [Table/Fig-3], which was identified as *Mycobacterium intracellulare* by MALDI-TOF.

So the final clinical diagnosis was right knee synovitis, right thigh necrotising myofasciitis and osteomyelitis of the distal part of the right femur caused by M. *intracellulare* (NTM). The patient was treated with clarithromycin 500 mg orally twice daily, ethambutol 1 g orally once daily, and rifampicin 600 mg once daily for one year. Patient came for a follow-up visit one month after starting treatment and showed improvement symptomatically.

Case 2

A 46-year-old male patient was referred to the surgery outpatient department with complaints of pain and swelling in the left lower abdomen for three months. He had no significant comorbidities. He had undergone laparoscopic bilateral TAPP repair (using polypropylene mesh) for an inguinal hernia six months back. He started experiencing pain in the lower abdomen three months after the procedure. It was more in the lower left part of the abdomen, and was progressing gradually. On local examination, there was a 7 x 5 cm-sized swelling in the left inguinal region. Haemogram showed a total count of 9600/μL (reference range: 4,000 - 11,000/μL) with 75% (40-80%) neutrophils, 16% (20-40%) lymphocytes, 7% (2-10%) monocytes and 2% (1-8%) eosinophils. C-Reactive Protein (CRP) was 1.1 mg/L (<10 mg/L) and ESR was 70 mm/hr (<20 mm/hr). The Ultrasound Sonography (USG) abdomen showed a pre-peritoneal fluid collection. The Contrast-Enhanced Computed Tomography (CECT) abdomen taken showed a large oblong-shaped peripherally enhancing hypo-dense collection in the left anterior lower abdominal and pelvic wall in the subcutaneous plane. Another small peripherally enhancing hypo-dense collection was noted in the extra-peritoneal aspect of the left pelvic region [Table/Fig-4,5].

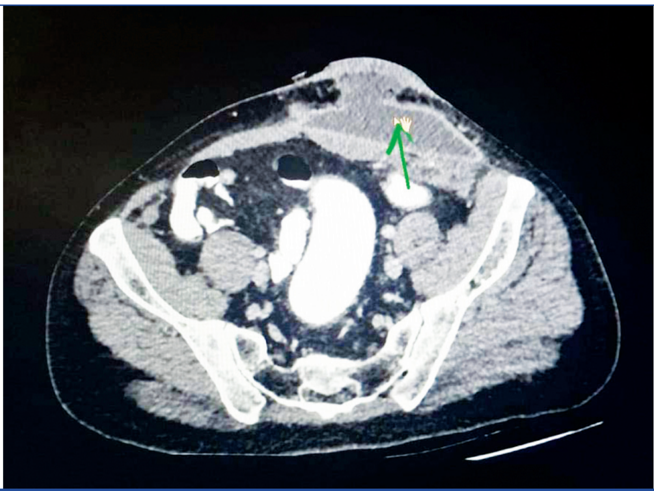
[Table/Fig-3]: Lowenstein Jensen (LJ) medium showing growth of Mycobacterium intracellulare.



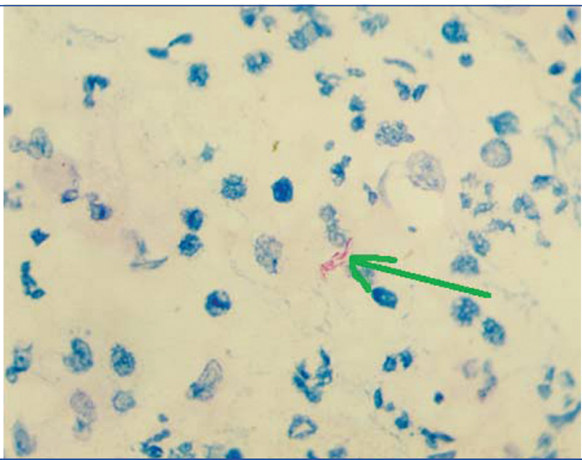
[Table/Fig-4]: CECT abdomen showing pus collection in the left anterior lower abdominal and pelvic wall.

Pus was aspirated and sent for aerobic and anaerobic bacterial culture and sensitivity, TB DNA PCR, AFB stain and AFB culture. Aerobic and anaerobic bacterial culture and sensitivity were sterile. AFB stain showed AFB [Table/Fig-6], and TB DNA PCR (CBNAAT) was negative.

Automated AFB culture (BACTEC MGIT) flagged positive after 10 days and AFB stain done from the broth was positive for AFB. MPT64 antigen test by immunochromatography (SD Bioline) done from the broth was negative, ruling out MTB.



[Table/Fig-5]: CECT abdomen showing pus collection in the left anterior lower abdominal and pelvic wall.



[Table/Fig-6]: AFB stain of pus sample showing Acid-Fast Bacilli (AFB).

Patient underwent left inguinal exploration, and the infected mesh with two non-absorbable tackers was removed, and an antibiotic streptomycin wash was given. Mesh and tissue samples were sent for aerobic and anaerobic bacterial culture and sensitivity, TB DNA PCR, AFB stain and AFB culture. AFB stain of the mesh and tissue showed AFB, and TB DNA PCR (CBNAAT) was negative. Automated AFB culture (BACTEC MGIT) of the mesh and tissue flagged positive after 10 days, and AFB stain done from the broth was positive for AFB. MPT64 antigen test by immunochromatography (SD Bioline) done from the broth (both samples) was negative ruling out *MTB*. LJ medium showed growth of rapidly growing NTM [Table/Fig-7] which was identified as *Mycolicibacterium fortuitum* (formerly called as *Mycobacterium fortuitum*) by MALDI-TOF.

Clinical diagnosis was mesh infection and abscess after bilateral TAPP repair for left inguinal hernia caused by NTM. Drug susceptibility testing for NTM was done by the broth microdilution method according to CLSI M24S-Ed2, 2023 guidelines [4]. The drugs tested were amikacin, ciprofloxacin, moxifloxacin, doxycycline, clarithromycin, linezolid, imipenem, cefoxitin and cotrimoxazole and the patient was susceptible to all the drugs tested. The minimum inhibitory concentration values obtained for this isolate were amikacin (≤8 µg/mL), ciprofloxacin (≤1 µg/mL), moxifloxacin (≤1 µg/mL), doxycycline (≤1 µg/mL), clarithromycin (≤2 µg/mL), linezolid (≤8 µg/mL), imipenem (≤4 µg/mL), cefoxitin (≤16 µg/mL), and cotrimoxazole (≤2/38 µg/mL). Susceptibility of levofloxacin and minocycline can be determined from the susceptibility of ciprofloxacin and doxycycline according to CLSI M24S-Ed2, 2023 guidelines [5]. Patient was advised to take amikacin 750 mg OD intravenously (i.v.) for two months, doxycycline 100 mg twice daily orally for three months and levofloxacin 750 mg OD orally for three months. On postoperative day 23, the patient was symptomatically better and haemodynamically stable and was discharged. After two months, amikacin 750 mg was given i.v. for one month, three times a week. After three months of antibiotic treatment, the patient's wound had healed completely. Follow-up ultrasound of the abdomen with pelvis was done, and there were no abnormal findings in the left inguinal region except for the postoperative findings. The patient came for follow-up at 10 days and one month after completion of treatment, and there was no recurrence of any symptoms.

[Table/Fig-7]: Lowenstein Jensen (LJ) medium showing growth of Mycolicibacterium fortuitum.

Case 3

A 63-year-old female patient, who had undergone laparoscopic hernia repair (using polypropylene mesh) for umbilical and paraumbilical hernia, developed high-grade fever and pus discharge from the surgical site after two months and was diagnosed with hernia mesh infection. She had been a known case of type II diabetes mellitus for 12 years and has a past history of surgery and radiotherapy for pituitary adenoma. Haemogram showed a total count of 12,100/µL with 87% (40-80%) neutrophils, 10% (20-40%) lymphocytes, and 3% (2-10%) monocytes. Fasting blood sugar was 114 mg/dL (74-100 mg/dL) and HbA1c was 5.6 % (4-5.6%). CRP was elevated and was 35.7 mg/L (<10 mg/L), and ESR was 70 mm/hr (<20 mm/hr). Surgical exploration of the surgical site was done, the mesh was removed completely, and the mesh was sent for TB DNA PCR, AFB culture (BACTEC MGIT) and AFB stain. AFB stain and TB DNA PCR were negative. Automated AFB culture (BACTEC MGIT) flagged positive after six days, and AFB stain done from the broth was positive for AFB. MPT64 antigen detection test by immunochromatography (SD Bioline) was negative, ruling out MTB. Broth from the MGIT tube was cultured on LJ medium and Blood agar and it showed growth after four days [Table/Fig-8,9].

So, it was concluded that the isolate was NTM-rapid grower. Isolate was identified as *Mycobacteroides abscessus* (formerly called as *Mycobacterium abscessus*) by MALDI-TOF. Drug susceptibility testing for NTM was done by broth microdilution method according to CLSI M24S-Ed2, 2023 guidelines [5]. The drugs tested were amikacin, ciprofloxacin, moxifloxacin, doxycycline, clarithromycin, linezolid, imipenem, cefoxitin and cotrimoxazole and was susceptible to all the drugs tested. The minimum inhibitory concentration values obtained for this isolate were amikacin (≤8 µg/mL), ciprofloxacin (≤1 µg/mL), moxifloxacin (≤1 µg/mL), doxycycline (≤1 µg/mL), clarithromycin (≤2 µg/mL), linezolid (≤8 µg/mL), imipenem (≤4 µg/

[Table/Fig-8]: Lowenstein Jensen (LJ) medium showing growth of Mycobacteroides abscessus.

[Table/Fig-9]: Blood agar showing growth of Mycobacteroides abscessus.

mL), cefoxitin (≤16 µg/mL), and cotrimoxazole (≤2/38 µg/mL). Susceptibility of levofloxacin and minocycline can be determined from the susceptibility of ciprofloxacin and doxycycline according to CLSI M24S-Ed2, 2023 guidelines [5].

The patient was given clarithromycin 500 mg twice daily orally, doxycycline 100 mg twice daily orally and levofloxacin 750 mg OD orally for four months and at review after one month the surgical site was healed, and all other symptoms subsided. Immediately after completion of treatment (after four months), the patient came for follow-up and there were no symptoms. At two weeks after completion of treatment, the patient came for follow-up and there was no recurrence of any symptoms.

DISCUSSION

The NTM are increasingly recognised as important causes of chronic post-surgical infections in both developing and developed countries. The present case series illustrates diverse clinical manifestations of NTM infections, including musculoskeletal involvement caused by slow-growing NTM (M. *intracellulare*) and post-operative mesh infections caused by rapidly growing NTM (*Mycolicibacterium fortuitum* and *Mycobacteroides abscessus*).

The clinical presentation in the current series was largely indolent and non-specific, which is consistent with findings seen in a study done by Johnson MM and Odell JA describing NTM infections as chronic, non-healing conditions with minimal systemic manifestations [5]. The delayed onset of symptoms in the second and third cases following hernia repair procedures reflects the characteristic presentation of rapidly growing mycobacterial infections, which often manifest weeks to months after surgical intervention. This is similar to the findings observed in a study done by Brown-Elliott BA and Wallace RJ Jr [6]. Their ability to survive in water systems and resistance to standard disinfectants facilitates contamination of surgical equipment and prosthetic materials with NTM ultimately leading to infection [5,7]. Similar post-laparoscopic outbreaks due to rapidly growing mycobacteria have been described in Indian settings [8].

The musculoskeletal infection caused by M. *intracellulare* in first case also mirrors observations from other case reports describing chronic osteomyelitis and synovitis requiring combined surgical and extended medical therapy [9-11]. This postsurgical infection may be caused by contamination from the hospital environment, due to inadequate sterilisation of equipment, usage of contaminated tap water or compromised infection control practices. NTM which may be present in the tap water, soil and dust can contaminate wounds and can cause infection. Another reason for NTM infection is due to the fact that it can survive standard disinfection processes. This patient is a known case of type 2 diabetes mellitus which is another risk factor for NTM. M. *intracellulare* is a slow growing NTM which causes delay in diagnosis. So in such clinical scenarios high clinical suspicion and AFB culture testing are mandatory. Also, drug susceptibility testing and targeted antibiotic combination therapy for prolonged duration is essential.

In this case series, two patients developed mesh associated infections after hernioplasty caused by rapidly growing NTM (*Mycolicibacterium fortuitum* and *Mycobacteroides abscessus*). NTM infections can occur if laparoscopic instruments are not sterilised but disinfected using high level disinfectants like aldehydes since NTM are resistant to aldehydes. The source of infection here can also be water which is used for cleaning the instruments after immersing in aldehyde solution. This can be prevented by doing proper sterilisation techniques like plasma sterilisation or ethylene oxide sterilisation [12]. Biofilm formation on mesh significantly reduces antimicrobial penetration, thereby necessitating surgical removal of the mesh [6,13]. One patient is a known case of type 2 diabetes mellitus and has done radiotherapy for pituitary adenoma. These two immunocompromised conditions would have contributed to occurrence of postsurgical infection. Fortunately, all the drugs tested were susceptible and the blood glucose levels were controlled by taking insulin regularly. These factors have helped in the proper healing of the surgical site.

The treatment approaches adopted in this case series were largely in agreement with current recommendations and previously published experiences, while also highlighting the importance of individualised therapy [2]. The patient with M. *intracellulare* infection required prolonged multidrug therapy with clarithromycin, ethambutol, and rifampicin, reflecting standard treatment practices for slow-growing NTM [1]. In contrast, infections caused by rapidly growing mycobacteria were managed with shorter, combination regimens including aminoglycosides, fluoroquinolones, and tetracyclines [6].

Delayed diagnosis remains a recurring concern since routine culture will be sterile and will be negative in TB DNA PCR. AFB culture growth will be delayed than routine bacterial culture resulting in delayed diagnosis. So AFB culture and identification of NTM by MALDI-TOF is crucial for diagnosing and treating infections caused by NTM [14]. When a mesh related infection occurs, combined medical and surgical treatment involving multiple antimicrobials for prolonged duration and surgical removal of the mesh is essential. In a Turkish study done by Akyol C et al., there were 15 cases of chronic mesh infection after open chronic inguinal hernia repair over a period of 12 years. All patients underwent mesh removal along with multiple antibiotic treatment for prolonged duration and the infection was finally controlled without recurrence [15].

Mycolicibacterium fortuitum and *Mycobacteroides abscessus* pose therapeutic challenges due to intrinsic resistance mechanisms and inducible macrolide resistance. Comparable treatment difficulties have been reported in previous case reports and series documenting prolonged multidrug therapy

Study (Author)	Study type	Organism identified	Clinical presentation	Risk factors	Management	Outcome
Wallace RJ et al., [10]	Original article	Rapidly growing NTM	Surgical site infections	Implants	Surgery + antibiotics	Improved
Akyol C et al., [15]	Case series	NTM	Mesh infections	Prosthetic material	Mesh removal + antibiotics	Good
Chohan A et al., [18]	Case report	*M. abscessus*	Pulmonary/disseminated disease	Chronic lung disease, immunocompromised	Multidrug therapy	Poor response

[Table/Fig-10]: A comparative analysis with previously published reports [10, 15, 18].

and occasional relapse [16,17]. So drug susceptibility testing by broth microdilution for NTM according to CLSI M24S-Ed2, 2023 guidelines is essential for targeted antibiotic therapy. In the second case, the patient has undergone surgical removal of the mesh and prolonged treatment with amikacin, doxycycline and levofloxacin for three months. In the third case, the patient was given clarithromycin, doxycycline and levofloxacin for four months along with surgical removal of the mesh. In both cases there was complete cure and no recurrence was present. This highlights the significance of prompt diagnosis, targeted antibiotic therapy and surgical removal of the mesh. The overall outcomes in this case series were favourable, with all patients demonstrating clinical improvement and no evidence of recurrence on follow-up, which is comparable to outcomes reported in earlier studies when appropriate therapy is instituted [2].

A comparative analysis with previously published reports demonstrates both concordance and variation in clinical features, management strategies, and outcomes [10,15,18] [Table/Fig-10].

CONCLUSION(S)

Postsurgical infections caused by NTM are emerging as a significant clinical problem. High level of clinical suspicion is necessary in patients with persistent surgical site infections for accurate diagnosis. Routine mycobacterial workup should be considered when routine bacterial cultures are negative. Early laboratory confirmation and identification of NTM by MALDI-TOF is essential to avoid inappropriate therapy. Removal of infected prosthetic material should be strongly considered whenever necessary. Prolonged susceptibility guided combination antimicrobial therapy improves the likelihood of cure. So drug susceptibility testing is also crucial for appropriate antibiotic therapy. This case series also emphasises that strengthening infection control practices will definitely reduce healthcare-associated NTM infections.

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