Original Article

Beyond the Needle: Unmasking Atypical Mycobacteria in Postvaccination Abscesses in Children

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Abstract

Introduction: Atypical or nontuberculous mycobacteria (NTM) are an environmental organism responsible for opportunistic infection. Rapid-growing NTM are more commonly associated with hospital-acquired infections. Many of the organisms responsible for diseases in immunocompromised patients and hospital-acquired infections originate from tap water, such as *Mycobacterium kansasii*, *Mycobacterium xenopi*, *Mycobacterium gordonae*, *Mycobacterium simiae*, *Mycobacterium mucogenicum, Mycobacterium fortuitum*, *Mycobacterium chelonae*, and *Mycobacterium abscessus*. NTM is a rare organism responsible for the injection abscess. Considering low incidents, not much clinical data are available for this condition. Here, we discuss such cases which can be helpful to spread awareness and provide data for future policy makers.

Materials and Methods: This was a retrospective study. Data on patients with injection abscess were collected from the last 6 years. Detailed history and clinical examination findings were analyzed. Children with injection abscess were operated and their further management and outcome were studied.

Results: A total of 13 cases with confirmed culture of NTM were treated over 6 years. The age ranged from 2½ months to 5¾ years with male:female ratio of 7:6. All patients hailed from the same geographical area. All children were healthy with no history of any long-term or chronic illness, without additional symptoms and had received Bacillus Calmette-Guérin vaccination at birth. The total duration of illness varied from 1 to 5 months, with a mean of 3 months. All patients had a history of intramuscular age-appropriate vaccination as per the national immunization schedule. All patients were followed up to 6 months after intervention and none of our patients developed relapse.

Conclusion: Patient who does not respond with optimum treatment should have a high suspicion of such opportunistic infection, which is crucial to their management. Hospital-acquired NTM infections often result from contaminated instruments or fluids. Adherence to strict aseptic precautions, hand hygiene and environmental precautions are the key to preventing these infections. In case of skin and soft tissue infections / abscesses, surgical intervention plays a significant role for managing the patient.

Keywords: *Atypical mycobacterium infection, injection abscess, nontuberculous mycobacteria, pediatric age group*

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Introduction

Atypical mycobacteria, also known as nontuberculous mycobacteria (NTM), are typically found in the environment.[1] These microorganisms are categorized

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based on their morphology, physiology, and biochemical reactions. The widely accepted classification is determined by the growth rate of the organism, where NTM is divided into either rapid or slow growers.[2] Rapid-growing organisms are more commonly associated with hospital-acquired infections. Many of the organisms responsible for diseases in immunocompromised patients and hospital-acquired infections originate from tap water, such as *Mycobacterium kansasii*, *Mycobacterium xenopi*, *Mycobacterium gordonae*, *Mycobacterium simiae*, *Mycobacterium mucogenicum, Mycobacterium fortuitum*, *Mycobacterium chelonae*, and *Mycobacterium abscessus*.[3] NTM can manifest across a spectrum of diseases, including lymphadenitis, pulmonary disease, bone and joint infections, skin and soft tissue infections, and even disseminated diseases. The overall incidence of NTM infection in pediatric population is 0.6–3.3 per 10,000.[4] Injection abscesses can result from improper technique or contamination. The most common organism responsible for injection abscesses is *Staphylococcus aureus*, followed by streptococcal and Gram-negative organisms. Very few cases are caused by rare organisms like NTM.[5]

Although injection abscess due to NTM infection is known, awareness of this disease is poor due to very low incidence rates, and there are no clear guidelines available for its management. Here, we discuss our series of 13 cases. In addition, this documentation will be helpful for formation of guidelines for similar cases in the future.

Materials and Methods

This was a retrospective study of 13 immunocompetent children over a period of 6 years, who had culture proven NTM abscesses following intramuscular injections for vaccination. All patients underwent a comprehensive assessment involving detailed history-taking, thorough clinical examination, and relevant hematological and radiological workup. The clinical suspicion of intramuscular abscess was confirmed with a local ultrasound scan following which surgical intervention was done. All patients underwent complete excision of the entire abscess cavity with primary wound closure. The operative specimens were sent for detailed investigations.

The investigative phase included a full blood count and erythrocyte sedimentation rate (ESR). At the time of the surgery, the pus samples were collected and subjected to Gram staining, acid-fast bacilli (AFB) staining, Cartridge-Based Nucleic Acid Amplification Test (CBNAAT) for tuberculosis, as well as regular and tuberculosis culture. For tuberculosis, samples were cultured on both Lowenstein–Jensen solid media and mycobacterium growth indicator tube media. In cases where NTM infection was suspected based on CBNAAT and AFB stain, additional maneuvers for culture growth were carried out as needed. The excised tissue was sent for histopathological examination (HPE). All the histopathological samples were subjected to hematoxylin and eosin stain. All patients were discharged 48 h following surgery. All patients were on perioperative antibiotics for Gram-positive bacteria. However, after initial histopathology and 48 h of no bacterial growth on culture, the children were shifted to oral clarithromycin, considering a high possibility of NTM infection. This treatment was continued for a period of 10 days following discharge. None of the patients were given antituberculous treatment. All patients were followed up for a period of 6 months to confirm complete resolution.

Results

A total of 13 children with postvaccination NTM abscess were studied over a period of 6 years. Patients presented to us 1–7 months after the onset of symptoms. Their age ranged from 2½ months to 5¾ years. All patients hailed from the same geographical area. There were 7 males and 6 females in the study. All children were immunocompetent and healthy with no history of any long term or chronic illness. All patients had received Bacillus Calmette-Guérin vaccination at birth, and none had exhibited additional symptoms such as fever, weight loss, or cough. The duration of illness varied from 1 to 5 months. All patients had received age-appropriate vaccination as per the national immunization schedule. Four patients had received vaccination at a private setup, whereas 9 patients had received vaccination at a government setup.

All patients developed swelling at the vaccination site followed by local cellulitis. All children had received oral antibiotics from their local pediatrician, primarily amoxiclav or cefixime, which caused resolution or reduction in the cellulitis, but the deep intramuscular swelling persisted. Two out of 13 patients underwent prior incision and drainage, whereas the third had a chronically discharging sinus following a burst open abscess. Two out of these three had also received a 3-month course of antitubercular therapy without significant clinical improvement. The clinical characteristics and management outcomes are enlisted in Table 1.

Surgical intervention was performed for all patients [Photo 1]. Under general anesthesia, an elliptical incision was placed, and the entire inflammatory mass was excised. All the lesions were in the intramuscular plane and well encapsulated as a result of which, complete excision

Table 1: Clinical characteristics and outcomes of patients presenting with postvaccination nontuberculous mycobacteria abscesses

Sex	Age	Presentation	Duration (months)	H/O I and D	History	Other symptoms/ past history	Medications received priorly	Operation	Histopathology	Mycobacterial culture	ESR	Regular follow-up up to 6 months
Male	9.5 months	Sinus + mass over right thigh	7	Yes	Vaccination at 1.5 months	I and D after 4 months → sinus and mass persisted	AKT for 3 months	Excision of sinus tract with intramuscular mass	Epithelioid granulomas and Langhans type of multinucleated giant cells	*M. chelonae*	15	Healed no recurrence
Female	1.5 years	Mass over right thigh	4	No	Vaccination at age of 15 months	None	Oral AB	Excision of intramuscular mass	As above	*M. chelonae*	22	As above
Male	5.7 years	Discharging sinus left thigh	5	No	Vaccination → swelling → sinus	None	AKT for 3 months	Excision of sinus tract with intramuscular mass	As above	*M. chelonae*	30	As above
Male	2 years	Mass over right thigh	3	Yes	Vaccination → swelling	I and D before 2 months → mass persisted	Oral AB	Excision of intramuscular mass	As above	*M. kansasii*	8	As above
Female	5.5 years	Mass over right thigh	5	No	Vaccination → swelling	None	Oral AB	Excision of intramuscular mass	As above	*M. abscessus*	21	As above
Female	1.5 years	Sinus over right arm	2.5	Yes	Vaccination → swelling → sinus	I and D before 3 months → mass persisted	Oral AB	Excision of sinus tract with intramuscular mass	As above	*M. chelonae*	16	As above
Male	2.5 months	Mass over right thigh	1	No	Vaccination → swelling	None	Oral AB	Excision of intramuscular mass	As above	*M. chelonae*	12	As above
Female	18 months	Mass over left thigh	1	No	Vaccination → swelling	None	Oral AB	Excision of intramuscular mass	As above	*M. chelonae*	28	As above
Female	2 years	Sinus + mass over right thigh	2.5	Yes	Vaccination → swelling → sinus → I and D → sinus	None	Oral AB	Excision of sinus tract with intramuscular mass	As above	*M. chelonae*	10	As above
Male	2.5 months	Mass over left thigh	1	No	Vaccination → swelling	None	Oral AB	Excision of intramuscular mass	As above	*M. chelonae*	8	As above
Male	1 years	Mass over right thigh	3	No	Vaccination → swelling	None	Oral AB	Excision of intramuscular mass	As above	*M. kansasii*	14	As above
Female	1.4 years	Swelling over left thigh	4	No	Vaccination → swelling	None	Oral AB	Excision of intramuscular mass	As above	*M. abscessus*	32	As above
Male	5 years	Swelling over right thigh	1	No	Vaccination → swelling	None	Oral AB	Excision of intramuscular mass	As above	*M. chelonae*	18	As above

AB: Antibiotics, *M. kansasii: Mycobacterium kansasii, M. chelonae: Mycobacterium chelonae, M. abscessus: Mycobacterium abscessus*, ESR: Erythrocyte sedimentation rate, AKT: Antitubercular therapy

of the entire lesion along with the abscess cavity was possible. Tissues were sent for HPE whereas pus was sent for AFB staining, CBNAAT for tuberculosis and culture and sensitivity. The histopathology reports revealed Langhans type giant cells, lymphocytes, histiocytes, and fibroblast forming granulomas [Photo 2]. All cultures were positive for AFB staining but negative for CBNAAT for tuberculosis. Out of the 13 samples tested, 9 (70%) were identified as *M. chelonae*, 2 (15%) as *M. Kansasii*, and 2 (15%) as *M. abscessus*. All hematological investigations were within the normal range, apart from a mildly raised ESR. After the procedure, all children were commenced on oral clarithromycin (15 mg/kg/day in two divided doses) with a high suspicion of NTM infection (*M. Abscessus*) and continued for 10 days. The oral antibiotics were stopped after 10 days following complete wound healing. All children were regularly followed up to a period of 6 months to confirm complete resolution. There were no complications or recurrence of the lesion in any of the patients.

Discussion

NTM, opportunistic infectious agents, predominantly affect immunocompromised individuals, with *M. fortuitum*, *M. abscessus*, and *M. chelonae* being common culprits for cutaneous infections. Resulting from penetrating injuries, cutaneous diseases manifest as localized cellulitis, draining abscesses, or nodules with minimal tenderness. Documented outbreaks link cutaneous abscesses to contaminated multiple-dose vials during injections.[6] Advancements in culture methods and molecular tools like DNA sequencing have increased NTM case reporting, but a high level of suspicion remains crucial for diagnosis, considering the possibility of overlooking cases even with advanced investigative support.[2]

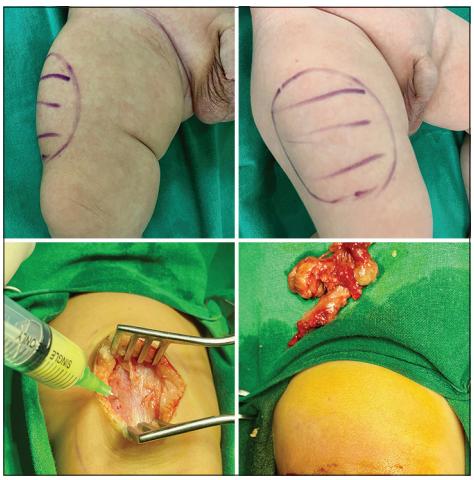

Photo 1: (Left to Right from top) Images of Preoperative clinical presentation, pus aspirated from the intramuscular abscess and postoperative result following excision

NTM's hydrophobic mycolic acid layer in their cell wall makes them undetectable using Gram staining. Fluorochrome staining is the preferred method, where these bacteria appear as yellow to orange bacilli. However, visualization occurs in only 30% to 60% of cases. Distinguishing between rapidly growing NTM types like *M. chelonae* and *M. abscessus* may require molecular studies.[7] In observations, *M. chelonae* accounted for 70% of cases, raising to 85% when combined with *M. abscessus*; *M. kansasii*, a slow-growing NTM, represented 15% of abscess cases.

In 2008, *M. chelonae* cutaneous abscesses post mesotherapy were reported in Peru, likely due to contaminated procaine vials.[8] In our cases, vaccination history preceding abscess development suggests inadequate skin sterilization before vaccine administration as the potential cause.

M. chelonae and *M. abscessus* are resistant pathogens. *M. chelonae* exhibits sensitivity to tobramycin, clarithromycin, and linezolid. Imipenem and amikacin are effective in nearly 50% of cases, while clofazimine, doxycycline, and ciprofloxacin may help in <50% of cases.[9] For *M. kansasii* infections, rifampin, ethambutol, and isoniazid are crucial.[10] Monotherapy with clarithromycin suffices for localized skin infections; but surgical intervention is paramount.[9]

In our experience, the first three cases that presented to us were of the chronic sinuses, two of whom had undergone incision and drainage and the third had a spontaneously burst intramuscular abscess. All these cases underwent complete excision of the sinus along

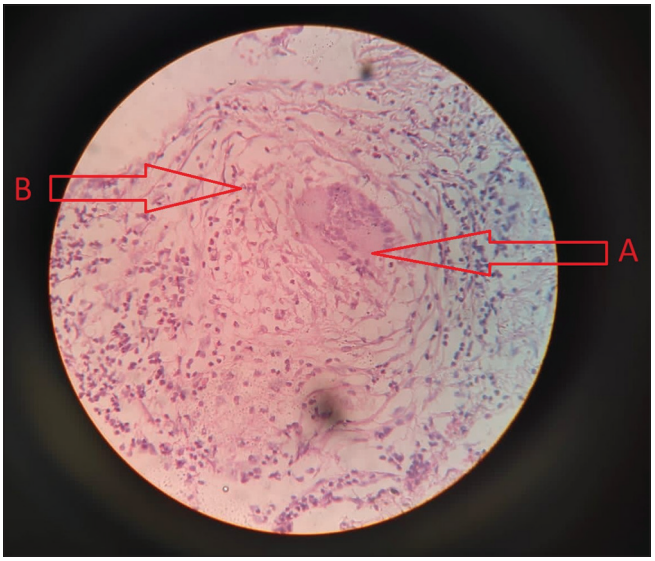

Photo 2: Hematoxylin and eosin-stained (H and E stained): Langhans type giant cell, lymphocytes, histiocytes, and fibroblast forming granuloma. A: Langhans giant cell, B: Granuloma

with the intramuscular abscess. These cases turned out to be NTM. This experience helped our management in subsequent cases with similar history, onset, and clinical findings. In all the subsequence cases, we opted for primary complete excision of the intramuscular abscesses.

In our cases, we initiated oral macrolide postoperatively for 10 days and, discontinued upon complete wound healing. None of our patients experienced recurrence after complete resection, highlighting the effectiveness of the surgical approach.

Conclusion

NTM are opportunistic infections that can cause significant illness, even in immunocompetent patients. A high suspicion of this disease is important for diagnosing these cases. An abscess that does not respond to optimal antibiotics, histopathology suggestive of granulomatous disease with negative CBNAAT, and positive AFB staining create a scenario where one can suspect this condition. When dealing with NTM infections, obtaining a culture and sensitivity report, along with molecular studies, is crucial, especially when initiating antimicrobial agents. However, due to financial and logistic reasons, it may not always be possible. In instances of skin and soft tissue involvement or surgical site infections, surgical intervention, in the form of debridement of infected tissue and excision of the abscess is of utmost importance. Hospital-acquired NTM infections often result from contaminated instruments or fluids, emphasizing the critical importance of adhering to proper aseptic precautions, maintaining hand hygiene, and implementing environmental precautions to prevent such events.

Limitations

This case series is a retrospective study covering a span of over 6 years. This is a single-center experience and does not represent the entire region. It is advisable to have more reporting of such cases from other areas and encourage multicentric studies to provide a comprehensive understanding of this disease.

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Conflicts of interest

There are no conflicts of interest.

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