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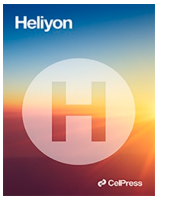

Case report

Disseminated nontuberculous mycobacterial infection mimicking lymphoma in an adult without diagnosed immunodeficiency: A case report

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ABSTRACT

Non-tuberculous mycobacteria (NTM) rarely manifest with lymphoma-like symptoms in immunocompetent adults. We report the case of a 70-year-old male with a disseminated *Mycobacterium kansasii* infection. Computed tomography revealed the presence of multiple lymph nodes in various areas. Biopsies confirmed the NTM infection. Urine and pus cultures confirmed *M. kansasii*. Empirical antibiotic treatment was initiated; however, the patient developed acute cholangitis. Despite interventions, including choledocholithotomy and broad-spectrum antibiotics, the patient succumbed to septic shock. This case underscores the necessity of maintaining suspicion and comprehensive testing for NTM infections to enable early diagnosis, appropriate treatment, and prevent fatal complications.

1. Introduction

Non-tuberculous mycobacteria (NTM) are mycobacterial species, excluding *Mycobacterium tuberculosis* complex and *M. leprae*. NTM are ubiquitous in the environment. To date, more than 200 species have been identified; however, only a few can cause human infections [1]. Despite their ubiquitous nature, NTM infections are more uncommon in immunocompetent hosts than in immunocompromised patients.

The clinical relevance of NTM infections has been increasing worldwide since 2000 owing to the aging population, increasing case complexity, diagnostic method advancements, and improved NTM awareness of among clinicians [2]. As estimated from claims data, the epidemiology of NTM infection in the Republic of Korea shows that the prevalence rate has increased approximately 28 times and the incidence rate has increased 18 times from 2003 to 2016 [3]. Only a certain proportion of these patients receive complex treatment within 1 year of NTM infection diagnosis [4]. Furthermore, infectious lesions are often disseminated, leading to fatal outcomes.

Disseminated NTM infections encompass a wide range of clinical manifestations in nearly all organs. Accordingly, these infections

Abbreviations: AFB, acid-fast bacilli; CT, computed tomography; FDG, F18 fluodeoxyglucose; FNA, fine-needle aspiration; IFN-γ, interferon-gamma; MIC, minimum inhibitory concentration; NTM, nontuberculous mycobacteria; PET, positron emission tomography; UTI, urinary tract infection.

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frequently manifest as fevers of unknown origin and are misdiagnosed as disseminated tuberculosis, metastatic carcinoma, or lymphoma, particularly in previously healthy individuals.

M. kansasii, a slow-growing acid-fast bacillus (AFB), is the second most clinically relevant isolated pathogenic NTM species and the second most frequent cause of disseminated NTM disease after *M. avium* complex [5,6]. Disseminated *M. kansasii* infections have also been reported in immunocompromised patients [7].

Recently, we encountered a rare case of disseminated *M. kansasii* infection that mimicked lymphoma involving the lungs, kidneys, and multiple lymph nodes in an adult without any diagnosed immunodeficiency. Here, we report this case and present a comprehensive review of previously reported disseminated *M. kansasii* infections in adult patients without known immunodeficiencies.

2. Case report

A 70-year-old male was admitted to the emergency room with a five-day history of dysuria and urgency, raising the suspicion of a urinary tract infection (UTI). The patient had a medical history of hypertension, persistent atrial fibrillation, and cerebral infarction, and was diagnosed 5 years before admission. However, the patient had no difficulty walking, speaking, or swallowing and had maintained good health prior to the illness. The patient had also undergone a cholecystectomy for gallbladder stones. He was treated with antihypertensive, antiplatelet, and antiarrhythmic drugs, with regular follow-up. He reported no significant allergies, denied smoking or alcohol use, and reported no exposure to cats or aquariums.

The patient developed sepsis on arrival. Vital signs were as follows: body temperature 35.8 °C, blood pressure 89/55 mmHg, and pulse rate 93 beats/min. The patient was 188.0 cm tall, weight was 75.0 kg, and was non-cachectic, but appeared exhausted. Physical examination revealed no abnormal heart or respiratory sounds, abdominal tenderness, or costovertebral angle tenderness. Palpation revealed no abnormalities of the neck, axilla, or abdomen. No skin lesions were observed. Laboratory findings were as follows: hemoglobin levels of 11.6 g/dL, white blood cell count of 39,310/μL (neutrophil 46 %, myelocyte 2 %, metamyelocyte 9 %, band neutrophil 41 %, lymphocyte 1 %, and monocyte 1 %), platelet count of 789,000/μL, C-reactive protein level of 148.47 mg/L, procalcitonin level of 12.8 μg/L, blood urea nitrogen level of 64.3 mg/dL, creatinine level of 3.75 mg/dL, aspartate aminotransferase level of 114 IU/L, alanine aminotransferase level of 79 IU/L, and total bilirubin level of 2.19 mg/dL. Urinalysis revealed red and white blood cells, proteinuria, and a bacterial infection. The patient was admitted to the intensive care unit. On day 2 of hospitalization, the patient's blood pressure recovered without the use of vasopressors or inotropic drugs. Therefore, the patient was transferred to the general ward. On admission, urine bacterial culture revealed extended-spectrum β-lactamase-producing *Escherichia coli*. The patient was initially treated with piperacillin/tazobactam (2.25 g every 6 h after a loading dose of 4.5 g every 8 h) for 7 days and then switched to ertapenem (1 g/day); however, fever persisted.

The human immunodeficiency virus Ag/Ab combination assay was negative. Furthermore, tests for natural killer cell activity, antinuclear antibodies, and complement components 3 and 4 yielded results within the normal range during the evaluation of fever of unknown origin. These findings permitted the exclusion of malignant and autoimmune diseases. Results from a whole blood

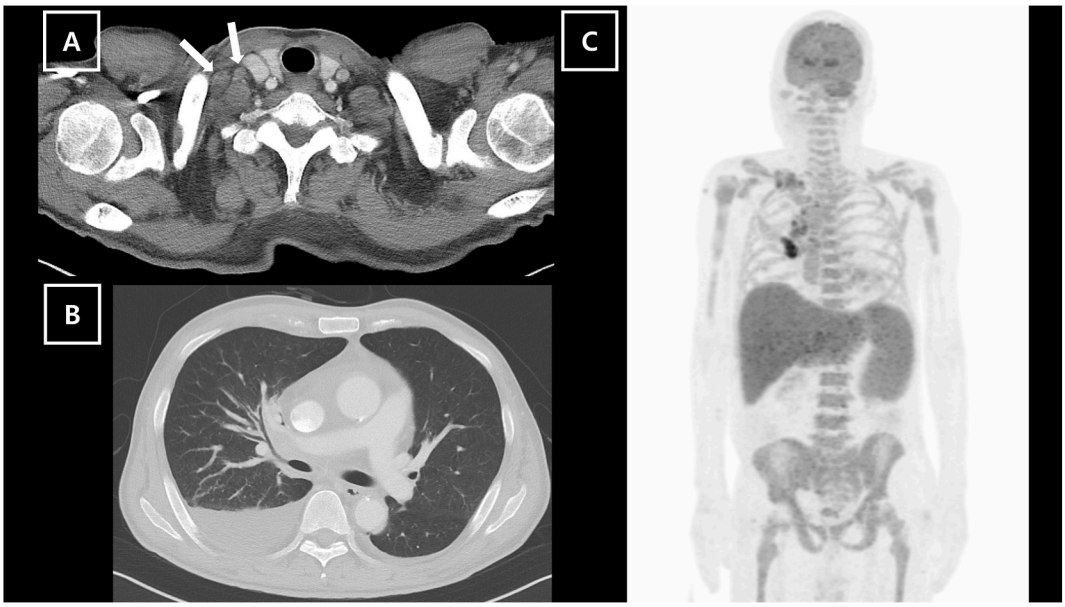

Fig. 1. A: On the 17th day of hospitalization, chest computed tomography (CT) revealed lymphadenopathy in the right supraclavicular (arrow). B: A chest CT also showed patchy consolidation in the right upper lobe with right pleural effusion. C: On the 31st day of hospitalization, positron emission tomography (PET) CT showed enlarged lymph nodes in the right supraclavicular area and mediastinum with hypermetabolism and a hypermetabolic consolidation in the right lung.

interferon-gamma (IFN-γ) release enzyme-linked immunosorbent assay (ELISA) (QIAGEN, Hilden, Germany) using an automated ELISA system (Dynex DS2, Dynex Technologies, Chantilly, VA, USA) were indeterminate owing to lack of a mitogen response (phytohemagglutinin). Abdominal computed tomography (CT) revealed choledocholithiasis and splenomegaly measuring 15.8 cm. On the 12th day of hospitalization, the patient continued to experience intermittent febrile episodes, reaching a peak of 39.1 °C. On the 17th day of hospitalization, chest CT showed multiple enlarged and conglomerated lymph nodes in the paratracheal, right perihilar, and right supraclavicular areas with patchy consolidation in the right upper lobe and right perihilar bronchovascular interstitial and interlobular septal thickening, which suggested lymphoma or central lung cancer and metastasis as differential diagnoses (Fig. 1A and B). On the 22nd day of hospitalization, laboratory findings were as follows: hemoglobin level of 7.7 g/dL, white blood cell count of 11,930/μL (neutrophil 89 %, myelocyte 1 %, band neutrophil 8 %, lymphocyte 1 %, and monocyte 1 %), platelet count of 498,000/μL, C-reactive protein level of 170.63 mg/L, procalcitonin level of 1.43 μg/L, blood urea nitrogen level of 20.4 mg/dL, creatinine level of 1.38 mg/dL, aspartate aminotransferase level of 34 IU/L, alanine aminotransferase level of 12 IU/L, total bilirubin level of 1.34 mg/dL, lactate dehydrogenase level of 377 IU/L, and serum β2-microglobulin level of 5.8 mg/L. On the 27th day of hospitalization, bronchoscopy, endobronchial ultrasonography, and transbronchial needle aspiration of the mediastinal lymph nodes were performed.

On the 31st day of hospitalization, whole-body F18 fluodeoxyglucose (FDG) positron emission tomography/CT revealed enlarged lymph nodes in the right supraclavicular and mediastinal regions with hypermetabolic consolidation in the right lung with increased FDG uptake (Fig. 1C). CD4 count, immunoglobulin levels, and neutralizing activity of anti-INF autoantibodies were not evaluated. An in-depth evaluation of immune deficiencies, including antibody deficiency, neutrophil disorders, and T-cell deficiency, was not feasible within the constraints of our clinical setting.

Endobronchial ultrasonography, transbronchial needle aspiration from the mediastinal lymph node, and fine-needle aspiration (FNA) cytology of the supraclavicular mass revealed grade 2+ AFB on Ziehl–Neelsen staining. Real-time PCR results for NTM (AdvanSure TB/NTM real-time PCR kit; LG Chem, Seoul, Korea) were positive. Ultrasound-guided core needle biopsy and histopathological evaluation of an enlarged lymph node in the right supraclavicular region revealed the presence of numerous neutrophils (Fig. 2). Real-time PCR for NTM was also positive in the AFB-positive tissues. Based on the results of species identification and antimicrobial susceptibility testing, an empirical therapeutic regimen comprising clarithromycin (500 mg every 12 h), ethambutol (1200 mg every other day), and levofloxacin (500 mg every other day) was initiated to treat the NTM infection.

Clinical specimens were inoculated in Ogawa medium (Shinyang, Seoul, Korea) and a mycobacterial growth indicator system (BD BACTEC MGIT 960 Mycobacteria Culture System; BD, Franklin Lakes, NJ, USA) was used for mycobacterial culture. Tuberculosis myobacteria and NTM in positive specimens were differentiated using the MPT 64 Ag test (SD Bioline Kit, Standard Diagnostics, Yongin, Korea). Positive NTM isolates were sent to the Korean Institute of Tuberculosis for species identification and antimicrobial susceptibility testing. Two weeks later, FNA pus culture was positive for *M. kansasii*. NTM species identification was performed using the AdvanSure Mycobacteria GenoBlot assay (LG Chem) and 16S rRNA and *rpoB* sequencing as per Clinical and Laboratory Standards Institute guideline MM18-ED2 [8].

AFB cultures of the urine and sputum specimens tested positive for NTM. However, AFB culture was not conducted on the blood samples. During the hospitalization period, as many as 14 blood culture tests to detect bacteria related to cholangitis and sepsis were performed until a day before death. Antimicrobial susceptibility testing was conducted using the reference broth microdilution method for slow-growing NTM [9,10]. The minimum inhibitory concentration (MIC) values were analyzed using Muller–Hinton broth in polystyrene 96-well plates containing drugs in two-fold increasing concentrations (μg/mL). Subsequent culture susceptibility testing reported susceptibility to clarithromycin, amikacin, moxifloxacin, rifampicin, ethambutol, and linezolid, with MIC values of ≤1, ≤2,

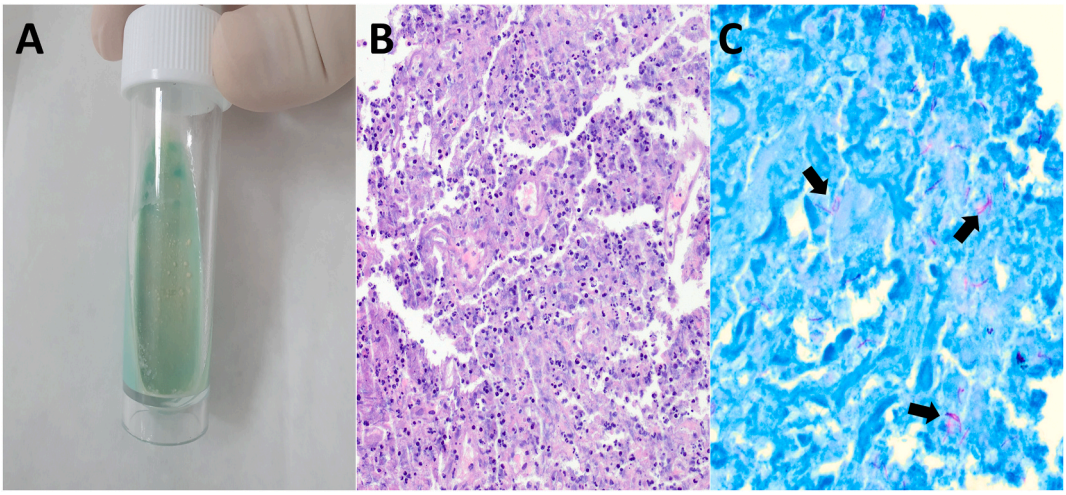

Fig. 2. A: After 2 weeks, dry, yellow colonies of *Mycobacterium kansasii* were observed on 2 % OGAWA medium. B: Hematoxylin and eosin staining of lymph node obtained by needle biopsy showed the necrotic material, including karyorrhectic debris, and numerous neutrophils were observed (original magnification: × 200). C: Ziehl–Neelsen staining revealed positive bacilli (black arrow) (original magnification: × 400).

≤0.125, ≤0.25, ≤2, and ≤1 mg/mL, respectively, and intermediate susceptibility to ciprofloxacin and doxycycline with an MIC of 2 mg/mL (Table 1). These findings confirmed the diagnosis of disseminated NTM infection in the lungs, kidneys, and lymph nodes.

On the 36th day of hospitalization, which was the 5th day after starting the NTM treatment, the patient complained of abdominal pain and fever, which seemed indicative of acute cholangitis. In addition to antibiotics against *M. kansasii* infection, other types of antibiotics besides piperacillin/tazobactam, such as carbapenems and tigecycline, were administered intermittently until death due to biliary tract infection. Laboratory findings revealed total and direct bilirubin levels of 8.0 and 4.2 mg/dL, respectively. Additionally, the patient presented with an alkaline phosphatase level of 241 IU/L and a gamma-glutamyl transferase level of 69 IU/L, indicating cholestasis. Abdominal ultrasonography suggested cholangitis due to mild extrahepatic duct dilatation, with slight wall thickening of the distal common bile duct. Although choledocholithotomy and endoscopic retrograde cholangiopancreatography were performed, the patient's condition rapidly deteriorated, leading to multiorgan failure and ultimately resulting in his death, before species-level identification of the mycobacterial isolate could be performed.

3. Discussion

To our knowledge, this is the first reported case of disseminated *M. kansasii* infection involving the lungs, kidneys, and multiple lymph nodes, mimicking lymphoma, in an adult patient without any evidence of immunodeficiency. Our patient presented with clinical manifestations of lymphoma and died prematurely from septic shock during the diagnosis of a severe *M. kansasii* infection.

Although disseminated *M. kansasii* infection was eventually diagnosed in this case, treatment failed because the diagnosis was established too late, and the patient suddenly developed septic shock with multiorgan failure resulting from cholangitis with choledocholithiasis in the common bile duct. We could not establish whether the *M. kansasii* infection caused the biliary tract infection because *M. kansasii* could not be isolated from bile culture. Disseminated *M. kansasii* infection usually occurs in children, and rarely appears as a non-specific symptom in adults with normal immunity. A diagnosis of *M. kansasii* infection in adults can be delayed because of a lack of clinical suspicion, which delays AFB-culture testing of clinical specimens. Additionally, *M. kansasii* is a slow-growing bacterium requiring an incubation period of more than 7 days (up to 6 weeks) for identification.

This case suggests a novel clinical presentation of a disseminated *M. kansasii* infection in an adult patient in the absence of any diagnosed immunodeficiency. The predisposing factors for *M. kansasii* infection demonstrate the multifaceted nature of conditions that can facilitate disease onset [11]. Recently, immunodeficiency caused by neutralizing anti-INF-γ-autoantibodies with severe disseminated mycobacterial infections has become an emerging medical issue, especially in Southeast Asia [12]. Neutralizing anti--INF-γ-autoantibodies interfere with the upregulation of TNF-α and interleukin-12 expression and inhibit the expression of INF-γ-inducible genes [13]. Performing this test in patients with disseminated NTM infection can provide important information for follow-up care. Neutralizing anti-INF-γ-autoantibodies could not be assessed in our patient. However, the QuantiFERON-TB Gold assay, showing subnormal responses to mitogens, may serve as a screening tool for anti-IFN-γ Ab activity [14]. Recent reports have suggested that these patients often have a history of co-infections such as herpes zoster or salmonellosis, although a history of co-infection was not established in this case [12,15]. The elimination of other diseases that reduce functional immunity is difficult. Hence, we could not identify any clear causes of the indeterminate outcome of the mitogen stimulation test or lymphopenia. Nonetheless, we successfully differentiated immunosuppressive disease from fever of unknown origin (FUO) in this case.

In our patient, the disseminated *M. kansasii* infection initially mimicked the typical clinical manifestations of lymphoma. Disseminated infections are characterized by the simultaneous involvement of at least two non-contiguous body organs via the blood or lymph system. Bacteremia with mycobacteria other than *M. avium* complex is rare. Although *M. kansasii* grows slowly, the development of lung lesions and the rapid deterioration of the condition are noticeable during diagnosis. Therefore, opportunistic infections by pathogens such as *M. kansasii* should be considered as a possible cause of FUO in immunocompetent patients, particularly when the usual microbiological cultures test negative and there is no response to general antibiotic treatment.

Genitourinary infections caused by NTM have rarely been reported and their pathogenesis is poorly understood [16]. The abnormal

Table 1
Antimicrobial susceptibility testing for *Mycobacterium kansasii* isolate.

Antibiotics	MIC (mg/mL)	Interpretation
Clarithromycin	≤1	S
Amikacin	≤2	S
Moxifloxacin	≤0.125	S
Linezolid	≤1	S
Streptomycin	2	NI
Ciprofloxacin	2	I
Doxycycline	2	I
Clofazimine	≤0.25	NI
Trimethoprim/Sulfamethoxazole	1/19	S
Minocycline	1	S
Rifampicin	≤0.25	S
Rifabutin	≤0.25	S
Ethambutol	2	NI

Footnotes. I, intermediate; MIC, minimum inhibitory concentration; NI, no Clinical and Laboratory Standards Institute interpretive guidelines for this antibiotic; R, resistant; S, susceptible.

chest radiograph in our case suggested a UTI resulting from hematogenous spread from the pulmonary site of the primary infection. Previous studies have demonstrated that urinary NTM infections can occur after surgical intervention with subsequent contamination in patients with normal chest radiographs [17]. Kidney involvement, which is easily missed, should be actively identified by assessing the extent of the infection.

Microbiological evidence is critical for accurate diagnosis and appropriate treatment of *M. kansasii* infections. However, performing AFB staining or culture for early detection of disseminated NTM infections is challenging. Furthermore, conventional AFB staining cannot distinguish NTM from *M. tuberculosis*, culturing is time-consuming, and PCR tests for NTM may yield false-negative results. Aggressive diagnostic workups, such as biopsies, are recommended for immunocompetent patients with lymph nodes to diagnose infections with unusual pathogens, such as NTM, before the infection disseminates.

Currently, clear evidence-based guidelines are lacking for the specific treatment of disseminated *M. kansasii* infections, and no guidelines are available for the evaluation of the need for lymph node resection in children. Additionally, identifying the optimal duration of antibiotic use remains challenging. Rifampicin and macrolide combination therapy appears reasonable, with the potential addition of ethambutol [18,19]. However, caution should be exercised regarding the local epidemiology of antimicrobial resistance in patients with NTM. Our patient presented with abnormal liver function test results upon admission and was administered levofloxacin, a second-line agent for the treatment of NTM infections and a substitute for rifampicin.

We comprehensively reviewed eight cases of disseminated *M. kansasii* infections that occurred in adults without a significantly immunocompromised status, including this case (Table 2) [20–26]. The mean age was 64.6 years and 62.5 % of the patients were male. *M. kansasii* is found in diverse visceral organs including the lungs, lymph nodes, spleen, liver, and bone marrow (Table 1). The prognosis of disseminated *M. kansasii* infection is poor, with a mortality rate of 37.5 %. The most common treatment regimens were isoniazid, rifampin, and ethambutol, which were dependent on identifying NTM species such as *M. kansasii* (Table 2).

4. Conclusion

Disseminated NTM infection is rare but may occur with clinical manifestations resembling lymphoma or disseminated tuberculosis in adults without diagnosed immunodeficiency. Early diagnosis to prevent fatalities requires a high index of suspicion, a multidisciplinary approach, and rapid intervention.

CRediT authorship contribution statement

Soo Hyun Park: Writing – original draft, Formal analysis, Data curation. **Jin Woong Suh:** Data curation. **Jeong Yeon Kim:** Data curation. **Yeseul Kim:** Data curation. **Sun Bean Kim:** Data curation. **Jang Wook Sohn:** Data curation. **Young Kyung Yoon:** Writing – review & editing, Writing – original draft, Validation, Supervision, Formal analysis, Data curation, Conceptualization.

Ethics statement

This case report was approved by the Institutional Review Board of Korea University Anam Hospital (IRB number: 2023AN0278). Written informed consent was obtained from the patient to publish the case details and accompanying images.

Consent for publication

Written informed consent for publication was obtained from the patient. There are no identifiable images or other personal or clinical details of the patient that compromise anonymity in this manuscript.

Table 2
Clinical characteristics and outcomes of reported *Mycobacterium kansasii* infection in adults that were not significantly immunocompromised.

Patient no.	Sex/age (year)	Comorbidities	Infection sites/clinical disease	Anti-NTM Tx. regimens	Outcomes	Reported year [Reference]
1	M/63	ESRD, T2DM, HTN	Multiple lumbar, pre-aortic, mediastinal LNs, liver, granuloma, gastric juice, skin	INH, RFP, EMB	Dead	1993 [17]
2	F/79	None	Disseminated skin lesion, mediastinal LN	INH, RFP, EMB	Recovered	2001 [18]
3	F/80	None	Blood	NA*	Dead	2006 [19]
4	M/71	None	Pleural effusion, abscess	No treatment	Dead	2006 [19]
5	F/26	None	Vertebral osteomyelitis, sacroiliitis, psoas abscess, Bone marrow, liver granuloma, spleen abscess	INH, RFP, EMB	Recovered	2006 [20]
6	M/74	DM, alcohol abuse	Brain, periportal, retroperitoneal, mediastinal LN	INH, RFP, EMB	Recovered	2007 [21]
7	M/67	Hypothyroidism	Neck, peri-nodal soft tissue, lung, joint, peritoneum	INH, RFP, EMB	Recovered	2014 [22]
8	M/57	None	Disseminated skin lesion, mediastinal LN	INH, RFP, EMB	Recovered	2017 [23]

Footnotes. DM, diabetes mellitus; EMB, ethambutol; ESRD, end-stage renal disease; HTN, hypertension; INH, isoniazid; LN, lymph node; NA, not applicable; RFP, rifampin; T2DM, type 2 diabetes mellitus.

Data availability statement

Further information can be provided by the corresponding author upon request.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:Young Kyung Yoon reports financial support was provided by Korea Health Industry Development Institute. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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