

Case Report

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Rising Non-Tubercular Chronic Respiratory Diseases

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Background: Chronic Respiratory Disease (CRDs) remain the leading causes of prevalence, mortality, and DALY worldwide. Most general population and even some primary care medical practitioners across the world are unaware of some non-tuberculous organisms causing mostly chronic lung infections, challenging early diagnosis for want of Culture and sensitivity facilities and needing long term management. They include Pseudomonas Aeruginosa (PA), Non tuberculous organisms (NTOs- bacteria & mycobacteria), and fungus etc. The most common such organisms include Pseudomonas Aeruginosa (PA), MAC- Mycobacterium avium complex and Aspergillus Niger, Aspergillus Fumigatus, and Mucor Mycosis, which are ubiquitously present in the environment, but cause diseases infrequently. Most people worldwide especially in the developing world are aware of Pulmonary Tuberculosis (PTB), its consequences, needing long term treatment, poor compliance leading to drug resistant and long drawn struggle in few cases.

Materials and Methods: This article is sharing of authors experience of the opportunities of learning in last 4 years, based on three rare cases of Non-TB Chronic Pulmonary infection cases the author was consulted. Supported by literature search this article describes the challenges of diagnosis and management even in tertiary care institutes in India.

Results: One case each of Pseudomonas Aeruginosa (PA), Mycobacterium avium complex recovered after a treatment of 2-3 months and third case of Covid Associated Mucor mycosis case died despite a week's struggle in one of the best tertiary care hospitals.

Conclusion: All these organisms are less virulent than Mycobacterium tuberculosis, but they cause diseases in both immunocompromised and immunocompetent hosts. As compared to tuberculosis, person-to-person transmission does not occur usually. Risk factors for these chronic respiratory diseases include diabetes, immunocompromised conditions like HIV/AIDs Corticosteroid therapy among hospitalized Covid 19 cases, Professional exposure to infected utensils, equipment's, fruits, and vegetables. Indoor air pollution often caused by cooking with solid fuels, tobacco smoking (including second-hand smoke), air pollution, allergens, and occupational risks and Outdoor air pollution are the common causes. Apart from standard culture and sensitivity tests, rapid molecular tests, AI based lung image studies and detecting fragments of NTM DNA in the bloodstream, are now available for confirmation of the diagnosis at species and subspecies level now a days.

Keywords: x ray; cardiomegaly; chest diseases; pseudomonas aeruginosa

Introduction

Chronic Respiratory Disease (CRDs) remain the leading causes of prevalence, mortality, and DALY worldwide, two billion people are infected with tuberculosis (TB), with 10.6 million becoming ill each year leading to 1.3 million deaths each year [1]. In 2019, 454.56 million individuals worldwide had a CRD, an increase of 39.8% compared to 1990. Deaths due to CRDs were 3.97 million, and DALY in 2019 was 103.53 million. COPD, with 212.3 million cases, was the primary cause of deaths from CRDs, accounting for 3.3 million deaths. With 262.4 million prevalent cases, asthma had the highest prevalence among CRDs. The age-standardized rates of all burden measures of COPD, asthma, and pneumoconiosis have reduced globally from 1990 to 2019 [2]. The age-standardized rates of incidence and prevalence of interstitial lung disease and pulmonary

sarcoidosis have increased throughout this period. Low- and low-middle SDI countries had the highest age-standardized death and DALYs rates of CRDs. The highest deaths and DALYs from CRDs were attributed to smoking globally, followed by air pollution, water, and soil pollution responsible for daily edible items like fruits and vegetables contamination and occupational risks. Non-optimal temperature and high BMI were additional risk factors for COPD and asthma, respectively [1,2]. Globally most people and more so Indian's fear Tuberculosis (TB) Infections for centuries basically due to long term treatment, stigma of seeking care in public sector through district TB program, forbidding cost in private sector and risk to other family members. TB infection affects lungs, bones, meninges, and other organs of the human body resulting mostly in chronic infections but occasionally acute infections. However, there are other causes of

chronic infections like i) Some people's body is too weak to fight infection (an antibody deficiency), ii) A structural damage to the lung (bronchiectasis) and iii) the infection caused by a difficult organism (Pseudomonas, a mycobacterium or aspergillus fungus) [3]. Very few people and even primary care medical practitioners across the world are unaware of some non-tuberculous organisms (NTOs) bacteria, mycobacteria, fungus etc. like PA (Pseudomonas Aeruginosa), MAC (Mycobacterium avium complex) and Fungi (Aspergillus Niger, Aspergillus Fumigatus, and Mucor Mycosis), which are ubiquitously present in the environment, but their diseases occur infrequently. All these organisms are less virulent than Mycobacterium tuberculosis, but they can cause diseases in both immunocompromised and immunocompetent hosts. As compared to tuberculosis, person-to-person transmission does not occur except with M. abscessus among cystic fibrosis patients. The lung is the most involved organ. NTO infections may involve extrapulmonary sites such as lymph nodes, skin, sinuses, soft tissues and rarely bones. Culture of the organisms and drug sensitivity test, Rapid molecular tests are now available for confirmation of the diagnosis at species and subspecies level [3,9,10,11]. The high death and DALYs rates in low and low-middle SDI countries highlights the urgent need for improved preventive, diagnostic, and therapeutic measures. Global strategies for tobacco control, enhancing air quality, reducing occupational hazards, and fostering clean cooking fuels are crucial steps in reducing the burden of CRDs, especially in low- and lower-middle income countries. Therefore, this article is a call for converting National Strategic Plans for TB Elimination to National Plans for CRD Elimination.

Case Reports

Pseudomonas Aerogenes Pulmonary Infection

Purnima aged about 54 years, was having cough for over 4 weeks in Hubballi, Karnataka and approached a local physician in the first week of October 2023. After a detailed history taking, which revealed that she had pulmonary Tuberculosis contact in her teenage as her father was known pulmonary TB case and had developed resistance to common drugs due to irregular treatment and died of the same. Her

occupation of professional cooking, in environment not necessarily clean always, history of significance included cracks and fissures in the soles and subclinical hypothyroidism leading to bilateral cellulitis of both legs treated with broad spectrum antibiotics in March 2022, gives a clue of her risk for her high risk for Pseudomonas Aeruginosa exposure and susceptibility of infections. After the Basic general examination completion, she was prescribed & got done a battery of tests on 6 October 2023.

Key results

1. X Ray Chest: Showed Mild Cardiomegaly, No other abnormalities.
2. The sputum examination for Acid Fast Bacilli was negative.
3. CBC: Normal ranges in Parenthesis
 - Hemoglobin: 11.9 gm% (11.5 - 17.5 gm%)
 - Total W. B. C.: 13,400 cells/cmm, (4000 - 11000 cells/cmm)
 - Absolute Neutrophil Count: 8,800 (2000 - 7000) cells/cumm
 - Absolute Lymphocytes Count: 3,900 (1000 - 3000 cells/cumm) cells/cumm
 - M. C. V.: 81.8 fL (82 - 100 fL), f) M. C. H.: 26.4 pg (27 - 34 pg)
 - Platelet Count- M.P.V.: 6.5 fL (7 - 11 fL),
 - P.D.W-SD: 8.3 fL (9 - 17 fL)
 - P-LCR: 7.9 % (11 - 45 %),
 - P-LCC: 24 30 - 90
 - E.S.R (Westergren method): 68 mm at 1 hr. (0 - 20) mm at 1 hr.
 - Random Blood Sugar: 110.0 mg/dl (80 - 160 mg/d)
 - m) Blood Urea: 19 mg/dl (15 - 45 mg/dl) (Method: UREASE-GLDH)
 - Serum Creatinine: 0.86 mg/dl (0.4 - 1.4 mg/dl), Method: Jafe's
 - Serum Uric Acid: 3.7 mg/dl (2.5 - 6.2 mg/dl), Method: Uricase-Trinder
4. Urien Routine (including microscopy): Except Epithelial Cells: 2-3 Cells/HPF & Pus Cells: 3-4 Cells/HP, nothing significant.
5. SPECIMEN SPUTUM, AFB - Smear examination by ZN stain, Negative for Acid Fast Bacilli
6. SPUTUM for Culture and sensitivity: Culture yields: ORAL COMMENSALS ISOLATED.



Figure 1: X Ray Chest

Sputum culture & sensitivity

Types of Culture

Bacterial Aerobic Culture.

Gram stain

> 25 pus cells / lpf, < 10 epithelial cells / lpf, few Gram-positive cocci in pairs, and few Gram-negative bacilli seen. Final Report: Heavy growth of *Pseudomonas aeruginosa* in culture. Methodology: Kirby Bauer disc diffusion method

Antimicrobial Susceptibility Test Result as per CLSI guidelines

Organism

Pseudomonas aeruginosa, Antimicrobial Agent Zone Size (mm), MIC ($\mu\text{g/ml}$) & Interpretation

Sensitive

Amikacin 24 Sensitive, Ciprofloxacin 30 Sensitive, Gentamicin 25 Sensitive, Levofloxacin 29 Sensitive, Meropenem 28 Sensitive, Piperacillin / Tazobactam 28 Sensitive, Tobramycin 25 Sensitive

Negative

Cefepime 16 Resistant, Ceftazidime 16 Resistant

Diagnosis

Chronic inflammation of the lungs due to of *Pseudomonas aeruginosa*

The patient was relieved that she did not have Tuberculosis as her father which was her fear but did not realize the infection, she has bad and needed long term treatment. The patient consulted me for the second opinion in mid-October 2023. After studying all the details and reviewing the sensitivity test and cost of the medicines I put her on Ciprofloxacin 500 mg daily. The medicine from PM Janaushadhalaya costs about INR 37/a strip of 10 tablets per tablet as

against market rate of 50-75/10 tablets. She was asked to consume the drug without an interruption for 2 months and then repeat Xray chest and Sputum Culture & sensitivity. Her cough was reduced after about 2 weeks and the sputum was less. However, she was advised to continue the medicines with an evaluation in December 2023.

A repeat laboratory tests on 01/21/2024 showed the following results

Microbiology

Sample Type

SPUTUM, AFB (Acid Fast bacilli): Negative

Source of Specimen

SPUTUM for Culture and sensitivity: Culture yields: ORAL COMMENSALS ISOLATED, NO *Pseudomonas*. The treatment was stopped from 25 January 2024 and the patient is doing well now.

Note

The author came across 2 more cases of PA infection one on a toe, and timely saving it from amputation, as was done on another toe a year back of same patient and a huge diabetic necrotic Ulcer again a struggle of 10 months has saved the limb advised to be amputated by a surgeon in April 2023 and wound is almost closed now.

A Rare Case of MAC Infection

A middle-aged non-smoker of 45years male attended the District TB Centre attached to a Medical College in Karnataka in 2019. The main complaints were breathlessness and cough with expectoration for last two years and low-grade irregular fever with evening rise of temperature. Two years back, he was diagnosed

as sputum smear positive pulmonary tuberculosis (PTB) in the neighbouring district TB centre and was treated with isoniazid (H), rifampicin (R), ethambutol (E), pyrazinamide (Z) as per the national TB program guidelines. He was declared cured though his symptoms were persisting after 6 months. The sputum became positive again after a year and this time he was treated with streptomycin along with HREZ considering the case as relapse PTB and he completed the course successfully. During the course his sputum for AFB became negative but at the end of the course, sputum became smear positive again. His symptoms persisted throughout the treatment course. He had no history of diabetes mellitus, haematological malignancies or chronic corticosteroid or immunosuppressive therapy. Now he was referred to us as multi drug resistant tuberculosis (MDR TB) suspect. Three sputa samples were taken one for AFB smear examination & another two for mycobacterium culture by MGIT-960 method. The sputa smear examination was positive. Complete blood count, blood glucose level and renal function were normal. HIV test was negative. Mantoux test (5 TU) was positive (induration of 11 mm). Chest x-ray showed left upper zone fibro-cavitary lesion with bi-lateral pseudo-blunting of costophrenic angles. Contrast enhanced computerized tomography (CECT) scan of thorax showed left upper lobe fibro-cavitary lesion. Spirometry revealed moderate airway obstruction with poor bronchodilator reversibility. Culture showed growth of atypical mycobacteria. Species identification revealed growth of *Mycobacterium avium* complex (MAC). As the organism was a slow grower, drug susceptibility test was not done. Then we started oral rifampicin 450 mg and ethambutol 800 mg once daily, oral clarithromycin 500 mg twice daily along with intramuscular streptomycin 500 mg daily. After 3 months of treatment, Streptomycin was stopped. After 6 months of treatment, patient was symptomatically better & culture was negative on two occasions. Rifampicin, ethambutol, and clarithromycin were continued for 1 year after the sputum conversion. Patient came to Chest OPD for follow up annually and is doing fine till his last visit in January 2024.

A rare Case Chronic Pulmonary Mucor Mycosis (PM) in a Diabetic Patient

Arvind a cousin of mine 53-year-old, HIV negative, with poorly controlled diabetes type 2 for over 15 years was taken from Hospice, Vijayanagar District in

Karnataka to the emergency department Tertiary Care private hospital in Hyderabad as his organization had a tie with them in early 2021. Main complaints were cough and shortness of breath or about 2 months, chest x-ray had excluded pneumonia in the local hospital, but was treated with Amoxicillin 500mg BD for a week before referring. At the admission, the patient had diabetic ketoacidosis (Hb1Ac= 12.9 %), severe hypoxemic respiratory failure. Laboratory exams showed leucocytosis and elevation of C-reactive protein. Chest x-ray showed roughly rounded pneumonia located in the upper lobe of the left lung. He was admitted in intermediate care unit under broad spectrum antibiotics. Sputum and blood cultures were drawn; urinary antigens for *Legionella* and *Pneumococcus* were negative. After 3 days of admission, he developed fever, hoarseness, and haemoptysis. On the fourth day, despite being hemodynamically stable and having good glycaemic control, the patient continued to be feverish, with hoarseness and still needing oxygen. Repeated chest x-ray showed pneumonia progression and associated left upper lobe atelectasis. Neck and thoracic CT scan revealed lung consolidation in the left upper lobe, small bilateral pleural effusion and excluded abscesses, solid masses, or apparent laryngeal recurrent nerve involvement. Flexible bronchoscopy revealed left bronchial necrosis and mucosal infiltration. There was no bacterial or fungi growth in sputum, bronchial secretions, bronchoalveolar lavage fluid or blood cultures. Pulmonary biopsy identified fungal hyphae, but no further characterization was possible. Pulmonary fungi infection, namely lung aspergillosis, were considered, and high dose amphotericin B treatment was immediately started (5 mg/kg/day). After day five of antifungal therapy, the patient had sudden and progressive clinical worsening with persistent fever and hoarseness and increasing oxygen demands. Vancomycin and meropenem were added to amphotericin B admitting possible nosocomial bacterial lung infection. Pan-fungal quantitative RT-PCR of the second pulmonary biopsy identified Rhizomic species from the *Mucor* genus, allowing the diagnosis of pulmonary mucormycosis. Head and brain MRI excluded rhino cerebral mucormycosis. Unfortunately, the patient died of massive haemoptysis seven days after the definitive diagnosis.

Discussions

Pseudomonas aeruginosa (PA) is a ubiquitous Gram-negative bacterium commonly encountered in the environment and readily cleared by host defenses. While, to healthy individuals it does not harm, but PA being a formidable opportunistic pathogen can cause invasive and fulminant infections, such as acute pneumonia or bloodstream infections, in immune compromised hosts either due to sub-clinical hypothyroidism, HIV infections or patients under corticosteroid therapy for any medical condition. Chronic PA infections thus result from a dynamic and complex interplay between pathogen and host, where bacteria persist without causing overwhelming host injury, and host defenses fail to eradicate the pathogen. Chronic lung infection in individuals with the genetic cystic fibrosis (CF) disease, a large genome encodes many regulatory genes involved in sensing environmental signals, controlling expression of virulence factors, metabolism, and resistance mechanisms [4]. *Pseudomonas aeruginosa* is a bacterium that's commonly found in the environment, for example in soil and water. It can be spread to people through contaminated surfaces, hands, and equipment. Some healthy people even have strains of it growing on their skin in moist parts of their body, like their armpits or genital area called a *Pseudomonas* infection. *Pseudomonas aeruginosa* can be found in- Drains and plumbing parts, Household cleaning products, Hospital or clinic equipment, Water and Soil. In India *Pseudomonas* infection is not uncommon in health care settings, among professional cooks, temporary cooking places like marriages, fairs, festivals etc. due to contaminated surfaces, hands, utensils, and equipment. Many people in good health do not get sick from it. Some people get a mild skin rash or an ear or eye infection. But among people with weakened immune systems, *pseudomonas* can cause a severe infection. In people with cystic fibrosis, cancer, or burns, it can be life-threatening. One can get *pseudomonas* infections from eating contaminated food as it can grow on fruits and vegetables, in moist areas like pools, hot tubs, bathrooms, kitchens, and sinks as the organism thrives in such places. It is one of the top causes of infections people get from being in hospitals as *Pseudomonas aeruginosa* easily grows in humidifiers, catheters, etc. if that aren't properly cleaned. If health care workers don't wash their hands well, they can also transfer the bacteria from an infected patient to another person [4]. The risk of *pseudomonas* infection goes up if health care provider gets a wound from surgery are being treated for burns, use a

breathing machine, catheter, or other medical device, have diabetes or cystic fibrosis, and have any disorder that weakens your immune system, such as HIV, Cancer, or Chemotherapy for Cancers etc. *Pseudomonas* infections can infect any part of our body, such as our blood, throat, lungs, stomach, urinary tract, or tendons. Pressure sores, wounds, and burns can also become infected. The signs and symptoms depend upon the places where infection occurs signs include

Ears

pain and discharge, Throat-Chronic Sore throat, Skin: rash, which can include pimples filled with pus, Eyes: pain, redness, swelling,

Bones or joints

joint pain and swelling; neck or back pain that lasts weeks,

Wounds: -green pus or discharge that may have a fruity smell,

Digestive tract

headache, diarrhea,

Lungs

pneumonia; severe coughing & congestion, Urinary: urinary tract infections. Fever is a sign of a severe *pseudomonas* infection [4].

Diagnosis

Pseudomonas aeruginosa is detected from a sample of our blood or sputum (as was done in our case report), or another body fluid by culture and sensitivity tests in the laboratories, which also in identifying which antibiotics will work best to cure the infection.

Treatment

For a mild infection, a course of antibiotics helps as it did in our case report. Depending on the site of the infection it could be in the form of a cream, eye drops or ear drops, or pills you take by mouth. A severe infection may need intravenous infusion of antibiotics. In most case the treatment requires 8-10 weeks of antibiotics therapy. Laboratory research in India shows that Ciprofloxacin, Levofloxacin, Meropenem, Piperacillin Gentamicin, Tobramycin, and Amikacin, Cefprozime, Imipenem, Cefepime-beta-lactams (BLI) inhibitor combinations and Meropenem are sensitive to PA organisms, and resistant to Cefepime and Ceftazidime as was shown in our case report.

Preventing a *Pseudomonas* Infection

Following simple actions can lower the risk of getting sick by avoiding *Pseudomonas Aeruginosa* type of nasty bacteria

Washing hands often, by all health professionals, Professional cooks working in unclean or temporary environment.

“Rinse or give a good wash-Vegetables, Fruits and Salads before eating”, as these organisms survive on them. Clean water bottles, sterilize with boiling water in between uses. Pseudomonas will thrive in pools and hot tubs, avoid using them unless they're cleaned often, and the chlorine and pH are well-controlled. The treatment lasts long, up to 2-3 months, take it exactly as prescribed. Don't skip a dose till the repeat blood (or any other body fluid) culture reveals no organisms. After surgery, keep watching for signs of infection. A fever, pain, or redness or discharge at your surgery site, consult right away.

Outcomes of a Pseudomonas Infection?

In most cases, antibiotics clear a PA infection in about 2-3 months. If one course of antibiotics doesn't completely get rid of the bacteria, may need to take them regularly to keep the infection under control. It is extremely hard for people with cystic fibrosis to beat the infection. It is the leading cause of death for people with the disease.

Mycobacterium avium complex infections (MACIs)

NTM infections continue to surge annually, fueled by climate change-driven shifts from subtropical to temperate regions. MACIs occur in both immunocompetent and in immunosuppressed patients. *M. avium* is the most frequent organism in HIV, and immunosuppressed patients, about 40% of pulmonary infections in immunocompetent patients, can be due to *M. intracellulare*. *M. avium* is not transmitted from person to person; MAC organisms usually enter the body through contaminated food and water however, and inhalation of aerosolized droplets containing *M. avium* cells. Most of the patients with NTM are misdiagnosed and are treated as tuberculosis in India, sometimes with a multidrug resistance regimen, which results in significant morbidity and mortality. NTM involves lungs mainly (60%), skin and soft tissue (17%), joint (11%), genitourinary (6%), and central nervous system (6%). History of immunosuppression may be present in about 10% of cases, whereas history of some form of intervention will be there in one thirds of patients. In India *Mycobacterium fortuitus* is the most isolated organism, followed by *Mycobacterium avium* complex, *Mycobacterium abscessus*, *Mycobacterium Kansai*, and *Mycobacterium Chelone*. In some patients, the combination of these bacteria may be

isolated i.e., *M. chelone* and *M. abscessus*. Of these 18 patients. Clinical response is observed in over 80% of the patients. Diagnosis and treatment of NTM in resource limited settings is extremely challenging. The newly developed blood test specifically targets *Mycobacterium avium* complex (MAC), the most prevalent type of NTM responsible for pulmonary diseases, has raised a big hope for simple and early diagnosis [5].

COVID-19-associated Mucormycosis (CAM)

Mucormycosis is a comprehensive term that includes a variety of infections caused by filamentous fungi belonging to the class Glomeromycota as per the revised classification. The favorable condition for establishment of mucormycosis includes neutropenia, immune deficiency, organ transplantation, significantly higher levels of iron in plasma, and in Covid 19 infections worldwide in 2020-2022 and other co-morbidities. Prior to Covid 19 pandemic the incidence of CAM in India was attributed to increased incidence of diabetes mellitus in India, which is an important risk factor for emergence of CAM [3]. Since 2020 studies across the world increased incidence of CAM in COVID-19 patients is attributed to hypoxic conditions created by pulmonary tissue damage by SARS-CoV-2, increased use of steroids, acidic conditions created by ketoacidosis and inflammation induced hyperserotonemia [6,7]. The degree of severity of CAM infection depends on region of body infected, degree of immune suppression, age and other co-morbidities present in patients. The mean time interval between COVID-19 diagnosis and emergence of CAM was found to be 15 days, however mucormycosis developed in patients up to 90 days post infection with COVID-19. Rhino-orbital mucormycosis is the most prevalent type of clinical presentation affecting patients with Diabetes, malignancy, solid organ, or hematopoietic stem cell transplant. Pulmonary mucormycosis is the second most widespread infection among different clinical presentations of mucormycosis. Inhalation of sporangiospores in immune compromised patients seems to be the primary cause of pulmonary infections. Cutaneous mucormycosis, Gastrointestinal mucormycosis and Disseminated and miscellaneous mucormycosis is the most severe variety. The diagnosis of mucormycosis depends on the location of the suspected patient, availability of trained personnel, radiological techniques, histological and mycological examination. For

diagnosis, a fluid sample from the patient's respiratory system, a tissue biopsy is taken for laboratory testing; or a CT scan of the patient's infected lungs, sinuses is performed [8]. Pulmonary mucormycosis (PM) is a life-threatening acute condition, but its chronic presentation is rarely seen as was in our case report, becoming fulminating leading to death, suggesting that it has an indolent course in diabetic patients. Therefore, chronicity of symptoms does not rule out PM. Three patients presented at Chest Disease Hospital Srinagar, Jammu and Kashmir infected with CAM have been described with their epidemiological data in supplementary section. All these cases were found to be affected with co-morbidity of Diabetes Mellitus (DM) and were under corticosteroid therapy [8].

Recent Advances in Chronic Lung Infections

Breakthrough Blood Test Offers Rapid Diagnosis of Lung Infections Nontuberculous mycobacteria (NTM) infections, often mistaken for tuberculosis due to similar symptoms, like chronic coughing, scarring, and increased susceptibility to respiratory illnesses like bronchitis and pneumonia. However, diagnosing NTM infections has historically been a slow and challenging process, complicating timely treatment. Researchers from Tulane University have developed a CRISPR-based platform capable of diagnosing NTM infections in just two hours through blood testing. The preliminary findings in the American Journal of Respiratory and Critical Care Medicine demonstrate the tests remarkable accuracy, successfully identifying over 93% of patients with NTM infections. The newly developed blood test specifically targets Mycobacteria avium complex (MAC), the most prevalent type of NTM responsible for pulmonary diseases. By detecting fragments of NTM DNA in the bloodstream, the test bypasses the lengthy culture analysis typically required for diagnosis. With over 190 NTM species complicated identification, this rapid and precise diagnostic tool promises to revolutionize the management of NTM infections, offering hope for faster intervention and improved patient outcomes [9].

AI's Ability to Detect Covid-19 in Lung Ultrasound Images

In a study published in Communications Medicine, artificial intelligence (AI) ability to effectively identify COVID-19 in lung ultrasound images, recent research suggests that the AI system can now analyze ultrasound lung images to detect specific features called B-lines, characterized by bright, vertical

abnormalities indicating inflammation in patients with pulmonary complications. The AI swiftly identifies these crucial indicators by amalgamating computer-generated images with accurate ultrasounds from patients. This was possible as researchers pioneered software capable of learning from a blend of authentic and simulated data accumulated over the last 3 years [8]. It is noted that the tool harnesses the power of deep neural networks, a sophisticated form of AI engineered to mimic the interconnected neurons facilitating pattern recognition, speech comprehension, and other complex cognitive tasks in the human brain. During the initial stages of the pandemic, scientists encountered challenges in employing AI to interpret COVID-19 signals in lung ultrasound images due to insufficient patient data and a developing understanding of the disease's physiological manifestations. This novel tool can also be developed into wearables capable of tracking various illnesses, including congestive heart failure, which shares similarities with COVID-19 in causing fluid overload in the lungs [10, 11].

Conclusion

Non-Tubercular chronic Infections like Pseudomonas Aeruginosa (PA), Non-tuberculosis bacteria & mycobacteria like Mycobacterium avium complex (MAC) and Aspergillus Niger, Aspergillus Fumigatus, and Mucor Mycosis, are ubiquitously present in the environment, their diseases though occur infrequently, have increased since the Covid 19 Pandemic 2020. Their diagnosis depends upon culture and sensitivity tests, therefore, is challenging, though of late new AI based technologies and blood tests are emerging. The treatment is also for long 6-10 weeks and affordability is another challenge. Preventing these nasty infections include i) Washing hands often, by all health care professionals, or Professional cooks working in unclean environment, ii) "Rinse before eating" the fruits and vegetables, as these organisms survive on vegetables and Fruits. The National and State Governments must consider expanding the NSP for TB Elimination & rename it as "National Chronic Respiratory Diseases Elimination Program (NCRDEP- 2025-2030).

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