

Patient with Pulmonary Tuberculosis: A Literature Review

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Abstract

Tuberculosis (TB) is a bacterial disease caused by the bacillus *Mycobacterium tuberculosis* (MTB) [1,2]. It can affect any parts of the body. In 2018, TB has affected about 10 million of the world's population according to World Health Organisation (WHO). In the United Kingdom (UK), there were 5,075 notified cases of TB in the same year [2], 4,655 (91.7%) of which were in England [1]. From the notified cases in England in 2018, 2,664 (57.2%) of those were pulmonary in nature. In this review, available guidelines and literatures were critically analysed and evaluated in relation to a certain patient with smear-negative pulmonary tuberculosis. The patient had weight loss, non-productive cough, night sweats, loss of appetite, and fevers. Lateral right upper zone opacification was found on a chest x-ray (CXR) when the patient was seen by his General Practitioner which led to a referral to the specialist TB team. Computed Tomography (CT) imaging then confirmed bilateral upper lobe consolidation with cavitating lesions. Due to sputum-scarcity, a fiberoptic bronchoscopy was performed for sampling. On smear, acid-fast bacilli (AFB) were not seen; however, MTB had been detected using the Rapid MTB Polymerase Chain Reaction test (i.e. Gene Xpert TB PCR) and Rifampicin gene had not been detected. Active TB treatment was then commenced with Rifampicin, Isoniazid, and Pyrazinamide and Ethambutol. Final culture results came back 18 days after which confirmed a fully sensitive MTB organism. The patient was counselled regarding the medications, side effects and even possible adverse reactions. Health education regarding TB and TB infectivity had been discussed with the patient. Usage of mask was not recommended. Importance of adherence to treatment regimen to prevent antibiotic resistance was reiterated. As a vital healthcare role, contact tracing was done. There was a continuous professional commitment and connection between the team and the patient which really helps with treatment progression. Questions were answered with compassion, honesty and evidenced-based healthcare guidelines and protocols.

Keywords: *Pulmonary Tuberculosis; Mycobacterium tuberculosis (MTB); World Health Organisation (WHO)*

Introduction

According to World Health Organisation (WHO), in 2018, about 10 million of the world's population has been affected by tuberculosis (TB) (2019a). This has been relatively stable during the last few years and remains to be an epidemiological burden [2].

In the United Kingdom (UK), there were 5,075 notified cases of TB in the same year [2], 4,655 (91.7%) of which were in England [1]. For England, it was an enormous 56.2% reduction from its peak in 2011 with 8,280 cases [3]. With the continued decline in incidence, this has been the lowest rate with 8.2 cases per 100,000 population which is below the WHO definition of 10 per 100,000 threshold for a low incidence country [1,2].

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From the notified cases in England in 2018, 2,664 (57.2%) of those were pulmonary in nature. Over a quarter (29%, 772 cases) of whom, also had extrapulmonary disease in at least one other site [1], as the disease could affect more than one physiological location [2].

In this paper, a certain patient with smear-negative pulmonary tuberculosis would be explored. Verbal consent has been sought, and the patient was informed of the usage of his health information in this paper [4]. He is then referred to as Ric as his pseudonym throughout the discussion to respect his right to privacy and confidentiality [4].

Aim of the Study

The aims of this review are:

- To assess for signs and symptoms of a patient with pulmonary TB;
- To examine the available diagnostic procedures which aid in distinguishing pulmonary TB;
- To identify the different medications being utilized in treating pulmonary TB;
- To outline psychosocial support, infection control measures, and education in relation to pulmonary TB;
- To explore the current guidelines used in different literatures and the guidelines used in the UK; and,
- To critically evaluate the application of these guidelines to a real-life scenario.

Method

For this review, Healthcare Databases Advanced Search (HDAS) was utilised to explore articles related to tuberculosis. Online databases of CINAHL, PubMed, Medline, EMBASE, and EMCARE were searched using keywords such as “tuberculosis”, “pulmonary tuberculosis”, “tuberculosis diagnosis”, “tuberculosis management”, and “tuberculosis medications”. Boolean operators such as “AND”, “OR” and “NOT” were utilised to delineate relevant and irrelevant concepts. Some data were taken from pertinent sources and organisations such as World Health Organisation (WHO), Public Health England (PHE) and Centers for Disease Control and Prevention (CDC).

Discussion

Clinical assessment

Tuberculosis is a bacterial disease caused by the bacillus *Mycobacterium tuberculosis* (MTB) [1,2]. It usually affects the lungs which has the typical symptoms of persistent cough for at least 3 weeks, fever, drenching night sweats, unexplained weight loss, and loss of appetite [1,2]; however, the tubercle bacilli could also infect other body sites such as the lymph nodes (glands), the bones and the brain which have organ-specific symptoms and can lead to serious complications [1].

Ric is a 45-year old gentleman who had a history of weight loss of approximately 14 kilograms over the last 12 months, and a non-productive cough, night sweats, loss of appetite, and fevers in the last 4 weeks [1,2]. He has never been a smoker. At the time being, he is working as a Store Manager. He was born and brought up in the Philippines and moved to the UK at the age of 21. There is no family history of TB or any other personal history of TB. He has no past medical history and no known drug allergies.

Clinical diagnosis

Ric sought medical attention from his General Practitioner about 11 months after the initial symptoms. During the initial health consult, lateral right upper zone opacification was found on a chest x-ray (CXR) [5,6]. Computed Tomography (CT) imaging confirmed bilateral upper lobe consolidation with cavitating lesions [5]. A fiberoptic bronchoscopy was then arranged to determine any infective aetiology [7].

With bronchoscopy as a safe and highly reliable method especially for sputum-scarce patients, samples can be taken and be tested for mycobacteria [7,8]. Apart from sampling hilar and mediastinal lymph nodes, histological and real-time Polymerase Chain Reaction (PCR) tests can also be performed on those samples taken which improves the diagnostic yield [7].

However, acid-fast bacilli (AFB) demonstration in bronchoscopic samples might depend on the staining method. For example, in a study by Bodal., *et al.* [8] in which bronchoscopic samples were obtained from bronchoalveolar lavage (BAL), bronchial brushings, bronchial washings and post bronchoscopic sputum from 75 patients with suspected TB, it was found out that fluorescent stain yielded 73.33% AFB positivity from all samples while Ziehl-Neelsen (ZN) only yielded 29.3%. In Ric's sample, auramine phenol fluorescent staining was initially performed and the result was then confirmed through ZN staining. This had improved the sensitivity and the specificity result as, according to Chhina, Gupta and Chawla [9] auramine staining is more sensitive while ZN staining is more specific.

On microscopic (or smear) examination, AFB were not seen on bronchial washings taken from Ric; however, MTB had been detected using the Rapid MTB PCR test (i.e. Gene Xpert TB PCR) and Rifampicin gene had not been detected. The presence of Rifampicin gene is a marker of strains that are multi-drug resistant. This means that Ric's TB is drug-susceptible. Detection of TB on rapid PCR is paramount for early diagnosis and initiation of treatment [10-12]. Eighteen days after, culture results had confirmed a fully sensitive MTB organism (sensitive to Rifampicin, Isoniazid, Ethambutol, Pyrazinamide, Streptomycin, Aminoglycosides, and Quinolones).

Treatment

Prompt initiation of treatment is paramount to prevent the disease process in getting extensive, thereby preventing multi-drug resistant TB as well. However, this is much difficult especially for low-income or the developing countries with minimal resources which lead to gaps in the TB care cascade [11]. On the other hand, National Institute for Care and Health Excellence (NICE) recommended that commencement of treatment should not be delayed even though culture results are not available yet especially when clinical features or histology results indicate tuberculosis (2019). Moreover, negative culture results should not be the basis for the discontinuation of treatment [13].

Ric had then been started on active TB treatment following the TB PCR detection [10-12]. The treatment would be for a minimum of 6 months depending on progress and symptom relief [13,14]. Rifater (Rifampicin, Isoniazid, and Pyrazinamide) and Ethambutol for the first 2 months as the initial phase of treatment. The continuation phase of treatment for the next 4 months includes Rifinah (Rifampicin and Isoniazid). Doses are dependent on weight. A cover of Pyridoxine for the whole course of treatment was also prescribed to prevent peripheral neuropathy as an adverse effect [13].

Physiological and psychosocial support

Health education regarding TB and TB infectivity is crucial towards prevention of both infection and stigma [15]. Usage of mask is not recommended by WHO [15]. Together with his family, Ric was given reassurance that TB is highly curable and that the one he has is not infectious; hence, he could not pass it on to someone else. He can do his usual day-to-day activities without any changes to be done, except that he needs to take his medications in the morning, about 30 - 60 minutes before his breakfast [13].

Ric has been educated regarding the importance of adherence to treatment regimen to prevent antibiotic resistance. Counselling had also been done regarding side effects and adverse reactions related to TB medications and as to how and when to report them. Side effects include orange-coloured urine, dry skin, loss of appetite, itchiness, nausea and vomiting. On the other hand, liver impairment, anaphylaxis and blurred vision are considered as adverse reactions [13]. TB Team contact details had been provided.

There is a continuous professional commitment and connection between the team and the patient which really helps with treatment progression. Ric had many questions which were answered with compassion, honesty and evidenced-based healthcare guidelines and protocols.

Infection prevention and control

Effective handwashing is still the universal first line of defence against any infection. Health-promoting behaviours such as respiratory hygiene (i.e. cough etiquette) should be reiterated [15]. Contact tracing is a vital healthcare role as well to identify at-risk individuals, thus preventing the spread of infection [16].

Conclusion

Therefore, a prompt healthcare consultation, as well as appropriate screening and referral for symptomatic individuals, are vital towards early detection and treatment of TB. Imaging tests are still the standard primary investigative tool being used; however, they have less diagnostic yield for TB detection. With the emerging bronchoscopy-guided diagnostic techniques (i.e. Gene Xpert TB PCR), better and rapid pulmonary TB diagnosis has now become a trend especially for those sputum-scarce or sputum-negative patients [10-12]. Infection prevention and control measures, including contact tracing, are of utmost significance to prevent the spread and outbreaks of TB [16]. Ric's symptoms are now improving; his recent CXR shows reduction in the peripheral rounded shadowing in the right upper lobe. He is currently on his fifth month of anti-tuberculous medications.

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