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Original Article

Evaluation of Pulmonary Tuberculosis Using High Resolution Computed Tomography (HRCT): A Cross Sectional Study

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ABSTRACT

Mycobacterium is an airborne organism that spreads from person to person. Tuberculosis can affect any area of the body, although the lungs are the most commonly affected known as pulmonary tuberculosis. **Objective:** To evaluate pulmonary tuberculosis using High Resolution Computed Tomography. **Methods:** It was a cross-sectional study conducted at the private sector hospital Gujrat, Pakistan. This study was conducted over 4 months from December 2021 to March 2022. The sample size of 91 patients was calculated via a convenient sampling approach from previously published articles. Patients who were diagnosed with TB during CT scan investigation presented at the study area were included after informed consent. A specially crafted data collection sheet was developed to contain the patient demographic statics. **Results:** The upper age limit occurrence of 36(39.6%) was observed in people aged 21 to 30 years, and the lowest occurrence of 7(7.7%) was observed in those aged under 21 years. Males composed 53% of the population, while females constituted 38%. (41.8 percent). The highest proportion of cough was 43 (47.3 percent), and the lowest frequency of weight loss was 14 (15.4 percent). The nodule incidence is 30(33%) and the LAP incidence is 6 (6.6 percent). **Conclusion:** Pulmonary tuberculosis was more prevalent among younger male individuals. The primary characterization among pulmonary tuberculosis patients was nodules, cavity, consolidation, and tree in bud shown on HRCT.

INTRODUCTION

Tuberculosis remains a major cause of death in less developed countries where populations are dense and sanitation standards are inadequate [1,2]. During 2011, 8.7 million of people infected tuberculosis (TB), with 1.4 million of them died as a direct result [3]. T.B in low- and bottom third countries, mortality accounts for over 95% of T.B deaths. According to WHO, it is now one among the top three leading causes of death among women aged 15 to 45. Tuberculosis is caused by bacteria which including M.tuberculosis, M.bovis, M.microti, M.africanum, and M.canettii [4,5]. Mycobacterium is an airborne organism that spreads from person to person. Tuberculosis can be treated and avoided [6]. Tuberculosis can affect any area of the body, although the lungs are the most commonly affected and creating a type of tuberculosis known as pulmonary tuberculosis [7]. Post-primary TB, also known as reinjection tuberculosis, is the most frequent form of active infectious diseases in adults [8]. Extra pulmonary TB occurs when tuberculosis develops outside of the lungs. In up to 33% of instances, other organs (liver, kidney, pancreas, brain or lymph nodes, spleen) are impacted [9]. Tuberculosis is defined as either latent or active. In Latent tuberculosis, you have a tuberculosis infection, but the bacteria remain dormant in your body and create no symptoms [10]. An educated guess One-third of the worldwide people has TB Disease [11]. Inactive tuberculosis you will become ill as a result of this illness, which can also spread to others [12]. It's possible It could happen within the first several weeks after contracting the tuberculosis germs, or it could happen later years down the

road [13]. The majority of infections are asymptomatic and latent, but around one-third of them are not [14]. A tiny fraction of latently infected people (5 to 10%) reactivate their infection during the course of their lives, resulting in active illness (reactivation) A persistent cough either with hematuria, body weight, chills with difficulties sleeping, and widespread malaise are the most obvious signs of active pulmonary TB [16]. Delays in diagnosing active cases of pulmonary tuberculosis add to the disease's burden, and these delays can be caused by a variety of factors [17]. TB can mimic many other diseases clinically and radiologically, such as pneumonia, cancer, and interstitial lung disorders; nevertheless, the yield of sputum smears is still low, and the findings take a few days to arrive [18]. Although new radiological cultures take roughly two weeks to generate new knowledge and are not accessible in every facility [19]. Culture for mycobacterium TB, which is the gold standard in diagnosing TB, takes up to 6 weeks for sure results [20]. As a result of the challenges in diagnosis, the patient's isolation is delayed; increasing the chance of transmission of infection and the severity of the illness worsening. A lung imaging is required for the first examination of PTB. Regression, enlarged lymphocytes, pulmonary edema, and extra - pulmonary nodules on imaging are all symptoms of primary TB. Apical consolidation, nodules, and cavitation are hallmarks of post-primary TB [22]. HRCT is a useful adjunct to chest X-rays in tuberculosis diagnosis, and it is more effective than chest radiographs in identifying and defining moderate histologic disease or mediastinal lymphadenitis [23]. Although sputum culture for acid-fast bacilli is the "standard method" for pulmonary TB diagnosis, computed tomography's greater sensitivity may allow early detection in tuberculosis patients with normal or equivocal radiographic abnormalities [24]. This study's goal was to show that HRCT is more accurate than a chest x-ray at detecting small granulomatous lesions and minor or concealed parenchymal illness, and measuring disease activity in patients with pulmonary tuberculosis. This study validates the clinicians about accuracy of HRCT for effective evaluation of pulmonary tuberculosis.

METHODS

It was a cross-sectional study conducted at the private sector hospital Gujrat, Pakistan. This study was conducted for 4 months from December 2021 to March 2022. The sample size of 91 patients was calculated via a convenient sampling approach from previously published articles [25-27]. Patients who were diagnosed with TB during CT scan investigation were included after informed consent. A specially crafted data collection sheet was developed to contain the patient demographic statics. The patients' demographic statistics were collected on a specially designed data collecting sheet. SPSS version 20.0 was used for data entry and analysis.

RESULTS

Table 1 shows that upper age limit occurrence of 36(39.6%) was observed in people aged 21 to 30 years, and the lowest occurrence of 7(7.7%) was observed in those aged under 21 years.

Age of patient	Frequency	Percent
<21	7	7.7
21-30	36	39.6
31-40	22	24.2
41-50	26	28.6
Total	91	100.0

Table 1: Frequency distribution of patient age

Table 2 shows that males made up 53 percent of the population, while females made up 38 percent (41.8 percent).

Gender	Frequency	Percent
Female	38	41.8
Male	53	58.2
Total	91	100.0

Table 2: Frequency distribution of patient gender

Table 3 shows the highest proportion of cough was 43 (47.3 percent), and the lowest frequency of weight loss was 14 (15.4 percent).

Presenting complain	Frequency	Percent
Cough	43	47.3
Fever	19	20.9
chest pain	15	16.5
weight loss	14	15.4
Total	91	100.0

Table 3: Frequency distribution of presenting complain

Table 4 shows HRCT finding that the nodule incidence is 30(33%) and the LAP incidence is 6 (6.6 percent).

HRCT Findings	Frequency	Percent
Nodules	30	33.0
Cavity	21	23.1
Consolidation	19	20.9
tree-in-bud	15	16.5
LAP	6	6.6
Total	91	100.0

Table 4: Frequency distribution of HRCT findings

DISCUSSION

Mycobacterium (TB) is a viral infectious agent in the tuberculosis complex. Bacteria such as M. TB, M. Bovis, M. Microti, M. Africanum, and M. Canettii cause tuberculosis. A descriptive inter research was carried out in the private sector hospital Gujrat. Patients who were diagnosed with tuberculosis after a Tomography investigation and appeared at the research site during the course of the study were included. In the current study, the age is distributed in four groups, a maximum age frequency of 36(39.6%) is seen in 21-30 years and a minimum frequency

of 7(7.7%) is seen in less than 21 years. Patients above the age of 65 are at a higher risk of contracting tuberculosis, according to a prior cross-sectional study published in 2020 by Rasheed et al. and a prospective observational study published in 2017 by Raj et al, [27, 28]. In the present study the frequency of male is 53(58.2%) and frequency of female is 38(41.8%). Males have a high chance to be affected by tuberculosis as declared by an observational study by Raj et al, in 2017 and Rasheed et.al study which is published in 2020 conducted at a large tertiary care teaching hospital [28]. The current study shows a maximum frequency of cough 43(47.3%) and a minimum frequency of weight loss. Another previously published paper by Rasheed et.al in 2020 has similar results which show that TB patients are commonly affected by cough [27]. In the current study 4 maximum frequency of nodule 30(33%) and a minimum frequency of LAP 6(6.6%). Similar results were shown by Raj et.al in 2017, concluded that nodule 63(63%) was the most common feature in HRCT findings [28]. Another previous cross-sectional study by Ahmed et.al which is published in 2019 also concluded that there were nodules in 17 (34%) patients, cavity in 13 (26%) patients, consolidation in 10 (20%) patients, Tree Bud in 7 (14%) patients, and lymphadenitis in 3(6%)[23].

CONCLUSION

According to the findings of this study, pulmonary tuberculosis was more prevalent among younger male individuals. Nodules, cavity, accumulation, and Tree in Bud were the most common pulmonary TB symptoms. HRCT can discriminate between active from inactive disease with greater sensitivity and whenever tuberculosis is suspected clinically, HRCT is advised for diagnosis confirmation and activity determination.

REFERENCES

[1] Sulis G, Roggi A, Matteelli A, Raviglione MC. Tuberculosis: epidemiology and control. Mediterranean journal of hematology and infectious diseases. 2014 Nov; 6(1):e2014070. doi: 10.4084/MJHID.2014.070.

[2] Oppong JR, Mayer J, Oren E. The global health threat of African urban slums: the example of urban tuberculosis. African Geographical Review. 2015 May; 34(2):182-95. doi.org/10.1080/19376812.2014.910815

[3] Glaziou P, Falzon D, Floyd K, Raviglione M. Global epidemiology of tuberculosis. InSeminars in respiratory and critical care medicine 2013 Feb; 34(01):003-016. Thieme Medical Publishers.

[4] Via LE, Weiner DM, Schimel D, Lin PL, Dayao E, Tankersley SL, et al. Differential virulence and disease progression following Mycobacterium tuberculosis complex infection of the common marmoset (Callithrix jacchus). Infection and immunity. 2013 Aug; 81(8):2909-19. doi: 10.1128/IAI.00632-13.

[5] Reddington K, O'Grady J, Dorai-Raj S, Maher M, van Soolingen D, Barry T. Novel multiplex real-time PCR diagnostic assay for identification and differentiation of Mycobacterium tuberculosis, Mycobacterium canettii, and Mycobacterium tuberculosis complex strains. Journal of clinical microbiology. 2011 Feb; 49(2):651-7. doi: 10.1128/JCM.01426-10.

[6] Cambier C, Falkow S, Ramakrishnan L. Host evasion and exploitation schemes of Mycobacterium tuberculosis. Cell. 2014 Dec; 159(7):1497-509. doi: 10.1016/j.cell.2014.11.024.

[7] Nachiappan AC, Rahbar K, Shi X, Guy ES, Mortani Barbosa Jr EJ, Shroff GS, et al. Pulmonary tuberculosis: role of radiology in diagnosis and management. Radiographics. 2017 Feb; 37(1):52-72. doi: 10.1148/rg.2017160032.

[8] Hunter RL. Tuberculosis as a three-act play: A new paradigm for the pathogenesis of pulmonary tuberculosis. Tuberculosis. 2016 Mar; 97:8-17. doi: 10.1016/j.tube.2015.11.010.

[9] Khusro A, Aarti C. Extrapulmonary tuberculosis: An overview on infection beyond Lungs. World News of Natural Sciences. 2020;28.

[10] Behr MA, Kaufmann E, Duffin J, Edelstein PH, Ramakrishnan L. Latent tuberculosis: two centuries of confusion. American Journal of Respiratory and Critical Care Medicine. Med. 2021 Jul; 204(2):142-148. doi: 10.1164/rccm.202011-4239PP.

[11] Cohen A, Mathiasen VD, Schön T, Wejse C. The global prevalence of latent tuberculosis: a systematic review and meta-analysis. European Respiratory Journal. 2019 Sep; 54(3):1900655. doi: 10.1183/13993003.00655-2019.

[12] O'Garra A, Redford PS, McNab FW, Bloom CI, Wilkinson RJ, Berry MP. The immune response in tuberculosis. Annual review of immunology. 2013; 31:475-527. doi: 10.1146/annurev-immunol-032712-095939.

[13] Orme IM. A new unifying theory of the pathogenesis of tuberculosis. Tuberculosis. 2014 Jan; 94(1):8-14. doi: 10.1016/j.tube.2013.07.004.

[14] Getahun H, Matteelli A, Chaisson RE, Raviglione M. Latent Mycobacterium tuberculosis infection. New England Journal of Medicine. 2015 May; 372(22):2127-35. doi: 10.1056/NEJMra1405427.

[15] Ford CB, Lin PL, Chase MR, Shah RR, Iartchouk O, Galagan J, et al. Use of whole genome sequencing to estimate the mutation rate of Mycobacterium tuberculosis during latent infection. Nature genetics.

2011 May; 43(5):482-6. doi: 10.1038/ng.811.
[16] van't Hoog AH, Meme HK, Laserson KF, Agaya JA, Muchiri BG, Githui WA, et al. Screening strategies for tuberculosis prevalence surveys: the value of chest radiography and symptoms. PloS one. 2012; 7(7):e38691. doi: 10.1371/journal.pone.0038691.
[17] Lee C-H, Lee M-C, Lin H-H, Shu C-C, Wang J-Y, Lee L-N, et al. Pulmonary tuberculosis and delay in anti-tuberculous treatment are important risk factors for chronic obstructive pulmonary disease. PloS one. 2012; 7(5):e37978. doi: 10.1371/journal.pone.0037978.
[18] Bhalla AS, Goyal A, Guleria R, Gupta AK. Chest tuberculosis: Radiological review and imaging recommendations. Indian Journal of Radiology and Imaging. 2015 Sep; 25(3):213-25. doi: 10.4103/0971-3026.161431.
[19] Bloom CI, Graham CM, Berry MP, Wilkinson KA, Oni T, Rozakeas F, et al. Detectable changes in the blood transcriptome are present after two weeks of antituberculosis therapy. PLoS One. 2012;7(10): e46191. doi: 10.1371/journal.pone.0046191.
[20] Sethi S, Dhaliwal L, Dey P, Kaur H, Yadav R. Loop-mediated isothermal amplification assay for detection of Mycobacterium tuberculosis complex in infertile women. Indian Journal of Medical Microbiology. 2016 Sep; 34(3):322-7. doi: 10.4103/0255-0857.188323.
[21] Molica M, Mazzone C, Cordone I, Pasquale A, Niscola P, de Fabritiis P. SARS-CoV-2 infection anxieties and general population restrictions delay diagnosis and treatment of acute haematological malignancies. British Journal of Haematology. 2020 Jul; 190(1):e5-e8. doi: 10.1111/bjh.16785.
[22] Skoura E, Zumla A, Bomanji J. Imaging in tuberculosis. International Journal of Infectious Diseases. 2015 Mar; 32:87-93. doi: 10.1016/j.ijid.2014.12.007.
[23] Ahmed EEAMN. Characterization of Pulmonary Tuberculosis by Using High Resolution Computed Tomography: Sudan University of Science and Technology; 2019.
[24] Ryu YJ. Diagnosis of pulmonary tuberculosis: recent advances and diagnostic algorithms. Tuberculosis and respiratory diseases. 2015 Apr; 78(2):64-71. doi: 10.4046/trd.2015.78.2.64.
[25] MUSTAFA AMK. Characterization of Tuberculosis Patients Abdomen by Using Ultrasound: Sudan University of Science and Technology; 2015.
[26] Nakanishi M, Demura Y, Ameshima S, Kosaka N, Chiba Y, Nishikawa S, et al. Utility of high-resolution computed tomography for predicting risk of sputum smear-negative pulmonary tuberculosis. European journal of radiology. 2010 Mar; 73(3):545-50. doi: 10.1016/j.ejrad.2008.12.009.
[27] Rasheed W, Qureshi R, Jabeen N, Shah HA, Khan RN. Diagnostic Accuracy of High-Resolution Computed Tomography of Chest in Diagnosing Sputum Smear Positive and Sputum Smear Negative Pulmonary Tuberculosis. Cureus. 2020 Jun; 12(6):e8467. doi: 10.7759/cureus.8467.
[28] Raj S, Mini MV, Abhilash Babu TG. Role of high resolution computed tomography in the evaluation of active pulmonary tuberculosis. 2017; 5(1): 20819-23. doi.org/10.18535/jmscr/v5i4.175