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OCCURRENCE OF TUBERCULOSIS IN ANTI-HIV POSITIVE PATIENTS BETWEEN 2010 AND 2020 IN BRAZIL A SYSTEMATIC REVIEW

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Abstract: **Objectives**: To carry out a literature review on the occurrence of co-infected patients with tuberculosis and anti-HIV positive in the period from 2010 to 2020 in Brazil. **Methodology**: This study is a literature review, using the bibliographic databases MEDLINE, PUBMED, SciELO and BVSalud, with the keywords "tuberculosis", "anti-HIV", "prevalence". Studies from controlled and randomized clinical trials, observational, systematic reviews, and meta-analysis were selected. The inclusion criteria used were the date of publication, between 2010 and 2020, types of study and language. Inclusion criteria were applied freely and independently by two reviewers. **Results**: TB-HIV co-infection is common but extremely harmful. The populations most prone to TB infection are males, indigenous people, people deprived of liberty, people living with the human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), homeless people and health professionals. The diagnosis is based on clinical anamnesis and physical examination, radiological, bronchoscopic and laboratory tests and ADA dosage. The treatment must be carried out concomitantly in order to establish the therapeutic goal. **Conclusion**: The treatment of TB-HIV co-infection must be done concomitantly to obtain an effective cure combined with the adoption of public policies aimed at reducing vulnerable environments that predispose to co-infection.
Keywords: "Tuberculosis"; "Anti-HIV"; "Prevalence".

INTRODUCTION

Tuberculosis is an infectious, chronic, endemic and universal disease, which can be stratified into pulmonary and extrapulmonary caused by *Mycobacterium tuberculosis* or Kock's bacillus (BK) (GUSSO, 2018). Pulmonary tuberculosis can be further classified into primary, secondary and miliary. Tuberculosis of extrapulmonary causes, on the other hand, occurs from the affected target organs and is often associated with anti-HIV positive patients. Its transmission takes place through the air by aerosols, therefore, it is transmitted through speech, sneezing or coughing (CORRÊA DA SILVA et. al., 2012).

The *Mycobacterium tuberculosis* is an aerobic intracellular parasitic microorganism, which stimulates an autoimmune reaction in the host, thus causing the appearance of a delayed-type hypersensitivity (cell-mediated), and exhibits structural and staining characteristics of an acid-alcohol resistant bacillus (AFB). Once inhaled, they can contaminate a first time (primary tuberculosis) or a subsequent time (secondary). This way, the microorganism will cause lung damage and, over the course of three to eight weeks, the symptoms may attenuate and disappear - more frequently - in the case of a non-progressive primary tuberculous infection, or the symptoms increase with progressive clinical worsening, and may include the severe miliary form of the disease and meningitis. Since then, the tuberculin reaction will remain positive as long as there are live and viable bacilli in the host tissues. In secondary tuberculosis - which manifests itself obligatorily in adult individuals - the evolution of the disease is due to bacilli that caused a first infection and persisted in the tissues, or in individuals who already had the primary infection and who inhale the bacilli again, and become if infected again (CORRÊA DA SILVA et. al., 2012).

It is known that tuberculosis is a secular disease and its first records date back to 5,000 years BC, according to archaeological evidence in Egyptian mummies. In Brazil, tuberculosis is linked to the colonial, political and social historical past, in which the disease is associated with less favored populations, such as slaves and tenement dwellers, and

consequently with poor living conditions and inefficient basic sanitation or even scarce (FIOCRUZ, 2017).

The Acquired Immunodeficiency Syndrome (AIDS) is an autoimmune disease of global, dynamic and unstable proportions, which emerged in the 1980s, resulting from individual and collective human behavior. (BRITO et al., 2001). At the beginning of the epidemic, the most affected population were homosexuals and bisexuals, but as the decades went by, there was a change in the categories of transmission, thus increasing cases among heterosexuals, at a rate of 6.6% in 1988, to 39.2% in 1998 (BRITO et. al., 2001).

AIDS is caused by the human immunodeficiency virus (HIV), a retrovirus with an RNA genome, from the Retroviridae Family (retroviruses) and subfamily *Lentivirinae*. Belonging to the group of cytopathic and non-oncogenic retroviruses that need, in order to multiply, an enzyme called reverse transcriptase, responsible for transcribing the viral RNA into a DNA copy, which can then integrate into the host genome. The HIV virus then compromises the immune response by inhibiting CD4+ T lymphocytes that are responsible for cellular immunity, responding to host aggression. When this response is very intense, there may be cell dysfunction or apoptosis (KUMAR et. al., 2013).

The transmission of AIDS is multifactorial, that is, it can occur through different ways, such as sharing syringes, vertical transmission (congenital), breastfeeding, accidents with infected needles and sharp objects, transfusion of contaminated blood and sexual intercourse without using it. of condoms (BVSMS, 2017).

Regarding the association between tuberculosis and anti-HIV positive patients, it must be considered that tuberculosis is the main cause of death among patients living with HIV and is responsible for one third of AIDS-related deaths. According to the Joint United Nations Program on HIV/AIDS (UNAIDS) Brazil, in 2018, approximately 10 million people developed tuberculosis and, 9% of this total, were anti-HIV positive (UNAIDS, 2020). Among the most vulnerable populations listed by the Ministry of Health - Brazil, are indigenous people, those deprived of liberty, people living with HIV/AIDS (PLWHA) and homeless people, who have a higher risk of falling ill from tuberculosis, in the proportion of 3 times greater, 28 times greater, 35 times greater and 44 times greater, respectively (GUSSO, 2018).

The objective of the present study is to carry out a literature review on the occurrence of co-infected patients with tuberculosis and anti-HIV positive in the period from 2010 to 2020 in Brazil.

METHODOLOGY

This is a literature review study using the search strategy, the following combinations of keywords: tuberculosis and anti-HIV, tuberculosis and prevalence, tuberculosis and HIV positive. Studies published in English or other languages were analyzed for the period between 2010 and 2020, using the MEDLINE, PUBMED, SciELO and BVSalud databases as reference. The studies with the greatest scientific evidence were selected, contemplating only studies of controlled and randomized clinical trials, observational, systematic reviews, and meta-analysis. The inclusion criteria used were the date of publication, between 2010 and 2020, types of study and language. Inclusion criteria were applied freely and independently by two reviewers.

To illustrate the data obtained, information on confirmed cases of TB/HIV co-infection was also collected by the Information System for Compulsorily Notifiable Diseases and Injuries (SINAN) of the Unified Health

System Database (DATASUS), for the period 2010 to 2020.

Rates were calculated by dividing the number of cases by the exposed population per 100,000 people.

Figure 1 presents a flowchart of the selected studies.

RESULTS AND DISCUSSION

After a careful analysis of the literature, it can be inferred that the rate of TB-HIV co-infection in Brazil does not exceed the margin of 5% per 100,000 inhabitants, although the rate is low, it represents one third of deaths from tuberculosis, according to the studies that will be presented below.

Figure 2 represents the descriptive analysis of the data obtained from SINAN-DATASUS, showing the TB-HIV co-infection rates between 2010 and 2020. It is observed that between 2011 and 2014 the TB/HIV co-infection rates were very close to 5% and there was a drop in 2020.

The result of the literature review will be presented in topics:

EPIDEMIOLOGY

Tuberculosis remains the leading cause of death among people living with HIV, accounting for about one in three AIDS-related deaths. According to a survey by UNAIDS Brazil, about 10 million people developed tuberculosis in 2018, and approximately 9% of this total were anti-HIV positive people. Due to this high incidence, even anti-HIV positive patients who are asymptomatic for tuberculosis must maintain preventive therapy in order to reduce the risk of mortality by approximately 40%. And it is estimated that about 44% of co-infected patients (tuberculosis and anti-HIV positive) are unaware of the condition, and therefore do not receive prophylactic treatment (UNAIDS, 2020).

According to *Figure 3*, it is possible to verify the number of cases of co-infection of Tuberculosis and HIV positive are relatively constant however, according to the study of the infection rate present in *Figure 2*, it remains below 5%, perhaps this is due to efforts Ministry of Health through the National Tuberculosis Control Program (PNCT). This Federal Government program aims to improve epidemiological surveillance to increase the detection of new cases, increase cure rates and reduce treatment abandonment, developing educational actions in health, communication and social mobilization, at the national, state and municipal levels, with a focus on health promotion, prevention, assistance and rehabilitation, and carrying out an annual epidemiological assessment and providing feedback to services with the dissemination of results for the purpose of reprogramming treatment. In addition to the goals established by the PCNT to be disseminated throughout the national territory, among them are: maintaining the annual detection of at least 70% of estimated TB cases, correct treatment of 100% of diagnosed cases of tuberculosis and cure at least 85% of the total number of cases and maintain treatment abandonment within percentages considered acceptable (5%). Brazil is committed to eliminating tuberculosis through the "Plano Brasil Livre da Tuberculosis" published in 2017 by the Federal Government. The plan was created by the Ministry of Health, with the participation of state and municipal managers, academia and civil society. In addition, it was submitted to public consultation and approved by the Tripartite Interagency Commission (CIT) (BVSMS, 2020).

RISK FACTORS

Due to the application of the inclusion criteria, all the other studies correlating the TB-HIV co-infection and the risk factors were

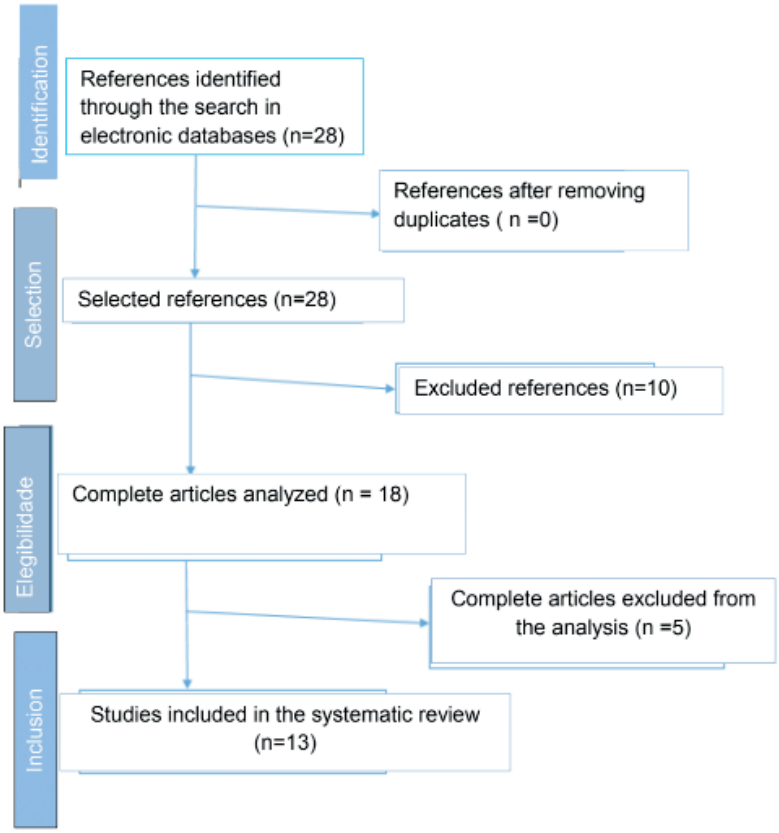

Figure 1 - Flowchart of selection of systematic review articles

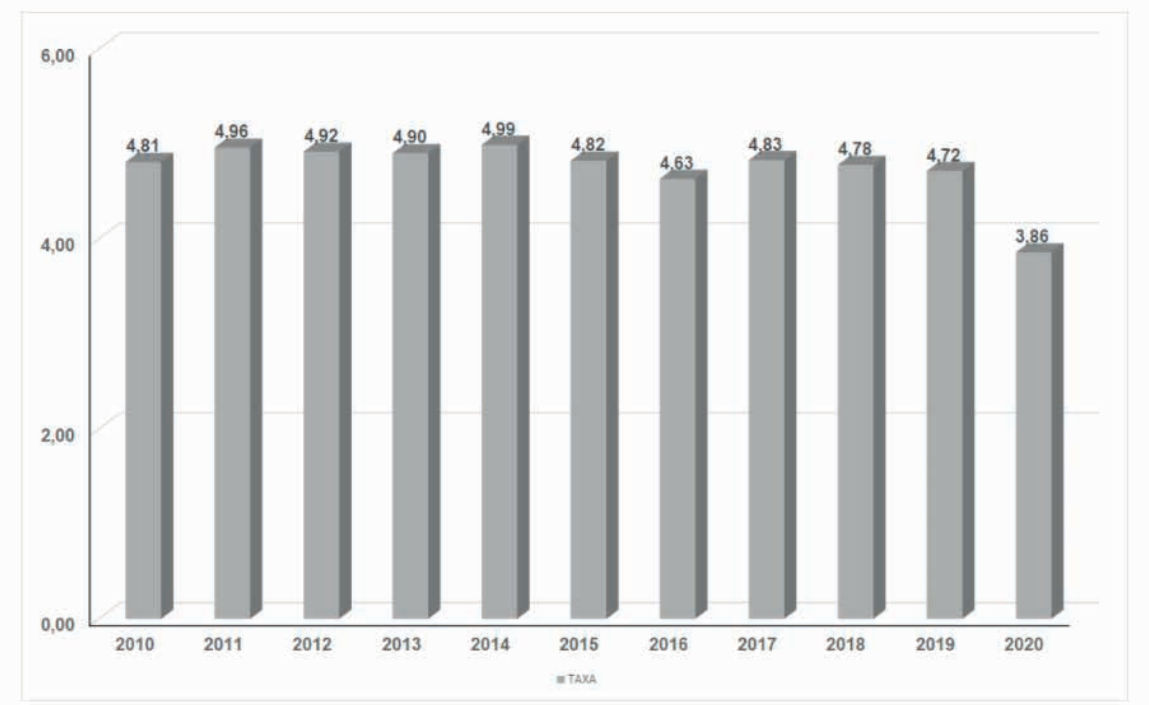

Figure 2 - TB-HIV co-infection rate in Brazil between the years 2010 to 2020

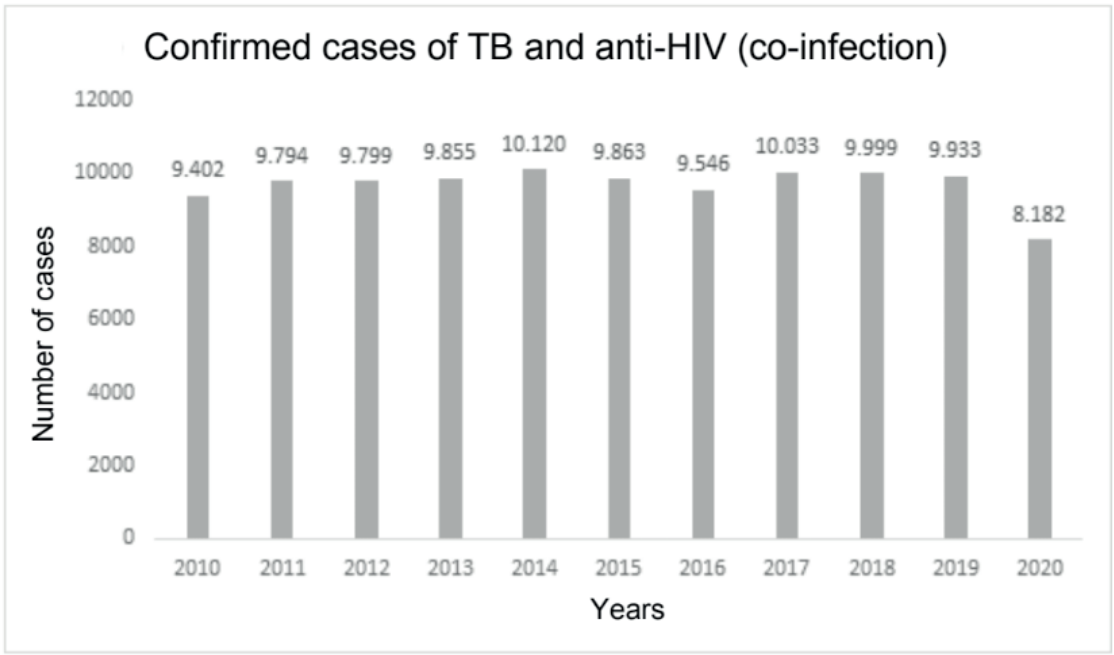

Figure 3 - Confirmed cases of Tuberculosis (TB) associated with positive anti-HIV notified in the Notifiable Diseases Information System (SINAN) – DATASUS

Region (number of countries)	HIV testing in persons with TB	Integration of HIV counseling and testing in TB services	Integration of TB screening in HIV services	Preventive therapy for PLHIV (IPT)	Antiretroviral therapy provision in TB clinics	TB treatment in antiretroviral therapy settings	TB infection control in HIV health care settings	Integration of ART and TB treatment
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Caribbean (16)	100.0[a] (13)	76.9[a] (10)	76.9[a] (10)	93.8 (15)	40.0[b] (6)	66.7[b] (10)	76.9[a] (10)	76.9[a] (10)
Latin America (17)	100.0 (17)	93.8[c] (15)	94.1 (16)	100.0 (17)	5.9 (1)	70.6 (12)	81.3[c] (13)	76.5 (13)
All LAC (33)	100.0[e] (30)	86.2[d] (25)	86.7[e] (26)	97.0 (32)	21.9[f] (7)	68.8[f] (22)	79.3[d] (23)	76.7[e] (23)

Source: Prepared by the authors based on indicators extracted from the UNAIDS Global AIDS Monitoring database.
Integration of services includes both total and partial integration.
(n) Numerator
[a] Information available for 13 countries
[b] Information available for 15 countries
[c] Information available for 16 countries
[d] Information available for 29 countries
[e] Information available for 30 countries
[f] Information available for 32 countries

Figure 4 - Integrated health services and policies for TB/HIV

SOURCE: MORENO et. al., 2020

dated before the year 2010. Therefore, after an extensive search, only the article by the author Moreira et was found et al, 2019.

The populations most prone to TB infection are indigenous people, those deprived of liberty, people living with the human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), homeless people and health professionals. Since the risk factors associated with TB/HIV/AIDS co-infection include socioeconomic, clinical, diagnostic and follow-up aspects (MOREIRA et. al., 2019).

The TB/HIV binomial interferes in the diagnosis, treatment and cure of TB patients, as antiretroviral treatment is started from the diagnosis, which can interfere with the treatment of TB, as both treatments must be started together. Antiretroviral therapy (ART) decreases the lethality of the disease, but early initiation during TB treatment increases the risk of adverse events related to anti-TB and anti-HIV drugs and paradoxical reactions (MOREIRA et. al., 2019).

The high lethality rate of TB/HIV co-infection occurs as a result of several factors, such as the failure of the immune system to stop the growth of Mycobacterium tuberculosis, leading to rapid progression of the disease. The extrapulmonary form of the disease is more recurrent in patients co-infected with HIV, and they have low rates of positivity in sputum smear microscopy, delaying the diagnosis (MOREIRA et. al., 2019).

According to a study carried out in Minas Gerais between 2006 and 2015, among the notified cases, the majority were male, residing in the urban area, aged between 18 and 49 years, with up to eight years of study and who declared themselves to be black, brown or indigenous. The prevalence of HIV/AIDS among people with tuberculosis was 9.4%, with young adults (30 to 49 years old) being the main targets of the TB/HIV/AIDS epidemic (MOREIRA et. al., 2019).

Among the risk factors for the spread of diseases and infections are urban areas with poor housing conditions, lack of basic sanitation and malnutrition. Regarding the clinical aspect, the patient with uncontrolled diabetes is prone to complications, such as increased vulnerability to infections, as hyperglycemia and decreased insulin interfere with the immune response and cellular function of macrophages and lymphocytes. Patients with mental disorders, on the other hand, have their symptoms underestimated, either by themselves or by their caregivers, and when the disease is confirmed, there is an obstacle in the treatment, as it is necessary to create a medication routine (MOREIRA et. al., 2019).

DIAGNOSIS

According to the Epidemiological Bulletin of the Health Surveillance Secretariat, the early diagnosis of TB-HIV co-infection is essential, so that there are actions aimed at linking individuals to health services, with the aim of improving adherence to treatment for both infections and achieving a better prognosis for the person with the co-infection (BRASIL, 2019).

In Brazil, since 1998, according to the Ministry of Health, all people diagnosed with active TB must be tested for HIV. However, considering the new cases of TB notified to Sinan-TB between 2009 and 2017, it is observed, when analyzing the difference in dates between the diagnosis of TB and the diagnosis of HIV, that in about 40% of cases of co-infection TB-HIV, the diagnosis of HIV happened due to the occurrence of TB (BRASIL, 2019).

As shown in *Figure 4*, although 100% of Latin American countries report the existence of anti-HIV testing policies in place for people with tuberculosis, only about 86% have built

mechanisms to integrate HIV counseling and testing into health services as a regular practice. Nevertheless, the current proportion of patients with HIV-associated TB with new diagnoses or treatment relapses was 80.8%. That said, there was a 25.6% increase across Latin America and the Caribbean between 2011 and 2017, with a tendency to stagnate at around 80% during the last 3 years of the study (MORENO et. al., 2020).

For the diagnosis of TB, the patient must be asked about the existence of 4 symptoms: dry cough or with sputum, fever (generally low, at the end of the day), night sweats and weight loss. If the existence of any of the symptoms is confirmed, the hypothesis of tuberculosis must be taken into consideration. (ARAKAKI, 2015).

The extrapulmonary forms of tuberculosis are the most frequent in people living with HIV/AIDS (PLWHA), and cough is often not the main symptom (ARAKAKI, 2015). TB presents itself in different clinical forms, sometimes related to the affected organ (CONDE et al., 2011). This way, other signs and symptoms, in addition to prolonged cough, must be investigated through clinical anamnesis, radiological examinations, bronchoscopic examination, biochemical examinations and adenosine deaminase (ADA) dosage (ARAKAKI, 2015).

CLINICAL ANAMNESIS

The most common form of extrapulmonary TB in PLWHA is Peripheral Ganglionic Tuberculosis, being more common under 40 years of age. The ganglionic forms affect the cervical, supraclavicular and submental chains in 90% of the cases, coursing with a subacute, painless and asymmetric increase, with greater impairment of the general condition (ARAKAKI, 2015).

In PLWHA, lymph node involvement can be unilateral or bilateral, with a hardened consistency if they do not present central caseous necrosis, adherent to each other and to the deep planes, with a tendency to fistulization, with inflammation of the adjacent skin (UNASUS, 2015).

The diagnosis is made by means of needle aspiration, which is effective in most cases, and the method of lymph node resection or lymph node biopsy can be used, with the surgical removal of entire lymph nodes, so that fistulas do not occur in the postoperative period. In the case of Brazil, which has a high prevalence of BCG vaccination, the tuberculin skin test has little value if proven positive (UNASUS, 2015).

RADIOLOGICAL EXAMINATIONS

A chest X-ray must be ordered for every patient with clinical suspicion of TB. It is one of the most used and easily available tools in Brazil, being of great importance to assess the presence of lung lesions, their severity, determine size and extent (UNASUS, 2015).

Radiographic findings can often be atypical, and up to 22% of PLWHA who develop TB may have a normal chest X-ray (ARAKAKI, 2015).

Among the findings, infiltrates in the pulmonary apices, in the posterior, superior subapical regions or in the upper segment of the lower lobe are common. Bilateral lesions and the presence of cavities may be suggestive of TB (UNASUS, 2015).

The results of the radiographs, in order to be notified, must be recorded according to *Table 1*.

BRONCHOSCOPIC EXAM

Before characterizing the bronchoscopy, it is important to point out that negative bacilloscopy on the bronchoscopy does not exclude active TB in PLWHA (JACOMELLI, et al., 2012).

Bronchoscopic examination is indicated in

cases of inconclusive sputum examinations, but the hypothesis of TB still persists. In addition to bacilloscopy, culture with identification of mycobacteria and sensitivity test to antimicrobials must be requested (UNASUS, 2015).

It must not be used alone for diagnosis, as it allows diagnosing only 30% of TB cases in PLWHA, due to the low bacillary load (JACOMELLI, et al., 2012).

BIOCHEMICAL EXAMS

Laboratory tests must be ordered along with chest X-rays.

Some of the nonspecific findings that are found in biochemical tests are: hypoalbuminemia, hematuria (renal TB), hypercalcemia (pulmonary TB), hyponatremia (adrenal, meningeal and pulmonary TB), normocytic and normochromic anemia and hypergammaglobulinemia, which is due to the increased response humoral (UNASUS, 2015).

DOSAGE OF ADA

The measurement of adenosine deaminase (ADA) activity, which is an intracellular enzyme present in an activated lymphocyte, can be performed in any body fluid (pleural fluid, synovial fluid, peritoneal fluid and even cerebrospinal fluid) for the diagnosis of TB. It is considered positive when the finding is greater than 30 U/ml (ARAKAKI, 2015).

TREATMENT

In a recent study in Uganda, spatial clusters of each cluster (TB and HIV/AIDS) and the TB-HIV curve were identified, and it was concluded that tuberculosis rates were positively influenced in the territory by HIV rates and vice versa., that is, the simultaneous approach of the two pathologies for effective management would be necessary. Another analysis in Kenya also identified the heterogeneous focus of the TB-HIV co-infection case in the country and emphasized the importance of more targeted interventions in these areas for better allocation of resources (CAVALIN et. al, 2020).

In cases where TB/HIV co-infection occurs, the initiation of antiretroviral therapy (ART) must be guided by the degree of immunosuppression, and in situations where the CD4 count is less than 50 cells/mm3, initiation of HAART 2 weeks after starting antituberculosis treatment. In other situations, ART must only be started after the eighth week of treatment (RABAHI et. al., 2017).

When the diagnosis of tuberculosis is made in those patients who are already on ART, it is necessary to modify the ART to allow the treatment to include rifampicin, with efavirenz being the antiretroviral of choice in these cases. Replacing rifampicin with rifabutin is recommended when it is necessary to use a protease inhibitor associated with ritonavir in the ART regimen, the recommended dose of rifabutin is 150 mg/day (RABAHI et. al., 2017).

The most frequent adverse reactions of rifabutin are rash (in 4%), gastrointestinal intolerance (in 3%) and neutropenia (in 2%). Since if an inflammatory immune reconstitution syndrome occurs, the suspension of any of the treatments is not indicated, being managed with drugs to treat the symptoms and corticosteroids in severe cases (RABAHI et. al., 2017).

In cases of transplanted patients, the treatment must be carried out in reference units using the RHZE scheme (Rifampicin, Isoniazid, PIrazinamide and Ethambutol) for 2 months, followed by RH (Rifampicin and Isoniazid) for 4 months, and this treatment can be extended for up to 9 months. Attention is drawn to possible drug interactions with corticosteroids, cyclosporine and azathioprine (RABAHI et. al., 2017).

Figure 5 represents some countries with a high viral load for TB in which 100% of HIV-positive patients started antiretroviral therapy (ART) associated with prophylactic treatment or tuberculosis treatment, concomitantly, which represents the ideal treatment for tuberculosis. The green bar shows the percentage of people recently started on antiretroviral therapy who have not received optimal tuberculosis treatment and are vulnerable to becoming ill or dying of tuberculosis (UNAIDS, 2020).

ABANDONMENT RATE

Dropping out of TB treatment is a serious and frequent problem. The Ministry of Health recommends that only 5% of abandonment is acceptable, and the patient who starts treatment and fails to attend the Health Unit for more than thirty consecutive days after the date scheduled for return is considered as abandonment (RODRIGUES et. al., 2010).

Treatment abandonment is one of the main challenges in the fight against tuberculosis, resulting in increased treatment costs, mortality and relapse rates, in addition to facilitating the development of resistant strains of bacilli. Generally, the factors associated with abandonment are related to the patient, the form of treatment and the Health Services (MOITA SÁ et. al., 2016).

There are several causes for abandoning TB treatment, including lack of information about the disease, use of drugs (illicit, alcoholism and smoking), low socioeconomic status, initial improvement in symptoms, low level of education, side effects of medications, lack of family support and irregularities in the health service. According to studies carried out in Brazil in 2010, the rates of noncompliance with tuberculosis treatment in TB/HIV coinfected patients vary between 38% and 42%, with extremely high rates, since the goal of the National Plan to Combat Tuberculosis (PNCT) is 5 % (RODRIGUES et. al., 2010).

PREVALENCE OF TB AND ANTI-HIV POSITIVE CO-INFECTION

In 2017, Brazil had 11.4% of TB-HIV cases, and the state of São Paulo identified 9.3% of co-infection. According to the World Health Organization (WHO), Brazil is among the countries with the highest burden of TB associated with HIV, therefore, it is one of the priority countries for investments in control actions. (CAVALIN et al., 2020).

São Paulo is the most populous city in Brazil, with around 12 million inhabitants, with emphasis on the more central areas, which present an important urban agglomeration, whether of residents, workers, health units and public transport users, which generates an intense flow and meeting of people, in addition to a greater possibility of transmission of diseases such as TB. Thus, a study carried out in the city of São Paulo reveals a geospatial pattern, in which the peripheral areas of the North and East regions and the city center are the most strongly affected areas, evidencing the socioeconomic character intrinsic to the TB-HIV co-infection (CAVALIN et al., 2020).

In a study carried out in the city of Ribeirão Preto, "the selected variables were: average income of heads of households, average years of education of persons responsible for households, average income of female heads of household, average years of education of female heads of family and proportion of illiterate women, proportion of illiterate people, percentage of households with five or more residents. These variables were selected based on previous work so that they could represent income, education, household crowding and more vulnerable groups (women)" (BRUNELLO, et. al., 2010).

However, in this same study there was a predominance of males, intermediate education and pulmonary clinical form,

CLASSIFICATION	FINDINGS
Normal	No changes suggestive of tuberculosis activity.
Suspect	Alterations suggestive of tuberculosis activity, such as cavities, nodules, consolidations, masses, interstitial process (miliary), pleural effusion and widening of the mediatism.
Sequel	Images suggestive of cicatricial lesions, such as bands, parenchymal retractions and calcifications.
Other diseases	Images suggestive of non-tuberculous lung diseases, such as Chronic Obstructive Pulmonary Disease (COPD) and other respiratory diseases.

Table 1- Classification of radiological findings of pulmonary tuberculosis described in the notification.

SOURCE: CGPNCT/SVS/MS

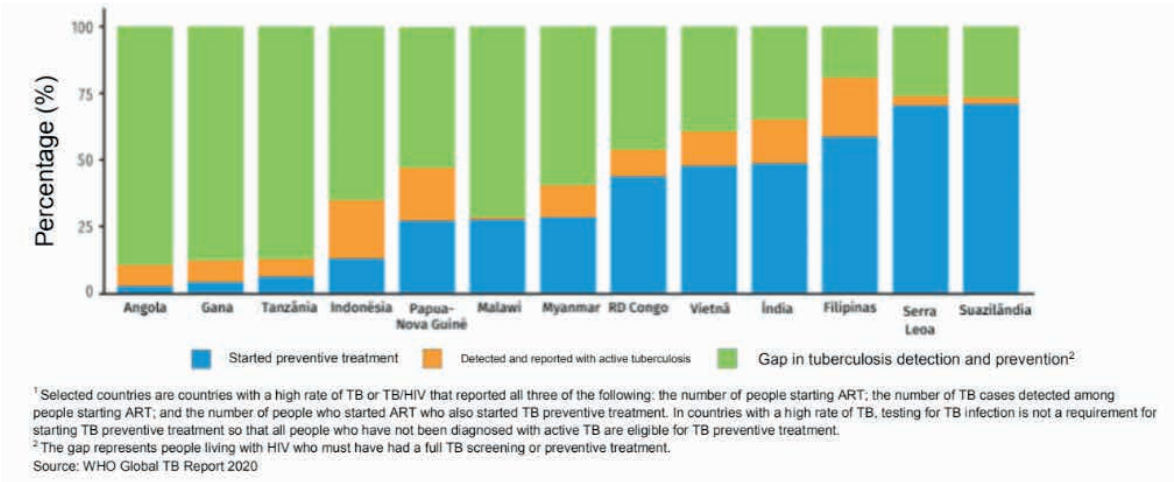

Figure 5 - Gaps in TB prevention and detection for people living with HIV starting antiretroviral treatment (ART) in selected high-burden TB or TB/HIV countries

FONTE: UNAIDS, 2020

with a significant number of cases of extrapulmonary, reinforces the results of other studies (BRUNELLO, et. al, 2010).

In 2018, about 8.6% of all tuberculosis cases in the world were anti-HIV positive, which amounts to approximately 862,000 people. TB-HIV co-infection mainly affects people who live in precarious living conditions and who suffer from the lack of resources for prevention, diagnosis, treatment and control of both tuberculosis and HIV. Therefore, it is noted that co-infection mainly affects underdeveloped and populous regions, such as in regions of the African continent, where it represents more than 50% of cases (CAVALIN et. al., 2020).

FINAL CONSIDERATIONS

HIV/TB co-infection is a disease of social complexity and its eradication is not restricted to the health sector, but depends on tripartite intersectoral management, from investments in housing, transportation, among others, to food. The inability of sectoral articulation imposes major barriers to health management. Thus, intersectoriality is one of the main measures in facing problems of a social nature in the territory, such as HIV/TB co-infection, as the integration of knowledge, mobilization of resources from different sectors and social responsibility are linked to this process. of different segments of civil society in favor of the well-being of the community.

TB is a social disease that emerges from the unfair distribution of income. The presence of this disease in a community is a reflection of the precariousness of local social development policies, and its permanence leads to the depletion of the community's productive capacity, as it is more prevalent in the economically active population. In a cyclical way, TB appears in poor communities and contributes to the worsening of the state of poverty, precisely because it affects their productive economic class. The advantage of using geographic spaces as indicators of living conditions, especially the place of residence, is the possibility of understanding the complexity of the problem in the social organization as a whole.

Therefore, TB and HIV must be treated concomitantly to obtain effective management of the development of these pathologies, linked to quality public policies that ensure social mobility and, above all, adequate living conditions.

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