Revisão Bibliográfica

Multidrug resistant Tuberculosis: still a problem in the Russian Federation.

Tuberculose multirresistente: ainda é um problema na Federação Russa.

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ABSTRACT

Tuberculosis is a primitive disease that is still quite prevalent today. Multidrug- resistant tuberculosis is the main cause of death by tuberculosis in Russia. This study aims to present results on tuberculosis and multidrug resistant tuberculosis in Russia, and why with the medicine development, we still have this problem in Russia till nowadays. A review was conducted to identify studies that investigated multidrug resistant tuberculosis in Russia, using the databases PubMed / NCBI, WHO, Google Scholar, CyberLeninka, XXX National Congress on Respiratory Diseases in Moscow, and Russian Ministry of Health databases from the last five years. Originally 684 studies were recognized in the databases searched, of which 40 articles were selected for the current study. According to the World Health Organization, Russia was the country with the most tuberculosis cases in the world, although these figures have decreased over the past 21 years. Instead, the cases of multidrug resistant tuberculosis are increasing: 37,3 people in 2015 against 34,832 in 2012. We observed a high rate of multidrug resistant tuberculosis in Russia due to mistakes such as lack of drugs, low adherence to treatment, dissolution of the Sovietic Union and the unfavorable social situation. Even more, the low adherence to the correct antibiotic and treatment facilitated the spread of the disease.

Keywords: epidemiology; MDR-TB; respiratory diseases; Russia; tuberculosis.

RESUMO

Tuberculose é uma doença primitiva que ainda hoje é bastante prevalente, sendo a tuberculose multirresistente a principal causa de morte por tuberculose na Federação Russa. Este estudo tem como objetivo apresentar resultados sobre tuberculose e tuberculose multirresistente na Rússia, trazendo o por que essa doença ainda é uma das mais problemáticas na Russia até os dias de hoje, mesmo com o avanço da medicina. Foi realizada uma revisão para identificar estudos que investigaram a tuberculose multirresistente na Rússia, usando as bases de dados PubMed / NCBI, OMS, Google Scholar, CyberLeninka, XXX Congresso Nacional de Doenças Respiratórias em Moscou e as bases de dados do Ministério da Saúde da Rússia. cinco anos. Originalmente, 684 estudos foram reconhecidos nas bases de dados pesquisadas, dos quais 40 artigos foram selecionados para o presente estudo. Segundo a Organização Mundial de Saúde, a Rússia foi o

país com mais casos de tuberculose no mundo, embora esses números tenham diminuído nos últimos 21 anos. Em vez disso, os casos de tuberculose multirresistente estão aumentando: 37.357 pessoas em 2015 contra 34.832 em 2012. Observamos um alto índice de tuberculose multirresistente na Rússia devido a erros como falta de medicamentos, baixa adesão ao tratamento, dissolução da União Soviética e a situação social desfavorável. Mais ainda, a baixa adesão ao antibiótico e ao tratamento corretos facilitou a disseminação da doença.

Palavras-chave: epidemiologia; TB-MR; doenças respiratórias; Rússia; tuberculose.

INTRODUCTION

Tuberculosis (TB) is an ancient disease caused by *Mycobacterium tuberculosis*, which mainly affects the lungs. It is a crucial public health problem, with around nine million new cases and two million deaths estimated every year[1,2]. The clinical symptoms are nonspecific and can raise suspicion by productive cough for more than three weeks, hemoptysis, chest pain, shortness of breath, fever, night sweats, and weight loss[3-5]. When people become infected with TB, in 95% of cases the immune system contains it in a latent form[6,7]. In 2020, TB is one of the top ten causes of death worldwide and about a quarter of the world's population is infected with TB[8]. The first study regarding drug resistance in the world enrolled 974 clinical isolates cultured from newly diagnosed cases of TB in Britain (1955–1956)[9] and showed strains resistant to streptomycin (2,5%), para-aminosalicylic acid (2,6%), and isoniazid (1,3%)[10,11].

Multidrug Resistant-TB (MDR-TB) is a *Mycobacterium* from the *Beijing lineage* that was stable for several hundred years, before expanding sharply from the early 1820s until the mid 1840s. The bacteria population shrank around the 1960s when antibiotics for TB were first introduced. Once people began taking their antibiotics intermittently or irregularly, the bacillus developed resistance to antibiotics[12]. Until the Soviet Union collapsed in 1990, the information about TB was available only for military use[13,14]. Socioeconomic issues like poverty, homelessness, malnutrition, unemployment, Human immunodeficiency virus (HIV), and the Soviet Union collapse facilitated the spread of TB[15,16]. While TB can be cured in six months, MDR-TB treatment should last one to two years (accounting for 50% of success)[17,18].

In the past, Directly Observed Therapy Short Course (DOTS) was advocated for as a treatment for MDR-TB, which is a strategy where healthcare workers observe patients as they take their medicine properly. However, around the 1990s some drugs from the four essential drugs in the DOTS regimen strategy, which are – isoniazid, rifampicin, ethambutol, and pyrazinamide – were not being produced in Russia. The problem emerged only in the 90s as these drugs were brought from other countries of the former socialist block (in Asia and countries close to

Russia). Upon the Soviet dissolution, the formal market agreements between those countries temporarily stopped and some of the essential drugs became unavailable[19]. Balakrishinan (National Medical Research Center of Phthisiopulmonology and Infectious Diseases at the Russian MoH) agreed that the proliferation of drug resistant bacteria was probably due to the absence of funding and lack of drugs during the 1990s [20].

METHODOLOGY

Database search

This review contains detailed information from PubMed / NCBI, WHO, Google Scholar, CyberLeninka, XXX National Congress on Respiratory Diseases in Moscow and Russian Ministry of Health databases. Originally, 684 studies were recognized in the databases searched (567 in PubMed, eight in CyberLeninka, 98 in Google Scholar, six in WHO, and five in TB congress in Moscow). Following the exclusion based on the abstract and title, 98 articles were selected for full text analysis. Finally, 40 articles were selected for the current study. MDR-TB is still a problem in Russian Federation (Figure and Table 1). This review includes manuscripts from the last five years, published in English and Russian.

Inclusion criteria

1. Prospective randomized studies, retrospective analysis, and serial cases that presented correlation to temporal geopolitical comparison or relevant epidemiological information on TB and MDR-TB from the last 20 years.
2. Studies that were in English and Russian.

Exclusion criteria

Studies that presented divergent values from the scope, lacked conclusion and molecular analysis were excluded from the review.

Keywords: epidemiology; MDR-TB; respiratory diseases; Russia; tuberculosis.

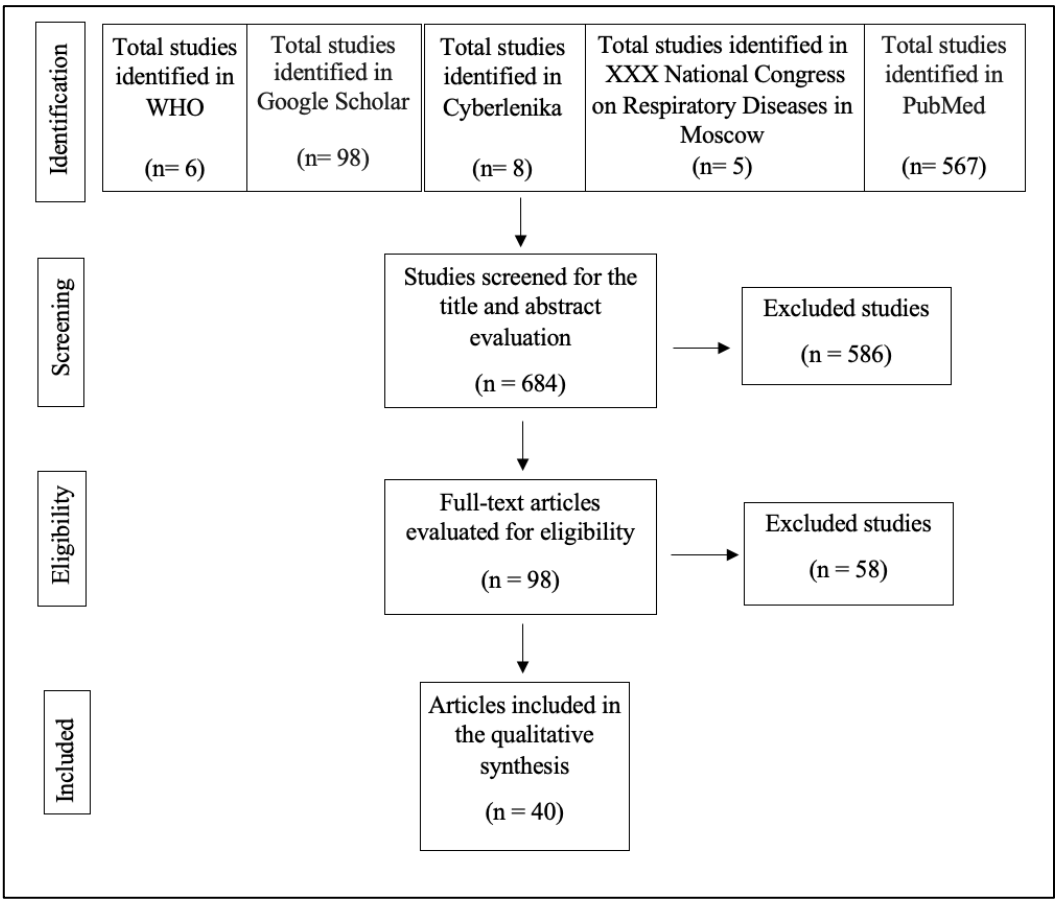

Figure 1. Flowchart summarizing the search strategy

Table 1. Description of studies

Reference	Theme of review	DESCRIPTION
Harries *et al*, 2006 [1]	Tuberculosis	Tuberculosis (TB) is an ancient disease, caused by *Mycobacterium tuberculosis,* which mainly affects the lungs.
Bloom *et al,* 2017 [2]	Tuberculosis	It is a crucial public-health problem, with around nine million new cases and two million deaths estimated to occur each year.
Mishin *et al,* 2020 [3]	XXX National Congress of Respiratory Disease	The cases of TB in Russia are decreasing year after year but the situation is still alarming.
WHO, 2010 [4]	2010/2011 tuberculosis global facts	Currently, WHO suggests that MDR-TB patients should be treated with a combination of at least four active anti-TB drugs for a minimum of 20 months.

API Consensus Expert Committee, 2006 [5]	API TB Consensus Guidelines 2006: Management of pulmonary tuberculosis, extra-pulmonary tuberculosis, and tuberculosis in special situations	The clinical symptoms are nonspecific and can raise suspicion by productive cough for more than three weeks, hemoptysis, chest pain, shortness of breath, fever, night sweats, and weight loss.
Kehl M., 2017 [6]	Under the Skin: Russia's Budding Healthcare Crisis.	When people become infected with TB, in 95% of cases the immune system contains it in a latent form.
Lerena *et al*, 2010 [7]	Drug-resistant *Mycobacterium tuberculosis* in children under 15 years.	The immune system contains TB in latent form.
WHO, 2020 [8]	Global Tuberculosis Report 2020	In 2019 was 10·000·000 (fell with TB) and 1·400·000 (died from TB).
Keshavjee *et al,* 2012 [9]	Tuberculosis, Drug Resistance, and the History of Modern Medicine	The first research about national drug-resistance in the world, which involved 974 clinical isolates cultured.
Sotgiu *et al,* 2013 [10]	History of tuberculosis and drug resistance	Streptomycin (2·5%), para-aminosalicylic acid (2·6%), and isoniazid (1·3%).
Marais *et al,* 2013 [11]	History of tuberculosis and drug resistance	Diagnosed cases of TB in Britain (1955–1956).
Wilson C., 2015 [12]	Soviet Union fall helped drug-resistant TB to take off	MDR-TB is a *Mycobacterium* from the Beijing lineage. That was "stable" for several hundred years, before expanding sharply from the early 1820s until the mid 1840s.
Perelman M.I., 2000 [13]	Tuberculosis in Russia	The principle 'treat the patient, not the disease' were established in the USSR between 1950 and 1970
Wright *et al*, 2002 [14]	Global Project on Anti-Tuberculosis Drug Resistance Surveillance. Epidemiology of antituberculosis drug resistance 2002-07: An updated analysis of the Global Project on Anti-Tuberculosis Drug Resistance Surveillance.	MDR tuberculosis remains a threat to tuberculosis control in provinces in China and countries of the former Soviet Union.
Semencheo M., 2020 [15]	Country factsheets Russian Federation 2019 Change HIV and AIDS Estimates	Human immunodeficiency virus (HIV) infection increases the aggressiveness of TB as well
Bickford *et al* 2006 [16]	Twin Epidemics of Multidrug-Resistant Tuberculosis: Russia and New York City.	It was a big failure and the rapid spread of TB was not only to high levels of MDR-TB but also to low rates of DOTS.

Merker *et al*, 2015[17]	Evolutionary history and global spread of the *Mycobacterium tuberculosis* Beijing lineage.	While common TB can be cured in 6 months, people with MDR-TB treatment time is one to two years
Lemos *et al,* 2013 [18]	Multidrug-resistant tuberculosis	The treatment of MDR-TB is expensive, complex, prolonged.
Liu *et al*,2018 [19]	Delamanid: From discovery to its use for pulmonary multidrug-resistant tuberculosis (MDR-TB)	Deltyba became the first drug to receive marketing authorization in Russia following the Eurasian Economic Union registration procedure.
Balakrishnan V.S. 2018 [20]	The changing face of tuberculosis care in Russia	After 2009, the annual incidence decreased slightly year after year, but MDR-TB is still a trouble situation in Russia.
Ershova *et al,* 2018 [21]	Epidemic Situation and treatment prospects of multiple resistant tuberculosis in Kanty-Mansiysky autonomous region	The cases of MDR-TB increased, in 2015 was 37·357 people against 34·832 - in 2012.
WHO.Global TB 2019,_ 2019 [22]	Global report TB 2019	Testing, detection, and treatment of MDR TB have achieved some successes.
Pasechnik *et al,* 2018 [23]	Prevalence of Extensively Drug-Resistant Tuberculosis: A Descriptive Study	The proportion of bacteria releasing strains with multidrug resistance among TB patients increased from 10·8 (2006) to 26·6% in (2017) and among the contingent of patients who excrete bacteria - from 30·7 to 58·1%.
Popova T., 2017 [24]	How to beat a disease with a system Russian multisectoral approach becomes a model for the whole world.	President Vladimir Putin emphasized in his speech "Reducing mortality from TB is among our state priorities - along with reducing mortality from cardiovascular diseases and cancer"
Bertolaccini *et al,* 2013 [25]	Surgical treatment of pulmonary tuberculosis: the phoenix of thoracic surgery?	Currently, we are witnessing a resurgence of the role of surgery in TB, because of the rapid increase in MDR-TB and XDR-TB. Thoracic surgery offers highly minimally invasive surgery.
Mphahlele *et al,* 2008 [26]	Pyrazinamide resistance among South African multidrug-resistant *Mycobacterium tuberculosis* isolates	Annual screening of the entire child population for TB has been conducted for many years.
Aksenova *et al,* 2020 [27]	Latent tuberculosis infection in children and adolescents in Russia	The incidence of TB in children is not high Tereza Kasaeva "she attributes such declines in childhood tuberculosis to the progress made in screening, vaccination, and treatment of latent and active infections"

Smirnova *et al,* 2016 [28]	Multidrug-resistant tuberculosis in children in northwest Russia: an observational cohort study	In the current year, Arkhangelsk (region of Northern Russia) has one of the highest rates of MDR-TB in Russia
Institute of Medicine (US) Forum on Drug Discovery, Development, and Translation, 2011 [29]	The New Profile of Drug-Resistant Tuberculosis in Russia: A Global and Local Perspective	International experts estimate that about 50·000 people in Russia have MDR-TB. Between 40 and 70 percent of newly detected TB cases occur in socially vulnerable groups.
Dheda *et al,* 2017 [30]	Clinical management of adults and children with multidrug-resistant and extensively drug-resistant tuberculosis.	Increasing prevalence of MDR-TB in countries like South Africa, Russia, India, and China. These developments threaten to reverse the gains already made against TB.
Dela *et al,* 2017 [31]	Adverse drug reactions and treatment outcome analysis of DOTS-plus therapy of MDR-TB patients at district tuberculosis center: A four-year retrospective study. Lung India.	Treatment of MDR-TB requires the use of expensive and toxic second-line anti-tubercular drugs which are given for a longer duration.
Parva et al, 2018 [32]	Evaluation of treatment outcome and adverse drug reaction of directly observed treatment (DOT) plus regimen in multidrug-resistant tuberculosis (MDR-TB) patients at district tuberculosis center Rajkot.	Adverse drug reactions of second-line antituberculosis drugs affect the treatment.
Prasad *et al*, 2019 [33]	Adverse drug reactions in tuberculosis and management.	Adverse reactions to first-line tuberculosis antibiotics are common and have a major impact on the outcomes of patients as second-line antibiotics are less effective and more toxic.
Gupta *et al*, 2020 [34]	Adverse drug reactions & drug interactions in MDR-TB patients.	Adverse drug reactions of second-line antituberculosis drugs affect compliance and thereby treatment outcome.
Szumowski *et al,* 2015 [35]	Profile of delamanid for the treatment of multidrug-resistant tuberculosis.	In 2020 an oral antibiotic drug created in Japan - Deltyba 'delamanid' was approved in Russia.
Blair *et al,* 2015 [36]	Delamanid: a review of its use in patients with multidrug-resistant tuberculosbbis.	Delamid has been used since 2014 in Japan, according to WHO is an essential medicine for the treatment of MDR-TB.

Skvortsova V.I., 2014[37]	Order of the Ministry of Health of Russia dated 12.29.2014 N 951" On the approval of methodological recommendations to improve diagnostics and treatment of respiratory tuberculosis"	In the current year the treatment for TB and MDR-TB change in Russian Federation, automated culture systems reduce the determination time drug sensitivity of the pathogen up to 4 weeks instead of 3 months with classical methods, and molecular genetic methods allow determining genetic markers in sputum in a matter of hours and the presence of mutations associated with MDR-TB
Olaru *et al,* 2015 [38]	Personalized medicine for patients with MDR-TB	The creation of a library containing mutations associated with MDR-TB has been initiated, to be used in conjunction with data obtained from sequencing the entire MDR-TB genome for predicting drug susceptibility within a few days.
Friedrich M.J, 2017 [39]	Drug-Resistant Tuberculosis Predicted to Increase in High-Burden Countries	Extensively drug-resistant tuberculosis (XDR TB) is defined as MDR TB with additional resistance to fluoroquinolones and second-line injectable drugs for TB.
Yablonskii *et al,* 2016 [40]	Drug resistance of *Mycobacterium tuberculosis* in different localizations of the disease	In recent years, the cause of death of TB patients in 98% of cases are MDR-TB

RESULTS

The last Congress of Respiratory Diseases in Moscow (October 2020) has shown the morbidity and mortality from TB per 100,000 people from 1970 to 2019 (Figure 2). In 1990 the morbidity of TB was 34,2%, the smallest number in the last 50 years. The peak was in 2000 with morbidity of 90,7% and mortality of 20,4%. After 2000, the numbers started to decrease and in 2019 reached a new low in the last 27 years, with morbidity of 41,2% and mortality of 5,2%. According to the WHO, Russia was the country with the highest number of TB cases that presented a rapid decrease in the incidences. Instead, the cases of MDR-TB increased: in 2015 there were 37,357 cases versus 34,832 in 2012[21].

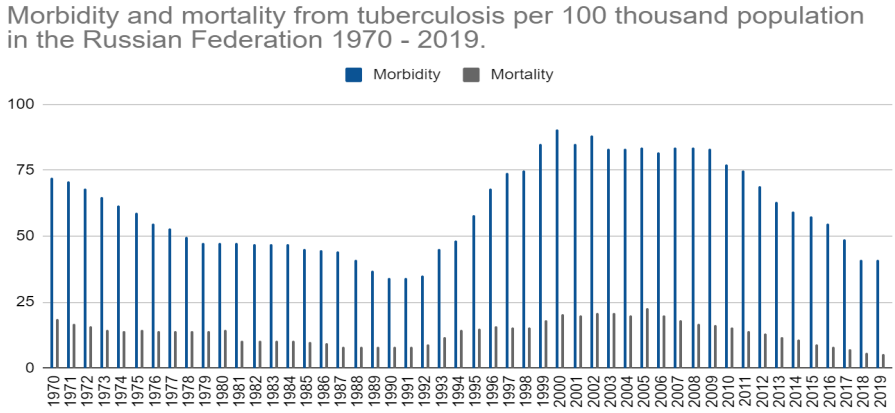

Figure 2. Morbidity and mortality from tuberculosis per 100 thousand population in the Russian Federation 1970 – 2019 (adapted from https://spulmo.ru/kongressy/30-kongress/).

Russia is the third country leading in cases of MDR-TB. The proportion of MDR-TB or rifampicin resistance globally accounted for 3,4% of new cases and 18% of previously treated cases and was the highest in countries of the former Soviet Union[22]. The proportion of bacteria resistant strains with MDR among TB patients increased from 10,8% in 2006 to 26,6% in 2017 and among the contingent of patients that eliminate the bacillus - from 30,7% to 58,1%[23]. The average rate of decline in mortality from TB since 2011 has exceeded 11% per year. In 2016, the death rate from TB in Russia decreased by more than 15%, and throughout 2017 by 17%. Only 56% of patients with MDR-TB complete their treatment or are considered cured[22]. The average drop in TB incidence in Russia has reached 3% per year, which is twice the world average[24]. There was an increased incidence of TB associated with HIV infection (Figure 3). MDR-TB continues to be a health problem and in 2019, close to half a million people developed rifampicin-resistant TB, of which 78% had MDR-TB[25].

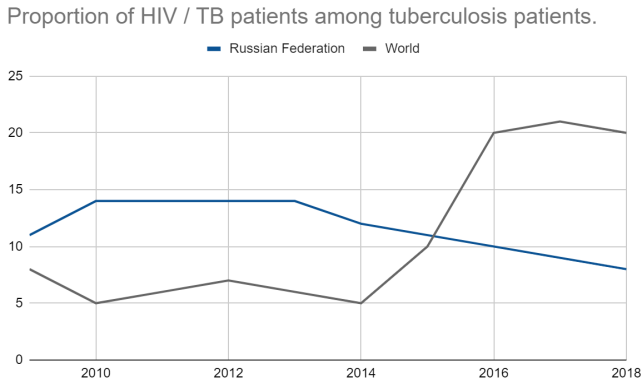

Figure 3. The proportion of HIV / TB patients among tuberculosis patients (adapted from https://spulmo.ru/kongressy/30-kongress/).

DISCUSSION

The detection of TB and MDR-TB is normally confirmed by sputum microscopy, X-rays (more sensitive), and blood and urine test. Microbiological diagnosis of TB in Russia includes a complex evaluation of specimens[13] and annual screening of the entire child population for TB[14,26,27]. Following the WHO guidelines, detection of MDR-TB requires bacteriological confirmation of TB and testing for drug resistance using rapid molecular tests, culture methods, or sequencing technologies[25]. The Arkhangelsk (region of Northern Russia) had the first pediatric case registered in 2001. Since then, 366 children

were diagnosed with TB, of which, 56 (15%) were MDR-TB cases[28].

International experts estimate that 50,000 people in Russia have MDR-TB in 2019. Between 40% and 70% of newly detected TB cases occur in socially vulnerable groups such as the homeless, unemployed, migrants, and people with drug and alcohol dependencies[29,30]. Treatment of MDR-TB requires the use of expensive and toxic second-line anti-tuberculosis drugs, which are given for a longer duration.

Adverse drug reactions of second-line antituberculosis drugs affect compliance and thereby treatment outcomes[31-34]. In 2020 an oral antibiotic drug was created in Japan - Deltyba ’delamanid’ (potent bactericidal activity against *Mycobacterium tuberculosis* was the first approved compound from the bicyclic nitroimidazole derivatives for the treatment of pulmonary MDR-TB in adult patients) was approved in Russia. It has been used since 2014 in Japan, according to the WHO is an essential medicine for the treatment of MDR-TB[19,35,36].

In 1918 arises the first system to fight against TB - a dispensary system for prevention and treatment was set in Russia under State assistance. In 1922, all anti-tuberculosis Organizations and Institutions were nationalized. Until 1990, information about TB and other infectious diseases associated with socio-economic conditions was available only for official use in the Soviet Union. Around that time, the TB incidence was about 41 per173 100,000 people. Over 2,000 years ago, Hippocrates performed the first open drainage of a TB pleural empyema surgery[25,20].

Surgical intervention is necessary to treat patients with chronic TB that does not respond to antimicrobial therapy, but also in patients with complications, MDR-TB, and intolerance to the anti-tuberculosis drug[13]. Around 50,000 surgeries were performed per year in the period after World War II. The majority of these interventions were thoracoscopy and thoracic-caustic procedures for control and correction of pneumothorax.

After 1950 surgeons started to perform lung resection procedures, in the same period 11,630 surgical interventions on TB patients were performed[13]. In 1944, the discovery of streptomycin changed the therapeutic protocol, reducing the need for surgical procedures[25]. Currently, we are witnessing a resurgence of a rapid increase in MDR-TB and extensive drug-resistant tuberculosis (XDR-TB).

The surgical indications in pulmonary TB contemplate TB complications (e.g., hemoptysis, empyema), cases displaying an inappropriate healing response to medication (e.g., cavity, tuberculoma), acid-fast bacilli sputum smears positivity after three months treatment period, with a circumscribed radiological lesion or a destroyed lung and previous relapse(s) in patients with histories of TB and proper drug regimen[25]. The WHO

standard treatment was adopted by Tereza Kasaeva (Director of the WHO Global TB Programme) and brought changes in an environment where some physicians treat patients in outdated ways[20,4].

Some drugs from the four-drug regimen DOTS were not being produced in Russia. Those classic TB drugs, by that time, were produced in Asia and countries close to Russia. After the dissolution of the Soviet Union, drug access became more limited, creating a convenient situation for MDR-TB transmission. The treatment success rates have remained consistently low, even though case notifications have declined, because of the long period of treatment, people started taking their own medicines and stopped appropriate treatment. With the collapse of the Soviet Union, many patient`s data was lost. And as a consequence of the unsuccessful method, Russian Federation stopped the use of DOTS[19,20].

Currently, the treatment for TB and MDR-TB has changed in the Russian Federation, automated culture systems reduce the determination time for drug sensitivity of the pathogen up to 4 weeks instead of 3 months with classical methods, and molecular genetic methods allow determining genetic markers in sputum in a matter of hours and the presence of mutations associated with MDR-TB[37]. Currently, WHO suggests that MDR-TB patients should be treated with a combination of at least four active anti-TB drugs for a minimum of 20 months. These long-term therapy regimens have high costs and thus make the total expenses challenging to support in low-income countries[4,38].

The combination of social factors facilitates the growth of MDR-TB. From 1990 to 1991, morbidity rates decreased to 34,2 – 40,6 cases per 100,000 in the Russian Federation. The principle 'treat the patient, not the disease' was established in the Soviet Union between 1950 and 1970, and are universally recognized in the Russian medical community [39].

The first phase is to eliminate the symptoms and the second phase is to prevent relapse. In the current years, specialized TB control services consist of the Phthisiopulmonology (or TB) Research Institutes, dispensaries, hospitals, and sanatoria. Monitoring MDR-TB is the major challenge, and resistance to isoniazid and rifampin has been detected in 20 – 22% of all patients with TB[13].

XDR-TB is defined as MDR-TB with additional resistance to fluoroquinolones and second-line injectable drugs for TB[39]. In the Russian Federation, the XDR-TB variant comprises up to a quarter of MDR-TB cases[10]. Although, there was an increased incidence of TB associated with HIV infection, as well as MDR-TB[23].

MDR-TB is resistant to rifampin and isoniazid, causing great difficulty in treatment[16]. In recent years, and is attributed to identified compensatory mutations of drug

resistance (secondary mutations), as a result, which retains not only the growth rate, often delayed in drug-resistant strains but also indicators of virulence.

To explain the phenomenon of a higher rate, it should be taken into account that MDR-TB vegetation in the foci of extrapulmonary TB occurs with increasing acidosis and anaerobiosis; Beijing genotype strains are found more often in Bacillus Calmette–Guérin vaccine (BCG) than in non-BCG vaccinated individuals[40].

The creation of a library containing mutations associated with MDR-TB has been initiated, to be used in conjunction with data obtained from sequencing the entire MDR-TB genome for predicting drug susceptibility within a few days. Experts consider that understanding the whole genome sequencing (WGS) analysis is comparable to phenotypic MDR-TB testing and this technology may become a new standard for MDR-TB testing in the future. WGS could be applied directly to clinical specimens, provided that the concentration of bacterial DNA is sufficient for amplification[38].

According to the WHO, the European Region has almost reached the 2020 End TB Strategy milestone, with a reduction of 19% in the TB incidence rate between 2015 and 2019. A total of 78 countries are on track to reach the 2020 End TB Strategy milestone, including the Russian Federation. But the MDR-TB cases are still making Russia one of the countries with the highest MDR-TB rates[25].

Until 2025, a healthcare strategy approved by the Russian government ensuring prevention and treatment of infectious diseases (TB, HIV, hepatitis B, and C), implementation of a complex of preventive and anti-epidemic measures aimed at preventing these diseases. Currently, 1,7 billion people worldwide are infected with TB, reaching the mark of 1,5 million deaths due to TB and the main cause is associated with drug resistance and HIV infection[40]. These data demonstrate that this disease is a major global health problem, raising TB to the level of diseases with a high potential for lethality[40].

CONCLUSION

The low adherence to treatment, mistakes made in the past for diagnosing the disease, and the lack of drugs in the past for proper treatment, associated with the dissolution of the Soviet Union and unfavorable social situation, were facts that contributed to the high rate of MDR-TB in Russia nowadays. Additionally, the uncontrolled use of antibiotics causes an increase in MDR-TB rates. Even now, the Russian system is recognized as the best system in the world for TB treatment. The Russian Federation is in the WHO list of 78 countries that reach the 2020 End TB Strategy milestone plan in reducing TB cases, but the MDR-TB cases are still making Russia one of the countries with the highest MDR-TB rates. There is a need

for a more accurate compilation of specific data regarding TB and MDR-TB in order to ensure a safer epidemiological panorama to optimize the necessary actions for this disease in Russia.

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