

Familial Tuberculosis and its Prevention in Terms of Health Care Restructuring

Gruźlica rodzinna i jej zapobieganie w aspekcie restrukturyzacji opieki zdrowotnej

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SUMMARY

Aim: To study the peculiarities of the course of familial tuberculosis, which includes tuberculosis revealed in someone in the family if there is a source of this infection.

Materials and methods: We studied 199 families. One member of each family contracted pulmonary tuberculosis and later became a source of the disease for contactees. The examination was performed with standard clinical techniques using radiological, bacteriological, and immunological examination techniques.

Results: We found that in 12-24 months, 207 people were diseased in these families. We also revealed the shift toward a younger age among the diseased contactees. Special emphasis should be paid to the disease of children under 18–52 people, while there was only one patient among the sources of tuberculosis. There were more cases of familial tuberculosis in urban than in rural areas. Females were more likely to suffer from these forms of tuberculosis.

Conclusions: Considering the above, we believe that the development of familial tuberculosis occurs due to closer contact of TB source patients with family members, which is facilitated by bad habits of source patients and lack of isolation of contactees from sources and ill-considered reform of health care in general and tuberculosis particularly.

Key words: familial tuberculosis, contactees, morbidity

Słowa kluczowe: gruźlica rodzinna, osoby z kontaktu, zachorowalność

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INTRODUCTION

Pulmonary tuberculosis remains one of the most urgent problems today, as in most cases, it is the source of the disease. In Ukraine, this is especially important given that 95-96% of TB patients are pulmonary. Despite the efforts of the medical community and governments around the world, it is not possible to significantly reduce the morbidity rate. The measures planned by WHO for the implementation in 2015 have not been accomplished. Thus, in 2020, 10 million TB patients were registered worldwide, and 1.5 million of them died. It is especially hard to perceive the high infant mortality rate. The fact is that in 2015, 210 000 children died of tuberculosis. In recent years, about 700 children die every day [1].

Peculiarities of tuberculosis in Ukraine are high morbidity, high level of mycobacteria resistance to antibacterial drugs, the spread of multidrug-resistant tuberculosis. In recent

years, the incidence of tuberculosis has somewhat dropped worldwide, as well as in Ukraine. This applies to the incidence of the adult population (42,2 per 100 thousand population in 2020, compared to 60,1 per 100 thousand population in 2019) and the incidence of tuberculosis in children aged 0 to 14 from 9,0 to 5,9 and at the age of 15-17 years including – from 20,0 to 14,2 respectively [2].

However, there is an increase in the number of patients with prevalent forms of pulmonary tuberculosis, which are accompanied by destructive changes [2]. The growth of primary resistance of *Mycobacterium tuberculosis*, which, according to various authors, occurs in 15-35% of newly diagnosed patients is of particular concern. Moreover, secondary resistance of mycobacteria to antibacterial drugs develops within 6 months of treatment in 45-65% of patients. Besides, Ukraine is one of the 5 countries in the world with the highest rate of patients with multidrug-resistant pulmonary tuberculosis.

Its treatment requires extraordinary costs, which are equal to those spent on the treatment of 5-10 patients with sensitive forms of tuberculosis. But in this case, achieving «effective treatment» is possible in about 50% of patients [2]. According to the reform of health care, the diagnosis and treatment of tuberculosis are transferred to the general health care network [3-5]. Such a situation is causing concern.

The relevance of the issue under consideration is that most newly diagnosed patients with pulmonary tuberculosis and extrapulmonary forms keep an unrestricted regimen and are not isolated from others, which is especially dangerous for family members, as pulmonary forms of tuberculosis are the main source of tuberculosis infection.

AIM

The aim is to study the peculiarities of the development and course of familial tuberculosis to reduce the bacterial load on society, and thus – to reduce the incidence and morbidity of tuberculosis.

MATERIALS AND METHODS

199 families were under observation. One member of each family contracted pulmonary tuberculosis and later became a source of the disease for contactees. The survey was conducted according to common methods. Besides the radiological methods, in addition to radiography, ultrasonoscopy was used when the pleural disease was suspected. In children, tuberculin testing was used. During the statistical processing of the material, the calculation of the arithmetic means M and the error of the arithmetic mean were used. Student’s t-test (with normal scores) and non-parametric Wilcoxon test were used.

RESULTS

Of the families that had members with various forms of pulmonary tuberculosis, 93 (46,7%) lived in cities and 106 (53,3%) in rural areas. Among the urban residents, there were 66 males (71,0%) and 27 females (29,0%). Male patients were predominantly 29-38 old – 21 persons (31,8%). The smallest number of patients-sources of tuberculosis were at the age of 59 and older – 7 people (10,6%). Most of the female patients were at the age of 29-38 years – 8 (29,6%) and 39-48 years – 7 people (25,9%). The smallest number of patients were 19-28 years old – 2 (7,4%).

In general, patients aged 29-38 years prevailed among urban residents – 29 (31,2%) people; there were 20 (21,5%) people aged 39-48; aged 49-58 – 18 (19,4%) people. The lowest number of patients was under 28 years and older than 50 – 13 (14,0%) and 12 (13,0%) persons, respectively. There was only one female patient under 18.

Among rural patients-sources of familial tuberculosis, there were 90 males (84,9%) and 16 females (15,1%). Among male patients aged 29-38 years, there were 21 (23,3%) persons, aged 39-48 – 30 (33,3%) persons, and aged 49-58 – 28 (31,1%) persons. The lowest number of patients was at the age of 19-28 – 5 (5,5%), and 59 and older – 6 (6,7%). Among female rural patients, the largest number of sources of infection was at the age of 29-38 – 8 (50,0%); at the age of 39-48 – 3 (18,8%) persons, at the age of 49-58 y – 3 (18,8%) persons; at the age of 19-28 and 59 older – 1 (6,3%), each group.

It is worth emphasizing that at the age of 18, there were no male patients among the urban patients, and among female patients at this age, there was only 1 (3,7%) patient. There were no sources of tuberculosis among the rural residents under 18. Thus, there was only 1 (0,5%) person under 18 among the sources of tuberculosis infection (Table 1).

Among the contactees of urban residents, the number of patients in familial tuberculosis centers increased to 207. In cities, there were 115 (55,6%) such patients and 44,4% in rural areas. There were 63 males in the cities (54,8%) and 52 females (45,2%). In rural areas, there were 38 males (41,3%) and 54 females (58,7%).

The largest number of urban male contactees was at the age of 29-38 – 15 (23,8%), the same number of sick contactees (23,8%) was at the age of 39-48. There were 9 (14,3%) and 8 (12,7%) patients aged 19-28, and 59 and older, respectively. A small number of such patients – 4 (6,3%) were at the age of 49-58. It should be emphasized that the largest number of sick contactees (12-19,0%) was at the age of 0-18. Although, there were no sources of infection at all.

The largest number of contactees, urban female residents, contracted tuberculosis at the age of 12 (23,1%) when there were no sources of tuberculosis infection at all (0-18 years). The same number of patients 12 (23,1%) was registered at the age of 29-38. A slightly smaller number of patients was at the age of 19-28 and 39-48 – 11 (21,2%) and 9 (17,3%),

Table 1. Features of sources of familial tuberculosis by age, gender, and place of residence

Place of residence		Gender						Total
		0-18 years old	19-28 years old	29-38 years old	39-48 years old	49-58 years old	0-18 years old	
Urban	male	-	11	21	13	14	7	66
	female	1	2	8	7	4	5	27
	total	1	13	29	20	18	12	93
Rural	male	-	5	21	30	28	6	90
	female	-	1	8	3	3	1	16
	total	-	6	29	33	31	7	106
TOTAL		1	19	58	51	49	19	199

respectively. A significantly smaller number of contact patients was at the age of 49-58, and 59 and older – 3 (5,8%) and 5 (9,6%), respectively.

Among the rural residents, there were 38 male contactees (41,3%) and 54 female contactees (58,7%). It is noteworthy that there were 1.4 times more females among familial tuberculosis contactees than males. The largest number of contactees, rural residents, was among males – 11 (28,9%) aged 0–18, among whom there were no sources of tuberculosis infection. A smaller number – 10 (26,3%) of male contactees were recorded at the age of 29-38 and 49-58 – 8 (21,1%). At the age of 19-28, 39-48, and 59 and older, there were 4 (10,5%), 4 (10,5%), and 1 (2,6%) patient, respectively. There were 17 (31,5%) female contactees aged 0-18, while there were no patients of this age at all among the sources of tuberculosis infection. At the age of 19-28 and 29-38, 11 (20,4%) and 13 (24,1%) female contactees were recorded, respectively. There were significantly fewer patients of other age groups (39-48, 49-58, and 59 and older) among females – 4 (7,4%), 3 (5,6%), and 6 (11,1%), respectively.

Thus, there is a higher incidence of contactees among people living in cities, which can be associated with much closer contact with the source of tuberculosis infection. At the same time, the higher incidence of contactees among the rural population among females is noteworthy, which is probably due to closer contact for the care of patients-sources of tuberculosis infection.

We should particularly emphasize the high incidence of contactees aged 0-18 in both urban and rural areas because at this age there was only 1 source of tuberculosis infection. In the cities, contactees there were 24 (20,9%) patients of both genders, and in the villages – 28 (30,4%) – $p < 0,05$.

Among patients-sources of tuberculosis infection, there were 70 (35,2%) working people, while there were 129 (64,8%) non-working people, i.e., 1,8 times more – $p < 0,05$. Given that most patients-sources did not work, they spent most of their time at home. Because of this, they had the opportunity to contact their roommates before the disease, as well as after the recovery, for a long time to some extent, which «facilitated» the possibility of «transmission» of an infectious agent. Thus, this group of people can be attributed to conditionally active sources of tuberculosis infection.

Besides the above-mentioned factor, 36 (18,1%) alcohol addicts and 24 (12,1%) smokers were at risk for tuberculosis. The harmfulness of smoke exposure is well known, it is almost as aggressive as active smoking. 14 (7,0%) people (patients-sources) were former prisoners, most of whom acquire bad health habits toward others. As this certainly affects the intensity of infecting contactees, the total number of «negative» active sources was 74 (37,2%) persons. Since these groups of people are not very concerned about others and they are not particularly worried about the fate of cohabitants, otherwise, they would not be drawn to this «evil» and would have long ago abandoned it, we believe that this group of sources of tuberculosis should be classified as an aggressive source. Considering the features of the sources of infection, we found unfavorable conditions in families, not

only in terms of possible infection but superinfection as well. This is especially dangerous given that 64,8% of sources did not work, so the conditions for the family contact increased. It is worth emphasizing that only 132 (66,3%) people were committed to receiving treatment for TB, and 67 (33,7%) people did not take good care of their health. Therefore, it is useless to expect a proper treatment of their cohabitants. Thus, the cohabitants of such sources of tuberculosis infection were held hostage and it was out of their control whether they will get sick or not, it is rather when it will happen. Thus, in this regard, the nature of the pulmonary process in patients-sources of infection was very important. Among such patients (199), focal tuberculosis was recorded in only 7 (3,5%). Infiltrative tuberculosis was in 123 (61,8%) patients. That is, the most aggressive form of pulmonary tuberculosis, which in the vast majority of cases was accompanied by the decay of lung tissue, and thus, the release of mycobacteria, which illustrates their combativeness as a source of infection. Disseminated tuberculosis was observed in 55 (27,6%) individuals. Fibrous-cavernous tuberculosis «accompanied» cohabitants in the center of this infection in 10 (5,0%) observed. In general, we observed the most aggressive forms of tuberculosis (infiltrative tuberculosis, disseminated tuberculosis, and fibrous-cavernous tuberculosis) in the vast majority of studied patients – 188 (94,5%).

It is worth emphasizing that the source of tuberculosis infection in 4 (2,0%) was extrapulmonary tuberculosis – tuberculous pleurisy, which most authors consider a non-life-threatening form of the disease in terms of possible contamination of others. Having considered such an experience, we applied a specific examination of such patients. The results will be discussed below.

Bacillary sources of tuberculosis were 99 (49,7%) observed. Microscopically, Mycobacteria of tuberculosis were found in 57 (57,6%) people.

Among the contactees, Mycobacteria tuberculosis were found in 94 (45,4%) patients. Microscopically, this was proved in 113 (54,6%). In the process of microbiological study, the sensitivity of Mycobacterium tuberculosis to antibacterial drugs was confirmed in 20 (20,2%) patients-sources of tuberculosis. Among familial tuberculosis contactees, susceptible mycobacteria were revealed in 26 (27,7%) individuals ($p > 0,05$). Multidrug resistance among patients-sources of tuberculosis was proved in 39 (39,4%) subjects, and among contactees of familial tuberculosis – in 31 (33,0%) persons ($p > 0,05$).

In rural areas, there were 14 patients with familial tuberculosis fewer among the contactees than the sources of infection, while there were more than 22 urban contactees. Male patients predominated among the patients-contactees (11 more). However, their number was less than the in the sources of infection. Attention was drawn by a significantly higher number of contactees with newly diagnosed tuberculosis among females – 52 people – compared to the number of sources (27). The difference was 25 people ($p < 0,05$), indicating a significantly higher risk of developing familial tuberculosis in females, which can be explained by the greater

possibility of contamination at home contacting with tuberculosis patients to the level that causes the disease. We see a similar situation among rural patients. However, the number of newly diagnosed patients with familial tuberculosis in female patients was higher than among males. That is, there were 3,4 times more female contactees with familial tuberculosis ($p < 0,05$). In contrast to the group of patients-sources of tuberculosis infection among urban residents, where there was only 1 person under 18. In the group of contactees there were 28 (30,4%) among rural dwellers, and among urban residents – 24 (20,9%). These two figures draw much attention. Their total number was 52 people. Thus, the availability of tuberculosis infection sources at home leads not only to the contamination of contactees but also to the disease development. Concerning all patients with familial tuberculosis, family-type contactees under 18 count for 207 people. Such a number (25,1%) is thought-provoking and worrying. Thus, what will be the life of these children in the future when they face all the realities of life, considering negative, as well as all the risk factors.

DISCUSSION

Considering the above-mentioned issues, we should emphasize that the maximum number of sources of tuberculosis – 158 (79,4%) people were at the age of 29-58, i.e., at the most productive age. At the same time, the vector of the maximum number of family-type patients (contactees) has shifted to rejuvenation: 19-48 years – 117 (56,5%) people. These people are still receiving education, including vocational education, and improving their professional skills. This is the cohort that the present and future of any state depend on. Unfortunately, the disease has hindered them from living active social life for many months. Moreover, the significant incidence between females and children under 18 (25,1%) should be emphasized.

Peculiarities of pulmonary tuberculosis are presented in the Table 2. It shows that the predominant form of tuberculosis between sources of infection and contactees of familial disease was infiltrative (61,8% and 57,0%, respectively – $p > 0,05$) and disseminated tuberculosis (27,6% and 12,6%, respectively). A significant number of contactees with extrapulmonary tuberculosis is noteworthy – 26 (12,6%), which is much more

difficult to diagnose as there are no specialists in extrapulmonary tuberculosis. Within the research presented in this article, we are considering their total number, everything else is the subject of a separate further study.

Bacillary cases among the sources of tuberculosis were found in 99 (49,7%) persons, and among the patients-contactees of familial tuberculosis – in 94 (45,4%) persons ($p > 0,05$). Sensitive tuberculosis was revealed in 20 (20,2%) sources of infection, and among the contactees of familial tuberculosis – 26 (27,7%). Polyresistant tuberculosis among the sources of infection occurred in 16 (16,2%), and among the familial tuberculosis contactees – in 12,8% ($p > 0,05$) patients. Multidrug-resistant tuberculosis was revealed in 39 (39,4%) patients, and in the familial tuberculosis contactees – 33,0% ($p > 0,05$). Tuberculosis with extended resistance of *Mycobacterium tuberculosis* among was recorded in 7 (7,0%) sources of tuberculosis infection, and among the familial tuberculosis contactees – in 5 (5,3%) – $p > 0,05$. In general, tuberculosis with the last three types of resistance (multidrug-resistant, polyresistant, and with extended resistance), which are extremely dangerous for the patient-source of infection and contactee, as well, as the cost of treatment of these patients exceeds that of sensitive tuberculosis many times. It is incredibly difficult to achieve the abacillation of such patients. Despite the WHO’s recommendations, as well as according to the order of the Cabinet of Ministers of Ukraine dated November 27, 2019 [4], which focuses on 85% sanitation of such patients, in our country, we can treat only 45–47% of such patients, which justifies the transfer of patients with multidrug-resistant tuberculosis to palliative treatment [5].

CONCLUSIONS

Summarizing the results of the study, we can state that the availability of tuberculosis patients (199 people) in the family, who were not isolated for the entire period of treatment, led to the development of familial tuberculosis in contactees (207). The age of the diseased contactees tended to rejuvenation. Moreover, if there was only 1 patient under 18 among the sources of infection, there were 52 people among the contactees of familial tuberculosis. Extrapulmonary tuberculosis occurred in a significant number of contactees – 26

Table 2. Characteristics of contactees who fell ill from the source of familial tuberculosis by age and sex and place of residence

Place of residence		Gender						Total
		0–18 years old	19–28 years old	29–38 years old	39–48 years old	49–58 years old	59 and older	
Urban	male	12	9	15	15	4	8	63
	female	12	11	12	9	3	5	52
	total	24	20	27	24	7	13	115
Rural	male	11	4	10	4	8	1	38
	female	17	11	13	4	3	6	54
	total	28	15	23	8	11	7	92
TOTAL		52	35	50	32	18	20	207

(12,6%) persons – $p < 0,05$, compared with 4 (2,0%) patients in the group of the sources of infection, which further indicates the danger of familial tuberculosis. We consider the development of the latter is happening due to the reform of health care and the reorganization of the tuberculosis service. Favorable factors for the development of familial tuberculosis were close contact of family members with the source of infection (super-infection), which is confirmed by the higher number of patients with familial tuberculosis in the urban area (115) compared to rural areas (92) – $p < 0,05$ and the predominant number of sick female contactees in rural areas – 54 (58,7%) compared to 38 (41,3%) males. The risk of developing tuberculosis was alcohol-addiction – 36 (18,1%), most males and only 1 female, and smoking abuse – 24 (12,1%).

Only 132 (66,3%) people among the sources of tuberculosis adhered to treatment. Unfortunately, there is no use asking other individuals in this group – 67 (33,7%) – to change their attitude to their health, and even more so to the health of others against the background of these habits, is useless. What is left to overcome this vicious circle? We think measures should be taken to overcome the second link of the epidemic process, which is breaking the chain of transmission of the infectious process. To this end, measures to isolate bacillary patients and persons with common pulmonary tuberculosis should be verified. To make it even more transparent – to stop the destruction of the tuberculosis service, as well as health care in general. We should stop and restore what is left before it is too late. We do understand that this is an incredibly difficult and problematic process, if at all possible.

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Conflicts of interest:

The Authors declare no conflict of interest

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Info

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