CHARACTERISTIC FEATURES OF THE FOCI OF TUBERCULOSIS INFECTION IN RURAL AREAS OF THE EXTREME NORTH

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Summary

The specifics of conducting antiepidemic work within the foci of tuberculosis infection in the setting of rural extreme northern region are presented. Study of 150 foci of tuberculosis infection showed: remoteness and hard accessibility of rural infection foci to specialized health service delays timely hospitalization of newly identified patients with tuberculosis, complicates examination and isolation of children to sanatoria, and hampers the conduction of antiepidemic measures in new foci of tuberculosis infection by epidemiologists and phthisiologists.

Keywords: tuberculosis, children, foci of tuberculosis infection, rural area, extreme north, health services accessibility

Incidence of tuberculosis (TB) in pediatric population from risk groups is what causes most alarm in the current epidemiologic situation for TB in the Russian Federation, although these groups of population are constantly followed-up by phthisiologists (Aksenova V.A. et al., 2011). In 2009 the incidence of TB among children exposed to smear-positive persons was 30 times higher than the incidence in Russian Federation for the same age groups; incidence among adolescents was 25 times higher.

Poor registration and follow-up of children and adolescents exposed to household contacts with active TB is reported (Shilova M.V., 2010). Pediatric TB incidence in children referred to dispensary follow-up group IV with histories of household smear-positive contact was 659.9/100 000 in 2010 (605.7 in 2009; 608.1 in 2008, per 100 000), i.e. grew 8.9% higher.

Detection of TB in rural areas (Punga V.V. et al., 2011) has some specific differences due to often long distances between the patient's place of residence and healthcare facility where examination, diagnosis and treatment are done, more unfavorable social conditions and closer social contacts between people, compared to urban population. In rural regions, pediatric incidence in the foci of infection was characterized by irregular registration of cases and high rates ranging from 3 to 20%. Cases with complicated forms of TB, with involvement of meninges and CNS were present in these regions.

Some authors (Son I.M. et al., 2002) think that intensity of the epidemiologic situation for TB is largely determined by pediatric incidence.

The above said is the reason why today there is a need to improve anti-tuberculosis work in the foci of TB infection, especially in rural areas under hard conditions of the extreme north.

Aim of the study was to analyze characteristic features of the foci of TB infection in rural areas of the extreme north.

To determine the characteristic features that influence the conduction of antiepidemic measures in the bacillary foci of infection, we studied 150 foci of TB infection referred by TB Dispensary classification to follow-up group I, where 287 children were residing. To achieve that purpose, we conducted questionnaires in cities and districts (*uluses*) of the Sakha Republic (Yakutia).

The foci of TB infection were divided to 2 groups based on the territory: the study group included 80 foci in rural area located in 20 administrative districts of Yakutia, with pediatric

population of 157 children; control group included 70 foci located in cities and urban-type settlements with pediatric population of 310 children.

Table 1
Distance and roads between the foci of TB infection and TB Dispensaries

Distance from TB Dispensary (km)	Group								Total	
	Study group (n=80)				Control group (n=70)					
	Roads				Roads					
	Unsealed		Sealed		Unsealed		Sealed			
	n	%	n	%	n	%	n	%	n	%
0 – 20	20	25.3	-	-	15	53.6	28	66.7	63	42.0
20 – 60	17	21.5	1	100	7	25.0	4	9.5	29	19.3
60 -120	19	24.0	-	-	3	10.7	10	23.8	32	21.3
120 - 180	4	5.1	-	-	3	10.7	-	-	7	4.7
180 - 240	13	16.5	-	-	-	-	-	-	13	8.7
240 - 300	3	3.8	-	-	-	-	-	-	3	2.0
300 or <	3	3.8	-	-	-	-	-	-	3	2.0
Total	79	98.8*	1	1.2*	28	40.0*	42	60.0*	150	100

* significance of differences between groups ($p<0.001$)

Analysis of remoteness of regional or municipal-level TB Dispensaries from the foci of infection has shown, that 71.3% of the foci are accessible only by unsealed roads; in rural areas up to 98.8% of the foci are accessible only by unsealed roads; most of the roads are inconvenient; automobile transport to the foci of infection is complicated; local animal transport is used depending on season and weather conditions. In urban areas up to 60.0% of the foci can be accessed by sealed roads, the rest 40.0% are accessible by unsealed roads. Distances in urban areas are significantly shorter, than in rural areas: only 21.6% of the foci are located at more than 60 km distances, while in rural areas 53.2% of the foci are even more remote (distances are up to 240 km and more). Inconvenient roads prevail in rural areas: difference between study groups is statistically meaningful ($Xi=63.01$; $p<0.001$).

Table 2
Seasonal accessibility of the foci of TB infection by road

Distance from TB Dispensary (km)	Groups								Total	
	Study group (n=80)				Control group (n=70)					
	Trafficability				Trafficability					
	Year-round		Seasonal		Year-round		Seasonal			
	n	%	n	%	n	%	n	%	n	%
0 – 20	5	71.4	15	20.5	43	67.2	-	-	63	42.0
20 – 60	2	28.6	16	22.0	11	17.2	-	-	29	19.3
60 -120	-	-	19	26.0	10	15.6	3	50.0	32	21.3
120 - 180	-	-	4	5.5			3	50.0	7	4.7
180 - 240	-	-	13	17.8			-	-	13	8.7
240 - 300	-	-	3	4.1			-	-	3	2.0
300 or <	-	-	3	4.1			-	-	3	2.0
Total	7	8.8*	73	91.2**	64	91.4	6	8.6	150	100

* significance of differences between groups ($p<0.01$)
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Only 8.8% of the foci in study group 1 and 91.2% of the foci in control group were located within the distance of 60 km and were open to visits year-round regardless of the season or weather conditions ($p<0.01$). Most of the remote foci of infection in rural area (57.5%), which are located at 60-120 km and more distances, can be accessed only seasonally depending on the trafficability of the automobile roads.

Seasonal automobile transport is the prevailing one in rural areas, with meaningful difference between study groups ($Xi=102.37$; $p<0.001$).

Table 3
Types of transport providing access to the foci of TB infection

Distance from TB Dispensary (km)	Groups											
	Study group (n=80)						Control group (n=70)					
	Transport type						Transport type					
	Automobile		Air transport		Specialty transport		Automobile		Air transport		Specialty transport	
	n	%	n	%	n	%	n	%	n	%	n	%
0 – 20	28	50.9	-	-	2	14.3	46	71.9	-	-	-	-
20 – 60	12	21.8	-	-	1	7.1	8	12.5	-	-	-	-
60 -120	11	20.0	-	-	3	21.4	10	15.6	-	-	3	60.0
120 - 180	-	-	3	27.3	1	7.1	-	-	-	-	-	-
180 - 240	4	7.3	3	27.3	6	-	-	-	1	100	2	40.0
240 - 300	-	-	3	27.3	-	-	-	-	-	-	-	-
300 or <	-	-	2	18.1	1	-	-	-	-	-	-	-
Total	55	68.8*	11	13.7*	14	17.5	64	91.4	1	1.4	5	7.2

* significance of differences between groups ($p<0.01$)

Analysis of the proportions of transport types, by which the foci of TB infection can be accessed, showed that:

- accessibility by automobile transport (mainly UAZ vehicles) was 68.8% for the foci of infection in rural area vs. 91.4% for the foci in urban areas ($p<0.01$);
- accessibility by air transport was 13.7% for rural foci vs. 1.4% for the foci in urban-type settlements ($p<0.01$);
- accessibility by specialty transport (tractor, all-terrain vehicle, animal transport) was 17.5% for rural foci vs. 7.2% for the foci in urban area ($p<0.1$).

Thus, rural and urban areas have meaningful differences by types of transport ($Xi=12.67$; $p<0.005$).

Table 4

Description of the foci of TB infection by distance from TB Dispensary and number of smear-positive cases

Distance from TB Dispensary (km)	Groups							
	Study group (n=80)				Study group (n=80)			
	Smear-positive cases in the focus of infection		MDR		Smear-positive cases in the focus of infection		MDR	
	n	%	n	%	n	%	n	%
0 – 20	-	-	12	41.4	2	100	9	81.8
20 – 60	1	20.0	8	27.6	-	-	-	-
60 -120	-	-	8	27.6			1	9.1
120 - 180	-	-	-	-			-	-
180 - 240	3	60.0	1	3.4			1	9.1
240 - 300	-	-	-	-			-	-
300 or <	1	20.0	-	-			-	-
Total	5	6.2	29	36.3*	2	2.8	11	15.7

* significance of differences between groups ($p<0.01$)

Number of the foci of TB infection with 2 or more resident smear-positive patients was 6.2% (5 persons) in rural area and 2.8% (2 persons) in urban area; 80.0% of rural patients reside at 180 km form the regional center, i.e. far from TB Dispensary, which extremely complicates timely sanitation of the focus of infection without delays.

Severity and complexity of a focus of infection is determined by the presence of patients, who are positive for multidrug-resistant M.tuberculosis (MDR MTB). In this study 143 (89.9%) out of 159 smear-positive patients were tested for drug sensitivity, of them patients from 79 rural foci of infection (96.3%) and patients from 64 (91.4%) urban foci. MDR MTB were detected in 36.3% of patients from rural areas and in 15.7% of patients from urban areas, i.e. epidemiologically dangerous foci of infection complicated with the presence of MDR MTB occurred twice more often in rural areas ($p<0.01$).

Delays in isolating the cases by timely hospitalizing patients from the foci of infection were observed in 72.5% of patients from rural areas, which was 1.8 times higher than in patients from urban areas (40.0%; $p<0.01$). Late case isolation was due to difficult transport system in those districts, where small aircrafts and all-terrain vehicles were the main means of transport. Only 27.5% of patients from rural areas can be isolated to in-patient TB clinics without delays. Study groups significantly differ by timely isolation of patients ($Xi=16.12$; $p<0.001$); there is a meaningful prevalence of delayed patient isolation in rural foci of infection.

Of 157 rural children, only 42.0% (66) of children with histories of contact with TB were

examined in time; the same rate for urban children was 88.5% (115) ($p<0.01$). Among all child contacts, rural children made 54.7%, of which only 58.0% were examined in specialty TB facility without delays; the rest of children were residing in hard-to-access regions of the republic out of the direct service area of TB Dispensaries, where healthcare is provided by the primary level specialists, such as rural practitioners at first aid posts (FAPs) and district physicians. There was significant difference between study groups by timeliness of examination of child contacts ($Xi=16.12$; $p<0.001$); delayed phthisiologist's or epidemiologist's visits to the foci of infection were significantly more often in rural foci: 22.5% and 18.8% vs. 80.0 and 48.6% in urban areas.

In conclusion, the specific features of the foci of TB infection in rural areas of the extreme north with its harsh environment are: remoteness from the specialty healthcare clinics and hard accessibility; road trafficability dependent on climate and geographic characteristics; shortage of needed transport. The above said complicates timely hospitalization of new cases with TB, examination and isolation of children to sanatoriums, conduction of antiepidemic activities in the newly detected foci of infection by phthisiologists and epidemiologists.

In view of the challenging climatic and geographic conditions in Yakutia, recommendations need to be developed: 1) to classify the rural foci of TB infection by degree of complexity; 2) to improve antiepidemic measures in the foci of infection, in cooperation with district physicians or rural practitioners (feldshers), registered nurses, local authorities represented by the assigned social worker and community leaders recommended by the phthisiologist.

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