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DYNAMIC CHANGES OF IN INCIDENCE OF IXODES TICK BITE CASES IN ADULT POPULATION OF VINNITSA REGION, UKRAINE

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Not all ticks carry dangerous pathogens, but their bites can threaten humans with diseases such as Ixodes tick-borne borreliosis (Lyme disease), Miyamoto disease, tick-borne viral encephalitis and about 150 other nosological entities. The season of life activity of Ixodes ticks begins in March and usually lasts until November and has two pronounced seasonal peaks during the year: over April – May and August – September. The relevance of the investigation is determined by the lack of the information on the incidence of tick bite cases among the population in Ukraine, and there no well elaborated sets of measures in order to prevent this problem. The purpose of this study is to provide a detailed analysis of the incidence of Ixodes tick bite cases among the adult population in the Vinnytsia region and in the city of Vinnytsia, to compare the number of detected cases for the period from 2013 to 2018, and to identify the most reliable and available prevention methods. The research was conducted at the laboratory of the municipal non-profit enterprise "Vinnytsia City Hospital G1" (KNP "VMKL"); statistical data were provided by the State Regional Sanitary and Epidemiological Station. We compared the prevalence of the disease in different districts of the Vinnytsia region and its insidence for the period from 2013 to 2018. During this period, the number of detected cases of tick bites resulted in the occurrence of various dangerous diseases went up from 53 to 317 cases among the entire adult population of the Vinnytsia region. For all years except 2018, the highest incidence rate was consistently observed in the Mogilev-Podilsk district district, even exceeding the level in more densely populated and large areas. Over the period from 2013 to 2018, the number of detected cases of tick bites in the adult population that resulted in various dangerous diseases rapidly and significantly increased. This necessitates to elaborate the set of preventive measures and to educate the population of all ages. Much attention should be paid to promoting vaccination as the only reliable way and the development of sanitary and hygienic recommendations for residents of municipal and rural areas (in the spring and summer).

Key words: ticks, epidemiology, tick bites, tick-borne encephalitis, diseases.

Introduction

Not all ticks carry dangerous pathogens, but their bites can cause such diseases as Ixodes tick-borne borreliosis (Lyme disease), Miyamoto disease, tick-borne viral encephalitis and about 150 other nosological names. The season of life activity of Ixodes mites begins in March and usually lasts until November with two pronounced seasonal peaks during the year: over April – May and August – September. Own experience has shown that ticks can infect humans at any time of the day or night or in any weather. This often happens during walks in parks, trips to the forest, as well as during the gardening or work in the countryside.

Tick-borne encephalitis (TBE) is an infectious disease of the central nervous system caused by a flavivirus and usually transmitted by the bite of infected Ixodes spp. These ticks can be found over the territory from Western Europe to Japan [1, 2].

Based on phylogenetic analysis of E protein, the TBEV has been classified into three subtypes, namely European (Eu-TBEV), Far-Eastern (FE-TBEV), and Siberian (Sib-TBEV). The Sib-TBEV and FE-TBEV were also called eastern TBEV. Recently, 886-84-like strains were divided from Sib-TBEV and proposed as a new subtype named Baikalian (Bkl-TBEV) [3]. Tick-borne encephalitis causes acute meningoencephalitis with or without myelitis. Morbidity cuased by this infection is age-related, and is the highest in adults, who develop encephalitis. A third of patients may develop long-lasting sequelae, often causing cognitive dysfunction and substantial impairment in the quality of life. The disease arises in patchy endemic foci in Europe, with climatic and ecological conditions suitable for circulation of the virus. Climate change and leisure habits expose more people to tick-bites and have contributed to the increase in number of cases despite availability of effective vaccines. The serological diagnosis is usually quite informative; no specific treatment for the disease exists, and immunisation is the main preventive measure [2].

Depending on the natural and environmental peculiarities, the subtypes of mite population are very diverse. Some are common in the forest-bush zone, others are found in the desert or semi-desert areas, the third reside in the steppe or mountains. It has been established that the first to appear after wintering (April 15-20) are Ixodes mites of the genus *Ixodes ricinus* (dog mite) and *Ixodes Persulcatus* (taiga mite). They are the most common and pose the serious danger for farm animals and humans in Ukraine. Humans are attacked almost exclusively by adult ticks. This determines the main role in the infection [4,5].

Ixodes mites are known as one of the most numerous ectoparasites among arthropods. In their life development, they are engulfed by two - three hosts. In the larval stage and in the state of nymphs, they attack small rodents and birds; and in their adulthood, they are carried by predators, ungulates, large rodents and humans. Piroplasmidosis pathogens can be carried by cattle, horses, dogs, pigs as well as pathogens of ruminant anaplasmosis and a large group of pathogens of infectious diseases of animals and humans. Urbanization of

large areas, which “disseminate” urban-type structures, usually leads to a decrease in the number and species diversity of many wild animals, and, at the same time results in the increase in the circulation of pathogens between human populations and wild and domestic animals.

Ixodes mites are a constant component of most terrestrial ecosystems. The existence of the species with pasture type of parasitism depends entirely on the whole set of ecological conditions. The variability of morphological characteristics of organisms determines their ability to adapt that leads to an increase or decrease in the variability of these properties in adverse living conditions (habitat boundaries, chemical pollution, etc.). The growing interest in the study of Ixodes mites and the large number of publications devoted to various aspects of morphology, physiology, biology, etc., is explained by the number of associated medical and social problems. Ixodes mites are reported as carriers and reservoirs of many communicable diseases [6].

There are many studies examining the Ixodes population and its effects on human health; numerous reports highlight Tick-borne encephalitis epidemiology, clinical presentation, current available diagnostic tools and treatment [7]. Special attention should be paid to the scientific contribution of scientists of the Eurasian continent including Europe, Russia, Far-Eastern Asia, and Japan [8, 9, 10]. This led us to the idea of researching this issue in Ukraine, in the Vinnytsia region and in the city of Vinnitsa.

The aim of this study is to perform a detailed analysis of the incidence of tick-borne encephalitis in the Vinnytsia region and in the city of Vinnitsa, to compare the number of detected cases of tick-borne encephalitis for the period from 2013 to 2018, and to determine the best available treatment in Ukraine.

The novelty of this study consists in a detailed survey of the prevalence of tick-borne encephalitis in the city of Vinnitsa and Vinnitsa region.

Materials and methods

The research was carried out in the laboratory of the Municipal Non-profit Enterprise "Vinnytsia City Hospital G1" (KNP "VMKL"); statistical data were provided by the State Regional Sanitary-Epidemiological Station. During the study period, the prevalence and incidence of the disease in different districts of the Vinnytsia region were analyzed and compared for the period from 2013 to 2018. The subject of the study was representatives of the family of Ixodes mites. Processing and analysis of the obtained data were performed by standard methods of variation statistics using "Statistica 8.0" software.

Results and discussion

The systematisation of ticks is shown in table 1.

Table 1.
Systematisation of ticks

Domain	Eukaryotes (Eukaryota)
Animal Kingdom	Animals (Animalia)
Realm	Multicellular Animals (Eumetazoa)
Caption	Multi-segment type
Type	Arthropodas (Arthropoda)
Subtype	Helicero
Class	Arachnidas (Arachnida)
Superorder	Acariformes — Acariform mites
Order	Mites
Suborder	Ixodotic mites

During the study, we divided the Vinnytsia region into small study areas. Each study area was a specific forest area (or part of it) up to 15-25 m^2. Such areas demonstrated all the most characteristic landscape features and included all the dominant forest types. The areas were marked on the map and numbered. No less than 10-15 ticks were collected from each area. Drag sampling and flagging were used as two of the most effective and widely applied techniques to monitor tick populations. The ticks were transported wrapped in a slightly moistened medical bandage, then placed into a plastic bag. In such bandages, the mites could remain alive at + 4-8 C^0 (in a standard refrigerator) for up to 2 months or more.

Ice containers were used to transport ticks over long distances. The collected ticks were brought alive to the laboratory of the State Institution "Vinnytsia Regional Laboratory Centre of the Ministry of Health of Ukraine" for microscopic examination. To detect the tick-borne encephalitis virus and to assess the individual infection burden of the ticks, which are reservoirs for infection, dark field microscopy was used.

In 2013, 53 cases of severe tick-borne tick bites were recorded in the Vinnytsia region.

The largest number of identified cases (n=19) was in May, followed by July (12 cases) and September (9 cases). The lowest number was observed in October (9 cases) and in November (4 cases).

In 2014, the level of diseases caused by tick bites in the Vinnytsia region increased by 55.32% compared to 2013, and amounted to 73 cases.

The highest number of detected cases of tick bites in 2014 was seen in July (53 cases), followed by May and June, while the lowest number of the cases were detected in September, October, and November.

Compared to 2014, in 2015, the level of tick bites and morbidity increased by 15.5% in the total population, and made up 84 registered cases. The highest incidence rate was registered in May (33 cases), followed by June (24 cases) and August (16 cases); the lowest rate was found in September, October and November (11 cases in total).

In 2016, the number of tick bite cases and severe morbidity among the entire population grew up by 27.74% compared to 2014, and made up 93 cases.

The highest number of severe cases was regis-

tered in July, 44 cases, followed by 20 cases in August and 10 cases in September; the lowest number of cases was registered in October (10 cases), in November (5 cases) and in April (4 cases). The incidence rate in 2017 compared to 2016 among the entire population increased by 60%, and amounted to 148 cases. In 2018, there was a significant growth in the incidence rate in the Vinnytsia region that reached 317 cases, compared to 148 cases in 2017, when about 60% of the cases were laboratory-confirmed. The rate was almost 33 cases per 100,000 of population with a national average value of 13 per 100,000. Thus, for the period from 2013 to 2018, the number of registered tick bite patients in the Vinnytsia region increased significantly from 53 in 2013 to 317 in 2018 (Fig. 1).

We found that in the period from 2013 to 2018 the incidence rate was steadily increasing that was especially noticeable in the period from 2017 to 2018. In 2016, there was a negligible rise in cases, and then the number of cases continued to grow, reaching a recorded peak in 2018.

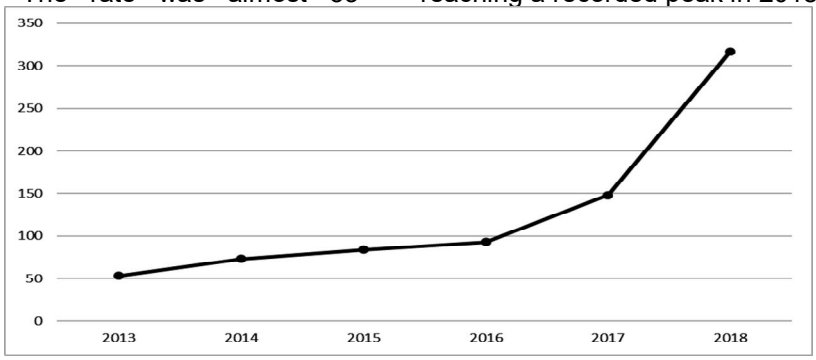

Fig. 1. Dynamic changes in rate of tick bite cases among the population in the Vinnytsia region for 2013 – 2018.

In the study of Ixodes mite bite cases among the population in the Vinnytsia region in 2013, the highest incidence rate was registered in the Mohyliv-Podilskyi district (28 cases) and in the Vinnytsia district (11 cases). The lowest rates were registered in the Orativ district (3 cases), in the Chechelnytsky district (1 case) and Pohrebyshche (2 cases). During the period from 2013 to 2014, the number of tick bite cases requiring medical assistance in the Vinnytsia region alone increased by 37.16% and made up 172 cases.

During the period from 2014 to 2015, the number of tick bite cases resulted in severe disease increased by 10.57%, and made up 174 registered cases among the studied population. Over 2015 – 2016 period, the incidence rate of tick bites cases increased to 177 cases. The largest number of cases, 59 cases, was registered in the Mohyliv-Podilskyi district in 2016; the second position was ranked by the Zhmerynskyi and Vinnytsiai districts with 30 cases in each. The lowest incidence, 2 cases, was found in the Kryzhopil district and in Pishchansky district. The incidence rate in 2017 among the adult population increased and amounted to 148 cases. In 2018, the number of tick bite cases went up to 317. Comparative rates of tick bite cases over the years are represented in the Table 2.

Table 2.
Incidence rate of tick-bite case in the Vinnytsia region for 2013 - 2018

			Number of cases compared to previous year	Growth ratio compared to previous	Growth Ratio, %	Growth rate in percents compared with previous year
			Chain	**Comparison with the previous year**		
	Year	Number of cases	Absolute growth, number of cases	Growth ratio	Growth rate, %	Growth rate, %
	2013	53				
1	2014	73	20	1,3774	137,74	37,74
2	2015	84	11	1,1507	115,07	15,07
3	2016	93	9	1,1071	110,71	10,71
4	2017	148	55	1,5914	159,14	59,14
5	2018	317	169	2,1419	214,19	114,19
		Sum	264	5,9811		
			arithmetic	geometric mean		
		On average for 5 years from 2014 to 2018	52,8	1,4301	143,01	43,01
			Basic	**Comparison with 2013**		
	Year	Number of cases	Absolute growth, number of cases	Growth ratio	Growth rate, %	Growth rate,%
	2013	53				
	2014	73	20	1,3774	137,74	37,74
	2015	84	31	1,5849	158,49	58,49
	2016	93	40	1,7547	175,47	75,47
	2017	148	95	2,7925	279,25	179,25
	2018	317	264	5,9811	598,11	498,11
		For 5 years	264	5,9811	598,11	498,11

Immediate medical care at the medical settings in tick bite cases is strictly recommended, even when dealing with an "easy" uncomplicated course. The neurologist ambulatory care and consultation of the optometrist is obligatory. In the presence of meningeal symptoms, it is necessary to perform diagnostic lumbar puncture. Bed rest can be recommended for 5-7 days until the symptoms of intoxication go away. Bed rest should be followed for 1-2 weeks after the body temperature has become normal. In cases of focal and meningeal forms of the disease, proper transportation to the hospital should be provided to ensure the correct position of a patient: the affected limbs should be placed in a functional provision in order to minimize contractures. In the cases of focal form of the disease, the patient should be discharged no earlier than in 21 days when demonstrating clinically confirmed recovery. There are no special dietary requirements; plenty drinking is recommended in the acute period. Physical activity should be limited; balneotherapy and massive electrical procedures are prohibited. In order to improve the diagnosis and treatment of patients with tick-borne encephalitis, one of the priority tasks is to reduce the percentage of late hospitalization, misdiagnoses, and to promote the study of the immune status of the population to tick-borne encephalitis, methods of high-quality epizootic prognosis, and to educate the population.

In Ukraine, it is necessary to establish an emergency care system for epidemiological surveillance to monitor natural foci of infection. Moreover, it is essential to remember the basic principles of the therapy of tick-borne encephalitis included early start of the treatment, careful monitoring of the condition, and the correct choice of the medication. Thus, to improve the overall situation with the incidence of tick-borne encephalitis, further studies on this topic should be conducted and their results should be disseminated by medical and preventive settings among the population. Undoubtedly, it is worthwhile to carry out education talks in schools, first and foremost explaining the symptoms of the disease. Also, reporting a case of human disease (infection) with tick-borne encephalitis is a prerequisite for performing an epizootic-epidemiological examination.

Conclusions

Thus, for the period from 2013 to 2018, the number of detected cases of tick bites among the adult population of Vinnytsia region has changed from 53 to 317 cases, i. e. 6 times.

To prevent dangerous infectious diseases, it is important to disseminate the information about the disease and to follow the recommendations:

1. Beware of tick bites. The highest concentration of mites is in forests, and many of them may be among the greenery, while few are in areas with mown grass.

2. Going for a walk, it is important to put on appropriate clothing. The safest are light-colored clothes with long sleeves that fit the body.

3. Repellent (acaricide), a special remedy against ticks, is very helpful. It can be manufactures as aerosols, ointments, etc. Befor using, reading the instructions is mandatory. Be sure to pay attention to the expiration date.

4. It is recommented to keep closer to the center of the trail and not to go into the grass, a place of the high tick concentration.

5. Careful inspection of own body after the the walk enables to detect tick and prevent the serious disease. It is worthy to remember a tick bite causes no sensations as a tick secretes a substance with anesthetic propertiesc.

6. Clothes must be thoroughly cleaned or washed and ironed. The same goes for the things we use on a walk. Shaking will not help get rid of the tick.

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Реферат

ДОСЛІДЖЕННЯ ДИНАМІКИ УКУСІВ ІКСОДОВИХ КЛІЩІВ У ДОРОСЛИХ ЖИТЕЛІВ ВІННИЦЬКОЇ ОБЛАСТІ В УКРАЇНІ

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Ключові слова: кліщі, епідеміологія, укуси кліщів, кліщовий енцефаліт, захворювання.

Не всі кліщі переносять збудників небезпечних хвороб, однак їх укуси можуть загрожувати людині такими хворобами, як іксодовий кліщовий бореліоз (хвороба Лайма), хвороба Міямото, кліщовий вірусний енцефаліт і ще близько 150 найменувань. Сезон активності іксодових кліщів починається у бере-

зні і зазвичай триває по листопад та має протягом року два виражених піки активності–у квітні-травні та серпні-вересні. Актуальність теми обумовлена тим, що динаміка укусів кліщів людей в Україні та Вінницькій області недостатньо виявлені та проаналізовані, так само, як і основні методи їх профілактики. Мета дослідження – зробити детальний аналіз перебігу укусів людей іксодовими кліщами в Вінницькій області та місті Вінниця, порівняти кількість виявлених випадків укусів за період з 2013 по 2018 рік та визначити найкращі із доступних профілактичних методів. Дослідження проводились у лабораторії комунального неприбуткового підприємства «Вінницької міської лікарні №1"(КНП «ВМКЛ») та статистичних даних державної обласної санітарно-епідеміологічної станції. За період наших досліджень було проведено порівняння поширеності захворювання у різних регіонах Вінницької області та порівняння розповсюдженості захворювання з 2013 по 2018 роки. Предметом дослідження були представники родини іксодових кліщів. За період з 2013 по 2018 рік кількість виявлених випадків укусів кліщами дорослого населення з плином різних небезпечних хвороб змінилася з 53 до 317 випадків серед всього населення Вінницької області. За всі роки, крім 2018, найвищий рівень захворюваності незмінно спостерігався в Могилів-Подільському районі, перевершуючи навіть рівень в більш густонаселених і великих районах. Отже, ми можемо спостерігати, що в період з 2013 по 2018 роки кількість виявлених випадків укусів кліщами дорослого населення з плином різних небезпечних хвороб швидко і значно збільшувалась. Тому необхідно активізувати профілактичну роботу серед населення всіх вікових груп. Велику увагу слід приділити популяризації вакцинації і розробці санітарно-гігієнічних рекомендацій для жителів міста і села (у весняно-літній період).

Реферат

ИЗУЧЕНИЕ ДИНАМИКИ УКУСОВ ИКСОДОВЫХ КЛЕЩЕЙ У ВЗРОСЛЫХ ЖИТЕЛЕЙ ВИННИЦКОЙ ОБЛАСТИ УКРАИНЫ
Панько В., Боярская З., Березовский И., Мушит С.
Ключевые слова: клещи, эпидемиология, укусы клещей, клещевой энцефалит, заболевания.

Не все клещи переносят возбудителей опасных болезней, однако их укусы могут угрожать человеку такими болезнями, как иксодовый клещевой боррелиоз (болезнь Лайма), болезнь Миямото, клещевой вирусный энцефалит и еще около 150 наименований. Сезон активности иксодовых клещей начинается в марте и обычно длится по ноябрь и должен в течение года два выраженных пика активности - в апреле-мае и августе-сентябре.

Актуальность темы обусловлена тем, что динамика укусов клещей людей в Украине и Винницкой области недостаточно выявлены и проанализированы, так же, как и основные методы их профилактики. Цель исследования - сделать детальный анализ течения укусов людей иксодовыми клещами в Винницкой области, сравнить количество выявленных случаев укусов за период с 2013 по 2018 годы и определить лучшие из доступных профилактических методов.

Исследования проводились в лаборатории коммунального некоммерческого предприятия «Винницкой городской больницы №1" (КНП «ВМКЛ») и статистических данных государственной областной санитарно-эпидемиологической станции. За период наших исследований было проведено сравнение распространенности заболевания в разных регионах Винницкой области и сравнения распространенности заболевания с 2013 по 2018 годы. Предметом исследования были представители семьи иксодовых клещей.

За период с 2013 по 2018 год количество выявленных случаев укусов клещами взрослого населения с течением различных опасных болезней изменилась с 53 до 317 случаев среди всего населения Винницкой области.

За все годы, кроме 2018, самый высокий уровень заболеваемости неизменно наблюдался в Могилев-Подольском районе, превосходя даже уровень в более густонаселенных и крупных районах. Итак, мы можем наблюдать, что в период с 2013 по 2018 годы количество выявленных случаев укусов клещами взрослого населения с течением различных опасных болезней быстро и значительно увеличивался. Поэтому необходимо активизировать профилактическую работу среди населения всех возрастов. Большое внимание следует уделить популяризации вакцинации и разработке санитарно-гигиенических рекомендаций для жителей города и села (в весенне-летний период).