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Evaluation of the tick bites in a Crimean-Congo haemorrhagic fever (CCHF) endemic area in Turkey

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Aim: After the first description of a CCHF outbreak in Turkey, tick bites became an increasing cause of visits to health-care facilities. In this study, we evaluated tick bites in a CCHF endemic region.

Materials and methods: The study included cases of tick bites that were referred to 2 hospitals in Erzurum between June and October 2008. All cases were followed-up for 10 days for the results of CCHF.

Results: During the study period, 161 patients were admitted for a tick bite. The majority (56.3%) were farmers and housewives. Children ≤ 13 years of age were bitten mostly on the head and neck (44.4%), while adults were bitten mostly on their legs (42.6%). Of the tick attachment sites, 18.3% were on non-visible regions of the body of the victims. In 39.1% of the cases, ticks were removed by medical staff. During a 10-day follow-up, CCHF occurred in 2 cases (1.2%).

Conclusion: A tick bite poses an important problem for the resident population in CCHF endemic areas. A detailed body inspection after each outing in areas of possible contact with ticks, as well as the early removal of an attached tick, is important to prevent tick-borne diseases. An inspection of the non-visible regions of the body of the victim should be performed by another person. Education of public and medical staff is required for the prevention and management of tick bites.

Key words: Tick bite, infection, Crimean-Congo hemorrhagic fever

Türkiye'de Kırım-Kongo hemorajik ateşinin endemik olduğu bir bölgede kene tutunmaları

Amaç: Türkiye'de Kırım-Kongo kanamalı ateşi (KKKA)'nin ilk tanımlanmasından sonra kene tutunması nedeniyle sağlık kuruluşlarına başvurular giderek artmıştır. Bu çalışmada KKKA'nin endemik olduğu bir bölgede kene tutunmalarını değerlendirmeyi amaçladık.

Yöntem ve gereç: Bu çalışma Haziran-Ekim 2008 tarihleri arasında kene tutunması nedeni ile Erzurum'daki iki hastaneye başvuran hastaları kapsamaktadır. Bütün olgular KKKA bulguları yönünden 10 gün izlendi.

Bulgular: Çalışma süresi boyunca 161 olgu kene tutunması nedeniyle hastaneye başvurdu. Olguların % 56,3'ünü çiftçiler ve ev kadınları oluşturmaktaydı. On üç yaşın altındaki çocukların çoğunluğunda (% 44,4) kene baş ve boyun bölgesine tutunurken, erişkinlerde daha çok alt ekstremitelere (% 42,6) turunduğu saptanmıştır. Kene tutunmalarının % 18,3'ü kişinin kendisi tarafından görülemeyecek vücut bölgelerinde olmuştur. Olguların % 39,1'inde kene sağlık personeli tarafından çıkarılmıştır. On günlük izlem süresinde 2 (% 1,2) hastada KKKA gelişmiştir.

Sonuç: Kene tutunmaları KKKA'nın endemik olduğu bölgelerde önemli bir problem oluşturmaktadır. Kene teması olabilecek alanlara gidilip dönüldükten sonra dikkatli bir vücut incelemesi yapılması ve kenenin vücuttan erkenden uzaklaştırılması kene ile bulaşan hastalıkların önlenmesinde önemlidir. Kişinin kendisinin göremediği vücut bölgelerinin incelenmesi bir başkası tarafından yapılmalıdır. Halkın ve sağlık personelinin eğitilmesi kene tutunmalarının önlenmesi ve yönetimi açısından önemlidir.

Anahtar sözcükler: Kene tutunması, enfeksiyon, Kırım-Kongo kanamalı ateşi

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Introduction

Ticks are both reservoir and vectors of several human pathogens. The risk of tick-borne diseases in humans is dependent on several factors, such as the prevalent tick species, its abundance, and their preferences towards humans as hosts. All these variable features are further complicated by the social habits in a given area, the presence of dense populations of hosts for immature stages, and the climate and vegetation features, all of which define the degree of environmental adequacy for the tick populations(1).

Crimean-Congo haemorrhagic fever (CCHF) is a viral hemorrhagic fever caused by the Nairovirus of the family Bunyaviridae, transmitted to humans by the bite of the Hyalomma tick, or by direct contact with the blood of an infected animal or human. Crimean-Congo hemorrhagic fever virus (CCHFV) has been isolated from at least 31 species of ticks. However, there is no definitive evidence that all these species are capable of serving as vectors for the virus. The most efficient and common vectors for CCHF appear to be members of the genus Hyalomma (2,3).

Although serological evidence of the CCHFV was detected years ago, clinical infection was first recognized in Turkey in 2002, and an increasing number of cases were reported between 2002 and 2009. By the end of 2009, more than 4400 patients with a confirmed diagnosis had been identified (4). Most of the cases were reported in the central, northern, and eastern regions of Turkey, indicating that CCHF is endemic in those regions (5). Since the first description of a CCHF outbreak in Turkey, tick bites are an increasing cause of visits to health-care facilities.

The aim of the study was to evaluate tick bites and its role in the occurrence of CCHF in an endemic region.

Materials and methods

An epidemiological survey was conducted between June and October 2008 in Erzurum. Erzurum is the largest city in the eastern Anatolian region of Turkey, and is located at 41°E and 39°N. CCHF has been endemic in Erzurum and the surrounding area since 2002. The study included cases where subjects were bitten by a tick, or exposed to a tick without a bite and were referred to 2 major hospitals in Erzurum city center, Atatürk University Medical School Hospital and Erzurum Numune Hospital. A standard questionnaire was filled-out by the physicians who participated the study and examined the patients in the 2 hospitals. The questionnaire included questions concerning demographic information, the location where the subject acquired the tick, occupation of the subject, admission date, the anatomical site of the bite, exposure prone activity, the date of the bite (if known), possible duration of tick attachment, and tick removal procedures. All the cases were followed for 10 days for clinical signs of the occurrence of CCHF and laboratory findings.

Statistical analysis: Chi-squared and Fisher's exact tests were used for comparison of anatomical site of bites between children ≤ 13 years of age and adults, to evaluate the relationships between the anatomical site of bites and gender, as well as the anatomical site of bites and attachment duration. A P value < 0.05 was considered significant.

Results

During the study period, 161 patients were admitted for a tick bite, and 15 for tick exposure without a bite (they found a non-attached tick on their bodies or clothes). Ninety-six (54.5%) of them were male, and 80 (45.5%) were female. The age of the patients ranged from 2 to 79 years (mean: 34.1 years). Nineteen patients (10.8%) were 13 years of age and below. Of the cases, 79 (44.9%) were admitted from the city of Erzurum and 97 (55.1%) from the surrounding rural area. The majority of the patients were admitted in July and August (Table 1). Forty-one of the adult patients were farmers, 58 housewives, 17 students, 13 state officials, 2 soldiers, and 26 had other

Table 1. Hospital admissions of cases according to months.

Month	Case no.	%
June	38	21.6
July	85	48.3
August	44	25.0
September	4	2.3
October	5	2.8
Total	176	100

jobs. Tick exposure occurred in fields, in gardens, at picnic areas, at home, and during animal contact in 48 (27.3%), 47 (26.7%), 37 (21.0%), 4 (2.3%), and 14 (8.0%) of the cases, respectively. Twenty-six patients (14.8%) were unable to define an area where the tick exposure occurred. The probable time interval between tick exposure and removal (duration of tick attachment) was 0-3 days (mean 1.0 ± 0.88 day; ≤ 1 day, 2 days, and ≥ 3 days, in 75.2%, 15.6%, and 9.2% of the cases, respectively). However, because 52 patients could not determine exposure time, they could not define the duration of tick attachment.

Tick attachment sites were documented in children (≤ 13 years of age) and adults separately (Figures 1 and 2). Children ≤ 13 years of age were bitten more frequently on the head and neck (44.4%), while legs (42.6%) were the major anatomical site of bites for adults (Table 2). The most frequent location of tick bite on the head (9/24) was the postauricular region. No significant difference was observed when the anatomical site of bites was compared with victim's gender (Table 3). Of the tick attachment sites, 18.3% were on non-visible regions of the body of the victims. However, there was no relation between tick attachment duration and attachment site.

Thirty-four (19.3%) of tick exposed patients were admitted to emergency departments and 85 (48.3%) to primary health care institutions. Almost all of the patients were directed to a secondary or tertiary health care institution, especially to an infectious diseases specialist.

In 63 (39.1%) of the 161 patients who had a bite exposure, ticks were removed by medical staff. No patient admitted with tick exposure received ribavirin or other drugs for prophylaxis.

During a 10-day follow-up, 2 patients (1.2%) presented laboratory and clinical findings of CCHF. The first patient was a 46 year-old male. He had removed the tick from his leg with tweezers. The patient was diagnosed with malaise and myalgia 5 days after the removal of the tick, and was hospitalized on the same day. During a 5-day hospitalization period, he had shown mild clinical symptoms, leucopenia, thrombocytopenia, and serum transaminase levels elevation. RT-PCR for the CCHF virus and the anti-CCHF-IgM antibody by ELISA were positive. Ribavirin was not administered because of its mild clinical course. The patient was discharged on the fifth day of hospitalization cured. The second patient was a 23-year-old female, bitten on her leg. She

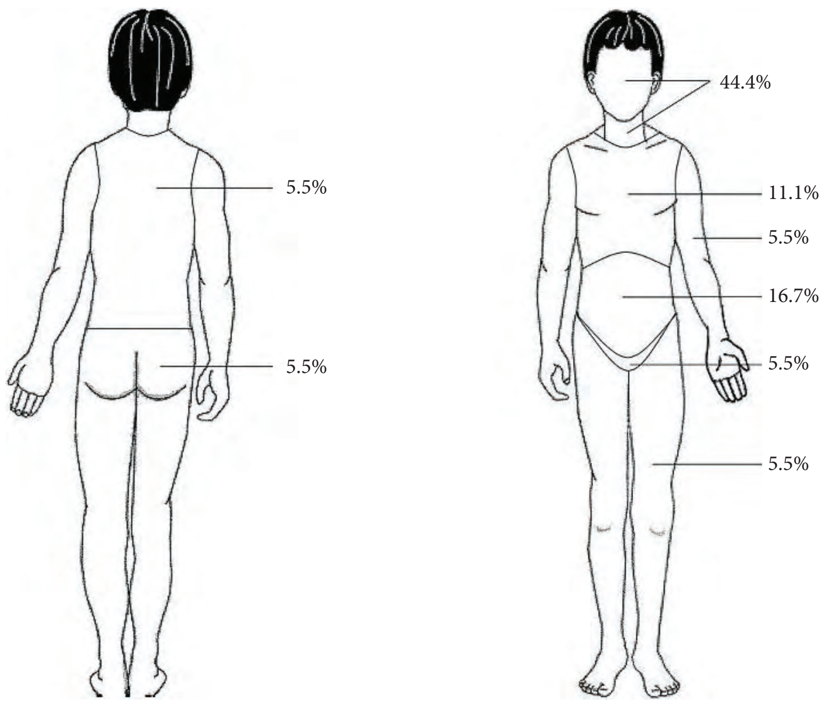

Figure 1. Anatomical sites of tick bites in children.

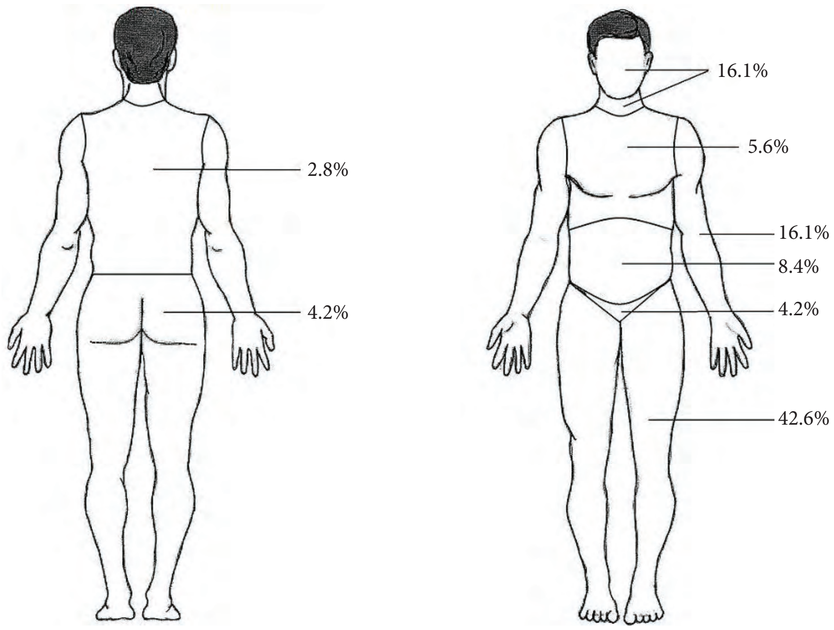

Figure 2. Anatomical sites of tick bites in adults.

Table 2. Anatomical site of bites in children and adults.

Anatomical site of bite	Children (%) n: 18	Adults (%) n: 143	P
Head and neck	8 (44.4)	23 (16.1)	0.009
Arms	1 (5.5)	23 (16.1)	0.5
Legs	1 (5.5)	61 (42.6)	0.002
Shoulder/back	1 (5.5)	4 (2.8)	0.45
Abdomen	3 (16.7)	12 (8.4)	0.38
Chest	2 (11.1)	8 (5.6)	0.31
Hip	1 (5.5)	6 (4.2)	0.57
Genital/inguinal	1 (5.5)	6 (4.2)	0.57

Table 3. Anatomical site of bites with respect to victim's gender (adults only).

Anatomical site of bite	Female (%) n: 67	Male (%) n: 76	P
Head and neck	14 (20.9)	9 (11.8)	0.17
Arms	8 (11.9)	15 (19.7)	0.25
Legs	26 (38.8)	35 (46.0)	0.4
Shoulder/back	3 (4.5)	1 (1.3)	0.6
Abdomen	7 (10.4)	5 (6.6)	0.5
Chest	3 (4.5)	5 (6.6)	0.7
Hip	4 (6.0)	2 (2.6)	0.4
Genital/inguinal	2 (3.0)	4 (5.3)	0.7

had removed the tick by herself. On the third day after the tick removal, clinical symptoms accompanied by fever, malaise, nausea, and vomiting occurred and the patient was hospitalized. Abnormal laboratory findings were leucopenia, thrombocytopenia, serum transaminase, and lactate dehydrogenase levels elevations. Diagnosis of CCHF was confirmed by RT-PCR and anti-CCHF-IgM positivity. Clinical and laboratory findings resolved within days without ribavirin therapy. The patient was discharged on the 10th day of hospitalization cured.

Discussion

Tick exposure is the most prevalent risk factor for the acquisition of CCHF (6-8). In Turkey, 68.9% of all the reported cases between 2002 and 2007 had a history of tick-bite or tick contact (5). Farmers, people living in rural area, handling livestock are at risk for tick exposure. Hiking, camping, and other rural activities are also a risk factor for tick exposure. Gender distribution varies between countries, depending on the participation of women in agricultural work (3). Due to the fact that women work in all types of farming tasks in rural areas, the high number of housewives (58/176) among our cases was not surprising.

About 10.8% of the patients were ≤ 13 years old in this study. In contrast, some previous studies reported that children were bitten more often than adults were (9,10). In a recent study from Switzerland, like our study, children < 10 years old accounted for only 8% of the participants (11). The reason for the different rate of children may be related to lifestyle and exposure prone activities in the study region. In our study, for example, more than 50% of tick exposures occurred during farming activities in field and gardens in rural areas. These activities were not related to children. The studies reported that children were bitten more often than adults were; therefore, tick exposure related activities were not clear. Areas such as public gardens, where children can often be found doing outdoor activities, may be the major area of tick exposure. In such a case, the majority of tick bite victims may be children. In public gardens, children usually play while sitting or lying on grass. This may raise the risk of tick exposure and the risk of attachment to the head and neck regions. In addition, distinct differences in anatomical sites of tick attachment were observed in children and adults. Children were bitten more frequently on the head and neck, whereas legs were the major anatomical sites of bites for adults (Figure 1). Similar observations were previously reported by Robertson and Hugli (10,11). The attachment site preferences of ticks may differ among species (12). It was reported that the Hyalomma species prefer the trunk, whereas the Dermacentor and Haemaphysalis species often attach to head and neck region. Although we did not examine tick species in this study, based on the rationality of adults and children in a specific region having the same risk of exposure of a specific tick species, we analyzed tick attachment sites in children and adults. Robertson and Hugli (10,11) reported distinct differences in anatomical sites of attachment in children and adults in a single tick species (*Ixodes ricinus*). As we mentioned before, differences between adults and children in the distribution of tick bites on the body could reflect behavioral and physiological differences between these 2 groups of the population. No significant difference was observed when the anatomical site of bites was compared with the victim's gender. Attachment sites can influence the discovery of ticks, and hence the duration of the tick bite (11). Early removal of ticks can help prevent Lyme diseases because at least 24 to 48 h of attachment to the host is required before infection occurs (11,13). However, the role of tick attachment duration in the CCHF virus transmission is not clear. In this study, the probable time interval between tick exposure and removal was ≤ 1 day in 75.2% of the cases. Although 18.3% of the tick bites were on non-visible regions, there was no relation between tick attachment duration and attachment site. A similar observation was reported by Hugli et al. (11). Similar to our result, in a recent study from Turkey, Gunduz et al. reported that 20% of the ticks were attached to regions of the body that patients could not themselves visualize (14). Nevertheless, they did not study tick attachment time.

This study suggests that admission of tick-exposed persons may cause an increase in workload for emergency services and primary health care institutions during the tick season. One important observation in the study was that almost all of the patients were directed to a secondary or tertiary health care institution, in particular, to an infectious diseases specialist. This suggests that general practitioners and specialists, other than infectious diseases physicians, have no knowledge and experience about tick bites and tick-borne diseases, or they have fear of CCHF. Before 2002, the year of occurrence of CCHF in this region, tick-exposed persons were not admitted to health care institutions very often for the reason that most physicians may be not familiar with tick-exposed cases. However, we think that fear of CCHF had an important role in directing the patients to a secondary or tertiary health care institutions.

All of the cases that presented with tick bites in the study were followed-up by laboratory and clinically for 10 days, and CCHF occurred in 2 (1.2%) cases. The first was a in 49-year-old man. The tick attachment site was on the right lower leg. He did not know when he had been bitten by the tick (he could not define an exposure prone activity). He removed the tick by himself and crushed it. The second case was in a 76-year-old man. He was bitten on the neck, and he did not know when he had been bitten either. The tick was removed by a doctor. During the follow-up period, some disturbances in the routine laboratory tests of the patients (leucopenia, thrombocytopenia, elevated serum alanine aminotransferase, and creatine phosphokinase levels) emerged on the third and fifth days, respectively. After a few days, the second patient had clinical symptoms and signs of CCHF. The diagnosis was confirmed by enzyme-linked immunosorbent assay and polymerase chain reaction (PCR) tests. The patients recovered fully in 7 days. Gunduz et al. reported that 3 of the 67 (4.5%) patients who were diagnosed with tick bites were later admitted to a hospital with a diagnosis of CCHF (13). Although their study region was close to our region, their infection rate was higher than our rate of 1.2%.

Species determination of the ticks was not a goal of this study. In a recent study from Turkey, tick species collected from humans in the area of the city of İstanbul and its surroundings (a non-endemic area for CCHF) were investigated (1). Among 1054 collected ticks, most were females of *Ixodes ricinus* (27%) and nymphs of *Hyalomma aegyptium* (50%). A few adults of *Hyalomma marginatum marginatum*, *Rhipicephalus sanguineus*, and *Dermacentor marginatus* were also recorded. The rate of *Hyalomma m. marginatum*, a recognized vector of the Crimean-Congo haemorrhagic fever virus, was 1.4%. However, climate and vegetation features of that area are fairly different from our study region's. Thus, the findings in that study do not reflect the tick population in our region. It has been reported that some Ixodes, Rhipicephalus, Dermacentor, Hyalomma, Argas, and Ornithodoros species are found in the eastern part of Turkey (15). Further studies are needed to investigate the tick population, and the prevalence of the CCHF virus among tick species in this region.

In conclusion, tick bites pose an important problem for the resident population and healthcare personnel in CCHF endemic areas. A detailed body inspection after each outing, in areas of possible contact with ticks, and the early removal of an attached tick, is important to prevent tick-borne diseases. Due to the fact that nearly 18% of the bites are on non-visible regions of the body of the victims, the assistance of another person for the inspection of these regions is required. Education of the public about the prevention of tick exposure, and the education of medical staff on the management of tick-exposed cases, and the risks of tick bites, will prevent the fear and panic of CCHF.

References

1. Vatansever Z, Gargili A, Aysul NS, Sengoz G, Estrada-Peña A. Ticks biting humans in the urban area of Istanbul. Parasitol Res 2008; 102: 551-3.
2. Whitehouse CA. Crimean-Congo hemorrhagic fever. Antiviral Res 2004; 64:145-60.
3. Ergönül O. Crimean-Congo haemorrhagic fever. Lancet Infect Dis 2006; 6: 203-14.
4. Ministry of Health of Turkey. Reports of the Communicable Diseases Department. Ankara, Turkey: Ministry of Health; 2009 (in Turkish).
5. Yilmaz GR, Buzgan T, Irmak H, Safran A, Uzun R, Cevik MA, Torunoglu MA. The epidemiology of Crimean-Congo hemorrhagic fever in Turkey, 2002-2007. Int J Infect Dis 2008; 13: 380-6.
6. Izadi S, Naieni KH, Madjdzadeh SR, Nadim A. Crimean–Congo hemorrhagic fever in Sistan and Baluchestan province of Iran, a case–control study on epidemiological characteristics. Int J Infect Dis 2004; 8: 299-306.
7. Ozkurt Z , Kiki I, Erol S, Erdem F, Yilmaz N, Parlak M et al. Crimean–Congo hemorrhagic fever in Eastern Turkey: clinical features, risk factors and efficacy of ribavirin therapy. J Infect 2006; 52: 207-15.
8. Gozalan A, Esen B, Fitzner J, Tapar FS, Ozkan AP, Georges-Courbot MC, Uzun R, Gümüşlü F, Akin L, Zeller H. Crimean-Congo haemorrhagic fever cases in Turkey. Scand J Infect Dis 2007; 39: 332-6.
9. Falco R, Fish D, Piesman J. Duration of tick bites in a Lyme disease-endemic area. Am J Epidemiol 1996; 143: 187-92.
10. Robertson JN, Gray JS, Stewart P. Tick bite and Lyme borreliosis risk at a recreational site in England. Eur J Epidemiol 2000; 16: 647-52.
11. Hügli D, Moreta J, Raisa O, Moosmanna Y, Erard P, Malinverni R, Gerna L. Tick bites in a Lyme borreliosis highly endemic area in Switzerland. Int J Med Microbiol 2008; 299: 155-60.
12. Felz MW, Durden LA. Attachment sites of four tick species (Acari: Ixodidae) parasitizing humans in Georgia and South Carolina. J Med Entomol 1999; 36: 361-4.
13. Belman AL. Tick-borne diseases. Semin Pediatr Neurol 1999; 6: 249-66.
14. Gunduz A, Turkmen S, Turedi S, Nuhoglu I, Topbas M. Tick attachment sites. Wilderness Environ Med 2008; 19: 4-6.
15. Aydin L, Bakirci S. Geographical distribution of ticks in Turkey. Parasitol Res 2007; 101(Suppl 2): S163-S166.