Osong Public Health Res Perspect 2013 4(3), 166–169
http://dx.doi.org/10.1016/j.phrp.2013.04.007
pISSN 2210-9099 eISSN 2233-6052

BRIEF REPORT

Trends in the Incidence of Scrub Typhus: The Fastest Growing Vector-Borne Disease in Korea

Mi Ae Jeong [a], Seung-Ki Youn [b], Young-Kwon Kim [c], Hyungmin Lee [b], Sun-Ja Kim [b], Aeree Sohn [a,*]

[a]*Department of Health, School of Public Health and Welfare, Sahmyook University, Seoul, Korea.*
[b]*Division of Epidemic Intelligence Service, Korea Centers for Disease Control and Prevention, Osong, Korea.*
[c]*Department of Medical Science, Konyang University, Daejeon, Korea.*

Received: February 12, 2013
Revised: March 25, 2013
Accepted: April 5, 2013

KEYWORDS:
Korea,
scrub typhus,
tsutsugamushi disease

Abstract
Scrub typhus, also called tsutsugamushi disease, is classified as a Group 3 disease in Korea according to the National Notifiable Diseases Surveillance Systems. It is an infectious disease transmitted to humans through the bite of mites that are infected with an intracellular parasite called *Orientia tsutsugamushi* (Family: Rickettsiaceae). This study aims to identify the demographic characteristics of the infected cases according to profession, region, gender, and onset period and provide a basic data for prevention and control of the disease in the infected patients. Between 2001 and 2010, 16,741 men (36.3%) and 29,373 women (63.7%) were reported to have been infected with scrub typhus, with men being 1.6 times less infected than women. When classified according to age, it was found that 4421 persons (9.6%) were under 40 years of age; 6601 (13.1%) in their 40s; 9714 (21.1%) in their 50s; 13,067 (28.3%) in 60s; 10,128 (22.0%) in their 70s; and 2723 (5.9%) aged 80 or more. The elderly (60 years or older) represented more than half of the infected cases. When the infections were classified according to region, it was found that the county residents had the major share of infection, with a total of 1583 infected cases (59.85).

1. Introduction

Scrub typhus, also called tsutsugamushi disease, is an infectious disease transmitted to humans through the bite of mites that are infected with an intracellular parasite called *Orientia tsutsugamushi* (Family: Rickettsiaceae). The disease is common in rural and mountain areas [1,2]. Since 1994 the disease has been categorized under Group 3 of the National Notifiable Diseases Surveillance Systems [3]. Since then, approximately 300 incidences have been reported every year, with the number increasing over 1000 in 1998 and over

*Corresponding author.
E-mail: aeree@syu.ac.kr

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6000 in 2005, before flattening to approximately 5000 from 2009 onward. Majority of cases are reported in rural and mountain areas, with the southwestern part of Korea having a high incidence rate [4].

This study aims to identify the demographic characteristics of scrub typhus cases by classifying the infected cases according to profession, region, gender, and onset period and provide a basic data for prevention and control of the disease in the infected patients.

2. Materials and Methods

This study used the data reported by the National Infectious Report System of the Korea Centers for Disease Control and Prevention from 2001 to 2010. A total of 46,114 cases were analyzed according to demographic and social characteristics (age and gender), region, and month (Tables 1 and 2).

3. Results

Between 2001 and 2010, 16,741 men (36.3%) and 29,373 women (63.7%) were reported to have been infected with scrub typhus, with men being 1.6 times less infected than women. Although the variation in gender is unchanging, there is a slight increase in the portion of men infected. When classified according to age, it was found that 4421 persons (9.6%) were under 40 years of age; 6601 (13.1%) in their 40s; 9714 (21.1%) in their 50s; 13,067 (28.3%) in 60s; 10,128 (22.0%) in their 70s; and 2723 (5.9%) were aged 80 or more. The elderly (60 years or older) represented more than half of the infected cases. When the infections were classified according to region, it was found that the county residents had the major share of infection, with a total of 1583 infected cases (59.85).

The disease has spread throughout the nation, with the provinces of Jeonbuk, Chungnam, Gyeongnam, and Jeonnam reportedly having relatively high incidence rates. Among the metropolitan cities, Busan has a prominent increase, whereas Daejeon has a fluctuated incidence rate. When the incidences reported in city and county were compared, it was found that 57% of the patients were shared. The difference between infected areas in county and city is more than 35% (data from 2002 to 2003); however, this difference has decreased since 2008 and in 2010 a difference of only 4.6% was reported, which is the smallest gap since 2001.

The peak months of infection were October (57.7%) and November (35.7%), representing a major portion (93.4%). The incidence rate starts to increase from September hitting peak in October and November and sharply decreases in December.

Table 1. Incidence of scrub typhus in Korea, 2001–2010

Month	Persons (%)									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gender										
Men	956 (36.1)	689 (36.0)	488 (34.6)	1669 (35.5)	2257 (34.4)	2287 (36.5)	2205 (36.8)	2217 (36.6)	1865 (37.6)	2108 (37.6)
Women	1692 (63.9)	1227 (64.0)	923 (65.4)	3028 (64.5)	4305 (65.6)	3978 (63.5)	3790 (63.2)	3835 (63.4)	3097 (62.4)	3498 (62.4)
Age										
<40	315 (11.9)	197 (10.3)	126 (8.9)	511 (10.9)	650 (9.9)	610 (9.7)	593 (9.9)	484 (8.0)	423 (8.5)	512 (9.1)
40–49	412 (15.6)	229 (12.0)	172 (12.2)	659 (14.0)	878 (13.4)	925 (14.8)	790 (13.2)	735 (12.1)	599 (12.1)	662 (11.8)
50–59	562 (21.2)	366 (19.1)	264 (18.7)	926 (19.7)	1367 (20.8)	1324 (21.1)	1275 (21.3)	1324 (21.9)	1062 (21.4)	1244 (22.2)
60–69	759 (28.7)	652 (34.0)	472 (33.5)	1376 (29.3)	1950 (29.7)	1743 (27.8)	1692 (28.2)	1662 (27.5)	1307 (26.3)	1454 (25.9)
70–79	478 (18.1)	386 (20.1)	295 (20.9)	975 (20.8)	1364 (20.8)	1319 (21.1)	1295 (21.6)	1450 (24.0)	1231 (24.8)	1335 (23.8)
≥80	122 (4.6)	86 (4.5)	82 (5.8)	250 (5.3)	353 (5.4)	344 (5.5)	350 (5.8)	397 (6.6)	340 (6.9)	399 (7.1)
Region										
City	1065 (40.2)	590 (30.8)	455 (32.2)	1896 (40.4)	2883 (43.9)	2897 (46.2)	2623 (43.8)	2537 (41.9)	2218 (44.7)	2675 (47.7)
County	1583 (59.8)	1326 (69.2)	956 (67.8)	2801 (59.6)	3679 (56.1)	3368 (53.8)	3372 (56.2)	3515 (58.1)	2744 (55.3)	2931 (52.3)
Total	2648	1916	1411	4697	6562	6265	5995	6052	4962	5606

Table 2. Incidence of scrub typhus by year and month, 2001−2010

Month	Persons (%)									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jan	2 (0.1)	3 (0.2)	5 (0.4)	6 (0.1)	3 (0.0)	1 (0.0)	7 (0.1)	10 (0.2)	26 (0.5)	15 (0.3)
Feb	1 (0.0)	4 (0.2)	0 (0.0)	1 (0.0)	2 (0.0)	3 (0.0)	7 (0.1)	6 (0.1)	6 (0.1)	11 (0.2)
Mar	1 (0.0)	2 (0.1)	1 (0.1)	2 (0.0)	3 (0.0)	8 (0.1)	6 (0.1)	2 (0.0)	12 (0.2)	9 (0.2)
Apr	2 (0.1)	6 (0.3)	7 (0.5)	5 (0.1)	1 (0.0)	12 (0.2)	14 (0.2)	16 (0.3)	15 (0.3)	12 (0.2)
May	0 (0.0)	7 (0.4)	9 (0.6)	8 (0.2)	9 (0.1)	11 (0.2)	15 (0.3)	18 (0.3)	21 (0.4)	33 (0.6)
Jun	1 (0.0)	1 (0.1)	1 (0.1)	2 (0.0)	8 (0.1)	6 (0.1)	13 (0.2)	7 (0.1)	16 (0.3)	23 (0.4)
Jul	6 (0.2)	6 (0.3)	3 (0.2)	2 (0.0)	4 (0.1)	2 (0.0)	15 (0.3)	9 (0.2)	12 (0.2)	26 (0.5)
Aug	6 (0.2)	6 (0.3)	3 (0.2)	7 (0.2)	8 (0.1)	7 (0.1)	16 (0.3)	9 (0.2)	13 (0.3)	34 (0.6)
Sep	55 (2.1)	81 (4.3)	45 (3.2)	40 (0.9)	75 (1.2)	97 (1.6)	76 (1.3)	103 (1.7)	179 (3.7)	80 (1.5)
Oct	1646 (62.2)	1427 (75.3)	956 (67.8)	3402 (73.3)	3833 (60.9)	3553 (58.2)	2405 (40.5)	4232 (70.6)	2535 (51.9)	2623 (48.1)
Nov	898 (33.9)	344 (18.1)	360 (25.6)	1130 (24.3)	2290 (36.4)	2284 (37.4)	3275 (55.2)	1485 (24.8)	1943 (39.8)	2468 (45.2)
Dec	30 (1.1)	9 (0.5)	19 (1.3)	39 (0.8)	55 (0.9)	122 (2.0)	82 (1.4)	97 (1.6)	110 (2.3)	122 (2.2)
Total	2648	1896	1409	4644	6291	6106	5931	5994	4888	5456

4. Discussion

This study evaluated the characteristics of cases infected with scrub typhus in Korea in the last 10 years. In addition, the epidemiological characteristics of the national data were analyzed, based on the results of which it was found that there has been a change in the onset month and region. The number of infected cases of women cases is more than men, which is consistent with results of previous reports [4−8]. However, this difference in the rate of infection between the genders is not clearly identified. There is a similar difference between men and women in Thailand (approximately 60%) and Japan (approximately 50%). Women have higher chances of contacting the infection from mites than men, mainly because they spend more hours on the dry-field farms and tend more to kitchen garden plots than men in rural regions. In addition, when visiting relatives in rural areas, women are more willing to help in field farming. Min et al provided another possible reason for the difference in gender distribution among the elderly population; women are more than men in rural area and have more chance to go to the forests for dry-field farming [7]. Kong et al gave credit to the aspect of dry-field farming, which increased the chances of getting into contact with mite distributed on the grass, soil, and crops [9]. The farmers have the highest proportion of infected cases when the infection was classified by profession. More than of half of the cases (56%) are the elderly population, i.e., 60 years or more, which reflects the age distribution of the population. It is also to be noted that the level of immunity drops in the elderly population. Furthermore, the elderly people get physically weak with growing age, resting more on the ground or on grass during their field works, causing them to get bitten by the mites. By contrast, the infected cases in the city are relatively young compared with those of the counties. The cases are reported almost every month, with the numbers increasing in late spring and early summer and peaking from autumn to early winter. The reason is that mice, the host of the mites, are active from late August to early October when the mites are in their breeding season, thereby increasing their population in the field [10]. The proportion of the cases between January and March has steadily increased since 2005, and it is necessary to monitor the impact of change in vectors or climate change.

The limitation of this study is that the study group included only those cases infected with scrub typhus without reference group, and therefore, that we could not perform a statistical analysis of the risk factors. However, we have provided epidemiological characteristics based on the national data, which can serve as a basic evidence-based data for future prevention and control programs of scrub typhus in Korea.

Steady monitoring of the incidences with in-depth epidemiological investigation and research on risk factors such as behavior associated with infection, factors

affecting sero-conversion, and identification of status of antibodies among healthy residents are necessary. The future studies could provide an effective prevention strategy and a systematic control program.

Acknowledgments

The authors thank the two scientists in the Division of Epidemic Intelligence Service in the Korea Centers for Disease Control and Prevention: Dr Chaeshin Chu for his work in translating the manuscript into English and Dr Donghyok Kwon for his meticulous review throughout the entire process in this article.

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