A Bibliographical Study of Human Cases of Hard Tick (Acarina : Ixodidae) Bites Received Abroad and Found in Japan

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ABSTRACT. This paper reviewed significant literature on human cases of hard tick bites received abroad and found in Japan between 1986 and 2005.

A total of 31 patients (19 males and 12 females) have been reported in the literature. The pertinent data on each case are summarized in the table. The patients ranged in age from 7 to 75 years old, with most of them being in the fifties to seventies. The localities where the patients tick bites occurred were distributed throughout the world (about 15 countries), although relatively high incidences were found in Australia (eight cases) and USA (six cases). Nine species in three genera excluding ten unknown species and two unidentified species were removed from 31 patients, including *Ixodes holocyclus, I. persulcatus, I. ricinus, Amblyomma americanum, A. hebraeum, A. testudinarium, A. tholloni, Dermacentor andersoni* and *D. variavilis*, in which infestation was with the genus Ixodes (12 cases) and genus *Dermacentor* (9 cases) more frequent than with *Amblyomma* (8 cases). The highest incidences of infestation sites on the 31 patients were the skin surface of the head and neck regions (16 cases), the trunk (9 cases), the extremities (5 cases), and unknown (1 case). The tick bites in the majority of the cases were principally acquired in mountainous areas (6 cases), in game reserves and on grassy plains (5 cases each).

Key words ① **tick infestation** ② **imported cases** ③ **Ixodidae** ④ **Acarina** ⑤ **bibliographical review**

Nearly 660 species of hard tick belonging to some 14 genera are known worldwide (Harwood and James, 1979)[1]. In general, almost all ixodid hard ticks inhabit hills and fields, and many species of them have a wide range of hosts. Ixodid ticks are blood-sucking ectoparasites of numerous wild animals, including mammals, avians, reptiles and amphibians, and they occasionally infest man. Over 1200 cases of human tick bites have so far been reported in Japan. Recently, the number of human cases of tick bites received abroad has been increasing along with the rapid growth in overseas tours. Ixodid ticks induce bite wounds on human skin and also transmit various kinds of microbial organisms including rickettsial, viral, bacterial, spirochaetal and sporozoan pathogens into human skin. Particular attention, therefore, should be constantly paid to hard tick bites received when abroad.

The present paper reviewed the significant literature on human cases of hard tick bites received abroad and found in Japan between 1986 and 2005.

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MATERIALS AND METHODS

Cases of human tick bites received abroad were examined by Japan Centra Revuo Medicina published by Igaku-Chuo-Zasshi Kanko-Kai, Tokyo, Japan. Some cases of tick bites have also been cited second-hand from literature referred to in case reports. This quoted literature on imported tick bite cases was included after confirmation of the contents of the original paper. The pertinent data on each patient infested with a hard tick are listed in the table chronologically according to the time a paper was published.

RESULTS AND DISCUSSION

Human cases of hard tick bites received abroad and found in Japan are summarized in Table 1. The first case of an imported hard tick bite of a 27-year-old male living in Tokyo who had traveled in Queensland, Australia was reported by Oka *et al* (1986)[2]. Since then (between 1992 and 2005), 30 more authentic cases (18 males and 12 females) have been recorded by a number of investigators[3)~27)] and are shown in Table 1. In Table 1, with the exception of eight cases of nymphal ticks (Cases 1, 5, 6, 8, 9, 18, 29 and 30), one case adult male (Case 4) tick and two cases of unknown origin (Cases 21 and 28), the tick bodies removed from 20 patients were identified as adult females.

The age distribution of the infested patients ranged from 7 to 75 years old, and the relatively high incidences were found in persons in the twenties (six cases ; 20.0%), fifties and sixties (five cases each ; 16.7%), followed by seventies (four cases ; 13.3%), teens, thirties and forties (three cases each ; 10.0%) and children under 10 years old (one case ; 3.3%). Approximately 47% of the infested patients were in their fifties to seventies.

The localities where the 31 patients were infested are distributed throughout the world (about 15 countries), although relatively high incidences were found in two countries ; eight cases (25.8%) in Australia, six cases (19.4%) in the USA, followed by four cases (12.9%) in Nepal, three cases (9.7%) in Africa, two cases (6.5%) in Canada. One hard tick bite case each occurred in 10 other countries. Cases 23 and 31 traveled in two countries, namely Australia and New Zealand, and Sweden and France, respectively. Regarding these two patients, the localities of infestation with hard ticks were unclear.

The ixodid ticks develop into adult by incomplete metamorphosis passing through three developmental stages ; those are, egg, larva and nymph. As stated above, individuals of larval to adult stages are blood-sucking ectoparasites of numerous wild animals as well as man. Woolley (1998)[28] stated that hard ticks may become infectious as larva, nymph, or adult since individuals of each developmental stage require blood as a meal for growth.

The 31 patients were infested with hard ticks as a result of brief visits to foreign countries. The circumstances of the cases in the order of its appearance were as follows ; Case 1 visited Queensland, Australia on a hiking tour from June 22 to 25, 1983[2]. Case 4 was on a wild animal watching tour in a game reserve in South Africa from April 4 to 13, 1984[5]. Case 5 took a bird-watching tour to Thailand from January 13 to 17 1987[5]. Case 2 lived in California for about one year from April 20, 1989[3]. Case 10 was on a salmon hatchery inspection tour in Yuzhino Sakhalinsk (South Sakhalin) from June 16 to 22, 1991[9]. Case 3 traveled to Hel-Lung-Chiang, China to worship ancestors from July 1 to 10, 1991[4]. Case 6 was

Table 1. Imported cases of hard tick bites reported in Japan(1986-2005)

Cases nos.	Examined dates	Patients ages	Patients sexes	Localities infested	Lesion sites	Hard tick species	Authors (year)
1	1983. 8	27	M	Australia	Buttock	*Ixodes* sp.*	Oka et al (1986) [2]
2	1990. 6	35	F	USA	Left upper arm	*Ixodes* sp.	Isobe et al (1992) [3]
3	1991. 6	73	M	China	Left axilla	*I. persulcatus*	Miyahara et al (1993) [4]
4	1984. 4	64	M	South Africa	Lower extremity	*A. hebraeum* §	Yamaguti (1994) [5]
5	1987. 1	?	M	Thailand	Occiput	*Amblyomma* sp.*	
6	1991. 9	27	M	Kenya	Scrotum	*A. tholloni* *	
7	1993. 7	74	M	USA	Left iliac region	*A. americanum*	Kanaizuka et al (1995) [6]
8	1995. 2	75	F	Nepal	Left ear	*Dermacentor* sp.*	Nishiyama et al (1995) [7]
9	1995. 3	67	M	Nepal	Eyelashes	*Dermacentor* sp.*	Miyamoto and Kato (1996) [8]
10	1991. 6	59	M	South Sakhalin	Left thigh	*I. persulcatus*	Hatsushika et al (1997) [9]
11	1993. 3	51	M	Sri Lanka	Right abdomen	*Amblyomma* sp.	
12	1997. 6	26	M	USA	Right axilla	*A. americanum*	Niiyama et al (1998) [10]
13	1997. 6	32	F	Canada	Right occiput	*D. andersoni*	Nagatoya et al (1998) [11]
14	1997. 8	11	F	Australia	Vertex	*I. holocyclus*	Isoda et al (1998) [12]
15	1997. 9	53	F	Australia	Right neck	*I. holocyclus*	Yajima et al (1998) [13]
16	? . ?	16	M	USA	Occiput	*D. variabilis*	Arai and Arai (1999) [14]
17	1999. 1	46	M	Australia	Right upper back	*I. holocyclus*	Miyamoto et al (2000) [15]
18	1999. 1	41	M	Malaysia	Right neck	*Dermacentor* sp.*	
19	1999. 6	61	F	USA	Right neck	*D. andersoni*	
20	2000. 1	35	F	Australia	Right head	*I. holocyclus*	Kusuhara et al (2001) [16]
21	? . ?	24	M	India	Scrotum	?	Ohtaki (2001) [17]
22	? . ?	7	M	Korea	Right frons	*A. testudinarium*	Hirata et al (2001) [18]
23	2000. 8	15	M	Australia New Zealand	Vertex	*I. holocyclus*	Yamashita et al (2002) [19]
24	2000. 12	59	M	Australia	Head	*I. holocyclus*	Inokuma et al (2002) [20]
25	1993. 7	70	F	USA	Right thigh	*Dermacentor* sp.	Masada et al (2003) [21]
26	2001. 6	67	F	Canada	Occiput	*D. andersoni*	Nishiyama et al (2003) [22]
27	2001. 11	29	M	Australia	Right thigh	*I. holocyclus*	Suzuki et al (2003) [23]
28	2002. 10	55	M	Kenya	?	?	Yoshikawa et al (2004) [24]
29	1998. 12	24	F	Nepal	Right ear canal	*Dermacentor* sp.*	Masaki et al (2004) [25]
30	? . ?	48	F	Nepal	Left auricula	*Amblyomma* sp.*	Tokumaru et al (2004) [26]
31	2004. 8	63	F	Sweden France	Right thorax	*I. ricinus*	Ito et al (2005) [27]

I. = *Ixodes*, *A.* = *Amblyomma*, *D.* = *Dermacentor*, * = *nymphal stage*

§ = *adult male*, M = *male*, F = *female*

doing wild animal inspection in Nairobi, Kenya from August 31 to September 7, 1991[5]. Case 11 was inspecting irrigation facilities in Sri Lanka from March 4 to 11, 1993[9]. Case 7 was in Georgia and Florida from June 5 to 20, 1993[6]. Case 25 visited Minneapolis for about three weeks from June 6 to July 17, 1993[21]. Case 8 was in Nepal and the Himalayas for sightseeing in February 1995[7]. Case 9 visited Royal Chitwan National Park in Nepal on a wild animal watching excursion from March 12 to 19, 1995[8]. Case 12 was in Arkansas from May 15 to 28, 1997[10]. Case 13 visited Canada from June 9 to 17, 1997[11]. Case 14 was in Queensland and Brisbane, Australia to see koala during summer vacation in 1997[12]. Case 15 traveled to Australia in September 1997[13]. Case 16 visited Washington, D.C. for extracurricular activities in high

school on an unknown date[14]. Case 29 was in Nepal to see wild animals on November 23 and 24, 1998[25]. Case 17 was in Sydney, Australia at the end of December 1998[15]. Case 18 traveled to Malaysia on January 1999[15]. Case 19 visited New Hampshire from May 21 to June 21, 1999[15].

Case 20 did jungle walking in Australia for about 10 days from January 5, 2000[16]. Case 23 had a home stay in Australia and New Zealand from July 16 to August 2, 2000[19]. Case 24 visited Queensland, Australia for two weeks from the beginning of December 2000[20]. Case 21 was in India for sightseeing and to ride an elephant on an unknown date[17]. Case 26 visited Canada, the Canadian Rockies and Niagara Falls for sightseeing from June 2 to 9, 2001[22]. Case 27 did bush-walking in Eden, New South Wales, Australia on November 23, 2001[23]. Case 22 traveled to Cheju Island, Korea on an unknown date[18]. Case 28 visited Kenya, for mountain range sightseeing from September 28 to October 6, 2002[24]. Case 30 was in Nepal for jungle walking and to ride an elephant on an unknown date[26]. Case 31 was in Sweden and France for about two months from June 2004[27].

The majority of the 31 patients experienced bites in locations which they visited for a brief period of time (3 to 38 days), except for two cases with a long stay of over two months (Cases 2 and 31). Six cases had an accidental encounter with hard tick bites in mountainous areas (Cases 1, 5, 8, 11, 26 and 28). Five cases experienced them in game reserves (Cases 4, 6, 9, 14 and 21). Five other cases were in grassy plains (Cases 2, 3, 7, 16 and 23). Four cases were jungle walking (Cases 10, 20, 29 and 30) and one was bush-walking (Case 27). The authors anticipate that the imported tick bites experienced at foreign resorts may increase in the near future.

Among the 31 imported tick bite cases shown in Table 1, nine species in three genera, viz., *Ixodes holocyclus, I. persulcatus, I. ricinus, Amblyomma americanum, A. hebraeum, A. testudinarium, A. tholloni, Dermacentor andersoni* and *D. variabilis* were removed. Seven species of the species, except for *I. persulcatus* and *A. testudinarium* do not practically exist in Japan. In general, the common hosts of these three genera of Ixodid ticks are livestocks, dogs, and large domestic and wild animals[29].

As noted above, ixodid ticks communicate various kinds of microbial diseases to man, mainly Tularemia (*I. persulcatus, I. ricinus, A. americanum, D. andersoni and D. variabilis*), Rocky Mountain spotted fever (*A. americanum, D. andersoni and D. variabilis*), Q fever (*I. holocyclus, I. persulcatus and D. andersoni*), Powassan encephalitis and Colorado tick fever (*D. andersoni*), Far Eastern Russian encephalitis (*I. persulcatus and I. ricinus*), Kemerovo tick fever and Lyme disease (*I. persulcatus*), Queensland tick fever and Australian tick paralysis (*I. holocyclus*) in many parts of the world[1]. Fortunately, there has as yet been no reliable recorded documenting of tick-borne microbial disease or other fatal diseases from the foreign tick bites of the 31 patients reported here, although utmost care must always be taken in future.

The infested sites in the 30 patients (except Case 28) were nearly everywhere on the body as shown in Table 1. The highest incidence of infested sites (16 cases, 53.3%) was found on the skin surface of the head and neck regions. There were four of the occiput (Cases 5, 13, 16 and 26), three each of the neck (Cases 15, 18 and 19) and ear (Cases 8, 29 and 30), two each of the head (Cases 20 and 24) and vertex (Cases 14 and 23), one each of the frons (Case 22) and eyelashes (Case 9), followed by nine cases on the trunk (30.0%), two each of the axilla (Cases 3 and 12), abdomen (Cases 7 and 11) and scrotum (Cases 6 and 21), and one each of the back (Case 17), thorax (Case 31) and buttock (Case 1). There were six cases (20.0%) of the extremities ; three of the thigh (Cases 10, 25 and 27) , one each of the arm (Case 2) and a lower extremity (Case 4). Thus, no exact relationship between the lesion sites of the tick bites and the tick species can be elucidated.

According to Belding's description[30], the genus *Ixodes* is found mainly in North America, Australia, Europe, North and South Africa, and Asia. The numerous species of the genus *Amblyomma* are found mostly in North, Central, and South America, New Mexico, Africa, and, to some extent, in Asia. The genus *Dermacentor* is widely distributed throughout the USA, Alaska, Europe and Asia, inhabiting fields covered with low shrubs and areas of grassy plain. Therefore, the possibility of receiving a hard tick bite in foreign countries seems to be a quite good, especially when travelers visit an endemic region of some tick-borne diseases.

The authors emphasize that the causative tick body should rapidly be removed and special attention should be paid to the patient for several months even after medical treatment.

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