Original article

Intra-aural ticks (Acari: Metastigmata: Ixodidae) from human otoacariasis cases in Pahang, Malaysia.

Mariana A[1], Srinovianti N[2], Ho TM[1], Halimaton I[1], Hatikah A[3], Shaharudin MH[3], Rosmaliza I[3], Wan Ishlah L[4], Sathananthar KS[3]

[1] *Infectious Diseases Research Centre, Institute for Medical Research*, 50588 *Kuala Lumpur, Malaysia*
[2] *Kuantan Specialist Centre*, 51 *Jalan Alor Akar*, 25250 *Kuantan, Pahang, Malaysia*
[3] *Department of Otorhinolaryngology, Hospital Tengku Ampuan Afzan*, 25100 *Kuantan, Pahang, Malaysia*
[4] *Department of Otorhinolaryngology, Kulliyyah of Medicine, International Islamic University Malaysia*, 25100 *Kuantan, Pahang, Malaysia*

Abstract

Ticks were extracted from ear canal of 318 cases in Hospital Tengku Ampuan Afzan, Kuantan, Pahang over a 5-year period (January 2002 to December 2006). A total of 329 ticks were recorded and a majority belonged to the genus Dermacentor (99.7%). The genus was represented by Dermacentor atrosignatus, Dermacentor compactus and Dermacentor steini. A single tick of the genus Haemaphysalis was found. All active stages (larvae, nymphs and adults) were present. The nymphal stages were most frequently encountered (82.4%). Usually, there was only one tick per case. However, there were 7 cases where 2 or 3 ticks were extracted from a single ear canal. Throughout the study, there were 6 repeat cases. Average body engorgement indices for detached larvae, nymph, male and female ticks were 1.04, 1.24, 1.32 and 1.31, respectively. Based on these indices, duration of attachment was then predicted. Attachment for most nymphal (99.6%) and all adult ticks were less than 24 hours. Only 1 nymphal tick attached for a 60 hours´duration. Ticks were commonly found in the bony part of ear auditory canal (47.3%), followed by tympanic membrane (29.1%) and cartilage part of ear auditory canal (22.0%); a small percent was attached to the pinna (1.6%). All ticks were alive before extraction. However, most attached ticks were found dead (71.7%) after extraction. Majority of the ticks were intact (90.3%) while others were either in a bad condition (3.6%) or broken (6.1%). Those alive were either unfed or at early stage of feeding. Generally, removal of ticks did not result in any complication (61.4%) to the cases. The most common complication was bleeding (27.6%), followed by haematoma of external auditory canal (5.5%), haematoma of tympanic membrane (3.1%) and perforated tympanic membrane (1.6%). Bleeding was a common complication at the site of skin abrasion due to the strong grip of ticks´mouthparts that were deeply embedded into the skin of cases. In this study, 32.5% of removal ticks had remnants of case tissues attached to the ticks´mouthparts.

Keywords: intra-aural ticks, human otoacariasis, Malaysia

INTRODUCTION

Otoacariasis in animals is a well recognized veterinary problem[1]. However in humans, otoacariasis will only appear to be a problem if self-attempts to detach the tick were not successful. The first reported case in Malaysia was in Kelantan[2]. A retrospective study over a 7-year period was then conducted to investigate cases of otoacariasis among patients with intra-aural foreign bodies in their ear canals[3]. This

Correspondence to: Mariana A, Infectious Diseases Research Centre, Institute for Medical Research, 50588 Kuala Lumpur, Malaysia. E-mail: mariana@imr.gov.my

Springer

Asian Pac J Trop Med
2008;1(3):20-24

was then followed by a one year retrospective study in Pahang, another state in the east coast of Peninsular Malaysia. In that Pahang study, the incidence of human otoacariasis was 0.93%[4].

In Malaysia, the ticks reported to be involved were Boophilus microplus[5], Dermacentor spp[2]. and Ixodes spp[4]. Ticks feeding in the ear canal can cause severe pain [2-5] and if not removed, can cause facial nerve paralysis and vestibulopathy[4,5] or may even be fatal[12]. Human otoacariasis in Malaysia has been 'overlooked' largely due to limited relevant expertise and low research priority. The recognition of otoacariasis as a public health problem in the east coast of Malaysia has given impetus to the initiation of research on human otoacariasis in the state of Pahang as a pilot study before broadening the scope to cover the rest of Malaysia. This is the first report to document biological dynamics of ticks involved in human otoacariasis in Kuantan, Pahang. Duration of blood feeding for each tick was also predicted.

MATERIALS AND METHODS

A total of 318 cases of human otoacariasis attending the Department of Otolaryngology, Hospital Tengku Ampuan Afzan (HTAA), Kuantan, Pahang, Malaysia over the past 5 years (2002 to 2006) were examined using otoscopes. Intra-aural ticks found inside their ear canals were extracted using crocodile forceps under surgical microscopes and placed in 70% alcohol before sending to the Institute for Medical Research, Kuala Lumpur for identification. Identification of genera, species, active life stage and sex for adults was made. To define engorgement of each tick, the total body length and scutum width of the body was measured. Measurements were made with the aid of a micrometer held in the eye piece of a dissecting stereo microscope. Engorgement indices were calculated as the ratios between total body length and scutum width following description by Yeh et al[6]. Based on this study, duration of blood feeding (in hours) for each tick was then predicted. Demographical parameters such as sex and race of cases were recorded throughout the study; however age of the cases were only recorded from January 2004 to December 2005. Clinical observations such as infestation site and complications on removal of ticks, were also made.

RESULTS

Demography of cases

Most cases were children (76.4%). Almost 69.0% of patients were females. The dominant ethnic group was Malays (94.6%), followed by Chinese (4.1%) and Aborigines (0.6%); there was only one Indian and one Indonesian.

Monthly trends of cases

The number of cases demonstrated similar monthly trends every year (Figure 1). Generally there is a major peak in the number of cases in January and a minor peak in the middle of the year.

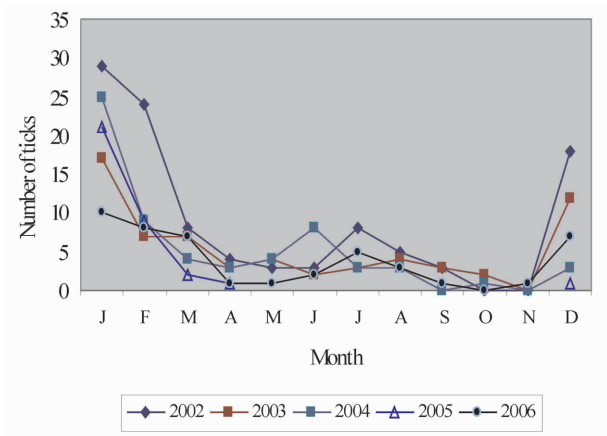

Figure 1. Number of ticks extracted from otoacariasis cases in ENT Department, HTAA, Kuantan, Pahang

Identification of ticks

A total of 329 ticks was recovered with a majority (99.7%) belonging to the genus Dermacentor (Table 2) represented by Dermacentor atrosignatus, Dermacentor compactus and Dermacentor steini. There was a single Haemaphysalis nymph. All active stages (larvae, nymphs and adults) were present with nymphs being the most frequently encountered (82.4%), followed by adults (6.4%) and larvae (1.5%). The nymphs were also the most abundant (76.2% - 85.8%) stage collected. Larval ticks were recovered only in 2002 and 2006.

Amongst the 21 adult ticks were 2 males and 12 females Dermacentor atrosignatus. This was the only species found from 2002 to 2005. In 2006 another 2 species were identified, i.e. Dermacentor compactus and Dermacentor steini; the former was represented by 1 male and 5 females whereas the latter was represented by a single female. More adult females

(81.0%) than males were found.

Number of ticks detached per case

Usually, only one tick was recovered from each case. However, there were a total of 5 and 2 cases where two ticks and 3 ticks respectively, were extracted from a single ear canal. One of these multiple-tick cases was observed in 2002, four cases each in 2003 and two cases in 2006. Most of such multiple-tick cases were females (71.4%). The ticks recovered from multiple-tick cases were 81.3% nymphs and a single larva. Identification of another 2 specimens could not be made due to breakage.

Throughout the study, there were 6 repeat cases. Two cases presented at the hospital 3 times in a year. The first subject came in January, February and July 2002 whereas the second one came in January, June and December 2004. The other 4 subjects only presented twice a year. Five of the repeat cases were females.

Body engorgement indices of detached ticks related to duration of feeding

Average body engorgement indices for extracted larvae, nymph, male and female ticks were 1.04, 1.24, 1.32 and 1.31, respectively (Table 3). Based on the indices, it is predicted that most nymphs (99.6%) and all adult ticks had attached for less than 24 hours. Only 1 nymph had a body engorgement index of 3.00 and thus a predicted attachment period of 60 hours.

Table 2: Ticks extracted from otoacariasis cases from Pahang, Malaysia.

Year	Species of ticks	No. of Adults		No. of Immatures		No. bad conditions & distorted	Total
		Male	Female	Nymph	Larvae		
2002	Dermacentor atrosignatus	2	6	91	4	3	106
2003	Dermacentor atrosignatus	0	1	68	0	11	80
2004	Dermacentor atrosignatus	0	4	48	0	11	63
2005	Dermacentor atrosignatus	0	1	28	0	4	33
2006	Dermacentor compactus	1	5	36	1	3	47
	Dermacentor steini	0	1				
	Total	3	18	271	5	32	329

Table 3: Body engorgement indices of ticks extracted from otoacariasis cases from Pahang, Malaysia.

Life-stage	#	Total Body Length (mm)			Scutal Width (mm)			Engorgement Index		
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Larvae	5	0.4	3.1	2.2	0.6	3.7	2.1	0.67	1.40	1.04
Nymph	271	0.5	5.9	2.1	0.4	5.0	1.7	0.54	3.00	1.24
Adult Male	3	1.3	4.7	3.5	0.9	3.8	2.7	1.18	1.44	1.32
Adult Female	18	1.4	4.9	2.6	1.1	3.4	2.0	0.70	1.64	1.31

Note: * Total body length (TBL) defined as distance on midline between anterior edge of scutum and posterior tip of opisthosoma.
* Scutum width (SW) measured at the widest point on scutum
* Engorgement index is ratio between TBL and SW

Ear and attachment site

Only one ear was affected for each case. More ticks were attached to the left ear (52.3%) compared to the right ear (47.7%), however the difference was not significant ($p > 0.05$). Data from 2004 onwards showed that intra-aural ticks were

commonly found in the bony part of ear auditory canal (47.3%), followed by tympanic membrane (29.1%) and cartilage part of ear auditory canal (22.0%). Only 1.6% of ticks was attached to the outer pinna.

Effect of extraction process on the ticks and clinical complications

Before removal, all ticks were still alive. However most ticks (71.7%) died after extraction. Majority of the ticks were still intact (90.3%) while others had flattened bodies and without mouthparts (3.6%) or broken (6.1%). Those alive were either unfed or had just started feeding; this was based on the physical appearance of the ticks which appear to be thin and not rounded. There was less clinical complications when extracting unfed compared to fed ticks. The majority of extraction did not produce any clinical complications (61.4%). Complications that occurred included bleeding (27.6%), haematoma of external auditory canal (5.5%), haematoma of tympanic membrane (3.1%) and perforated tympanic membrane (1.6%). The use of an anaesthetic cream for general anaesthesia during tick removal resulted in pain in only few subjects (0.8%). Bleeding is most likely due to the strong grip of ticks´mouthparts deeply embedded in the skin. In this study, 32.5% of extracted ticks have remnants of case tissues attached to their mouthparts. There was no case of facial paralysis as a complication of the tick feeding.

DISCUSSION

There were 2 genera of ticks and at least 3 species of Dermacentor involved in human otoacariasis in Pahang. It was difficult to identify the species of Dermacentor ticks based on the immature stages because the ranges of several species overlap and not morphologically distinguishable[9]. At present there is no taxonomic key for identification of nymphs and larvae of most species of Dermacentor. Dermacentor atrosignatus was the most abundant tick extracted in this survey. The species is predominantly a parasite of wild pigs, Sus spp., and they have occasionally been found on domestic pigs, buffalo, Malayan Sun Bear, dogs and pangolin[10]. Other species such as D. compactus and D. steini recovered in this study were also most commonly found on wild pigs[11]. Wild pigs are therefore suspected to be the main host for these intra-aural ticks. Inspection of surroundings of houses of patients found many signs of frequent visits by wild pigs such as piles of long grass where the pigs slept and muddy areas where the pigs wallowed and searched for food (Mariana, pers. comm.).

Almost 60% of ticks recovered from surroundings of houses of patients are nymphs (Mariana, pers. comm.). This is probably why the majority of ticks extracted from cases were nymphs. There is a need to obtain ecological information on species and stage of ticks involved in otoacariasis. The source of ticks is most likely vegetation surrounding homes, work places or school compounds. Small wild animals from nearby forest may invade houses if there are changes in the weather especially during or after rains and floods. In order to determine the source of ticks, it is necessary to trap small animals inside and outside houses, as well as examine vegetation surrounding the settlement where cases of otoacariasis had been reported. It is also recommended to fully examine domestic animals and pets as these animals may be involved in introducing the ticks during contact with human. Interview of cases should be conducted to obtain further epidemiological information.

Damage from the physical removal of attached ticks may be the primary cause of death of those ticks. The use of 4% lignocaine, olive oil or sodium bicarbonate ear drops to ease the grip of ticks and immobilize them may be another possible cause of death. These solutions were used in order to give relief to the patient and allow ease of removal. However, usage of these solutions amongst the medical personnel is not standardized and differs from one another depending on severity of cases, past experience and availability of solutions in the clinic.

In order to remove attached ticks in an intact condition from host tissues, it is necessary to gently tease the tick out using a sharpened instrument. This however is not practical or permitted in otoacariasis cases. In these cases, where a tick is clearly visualized and superficially attached it can be easily grabbed by a Hartman crocodile ear forceps before pulling out steadily. The use of force in grabbing and pulling out a tick will kill or damage the tick. Ticks with flattened bodies and without mouthparts are a result of unsteady removal. A steady pulling force is important to avoid break of mouthparts (gnathoso-

ma) that may cause infection and irritation[8]. If the tick is embedded at the anterior deeper part of the external ear canal, it is syringed out. Syringing usually breaks the tick into pieces and makes identification of the tick impossible.

Majority of the tick attachment was less than a day and may be due to the pain and distress caused by an attached tick, necessitating the patient to have it removed as soon as possible. The longest attachment was by a nymph for two and a half day. A short duration of attachment is most likely the explanation for the absence of facial paralysis in all cases. It is important to know the duration of attachment because the longer the duration, the higher the risk of facial paralysis[5] or risk of infection with several tick-borne pathogens[6]. All detached adult female ticks were not engorged indicating insufficient time to inject toxins causing paralysis in those cases. The toxin is secreted by engorged female ticks late in the feeding cycle[7]. There is currently no information on tick toxins affecting humans in Malaysia. Similarly, there is limited information on tick-borne pathogens of public health importance in Malaysia.

ACKNOWLEDGEMENTS

The authors wish to thank the Director, Institute for Medical Research (IMR), Kuala Lumpur, Malaysia for permission to publish this paper. We also wish to thank the Director, Tengku Ampuan Afzan Hospital (HTAA), Kuantan for clinical and facility support during the study. Our thanks are extended to Haji Muhammad Najemuddin, Staff Nurse Roslilawati AR, Staff Nurse Yau MT, Staf Nurse Zainun A, Medical Assistants, Health Assistants and all other supporting staff in the Department of Otorhinolaryngology, HTAA and Unit of Acarology, IMR for various assistance towards the successful completion of this study. We appreciate the assistance provided by Ms Intan Nurlemsha Baharom. The project was supported by a grant (Code: 04-002) from the Ministry of Health, Malaysia.

REFERENCES

1 **Bates PG.** Epidemiology of subclinical ovine psoroptic otoacariasis in Great Britain. *Veterinary Record*. 1996; **138**: 388-393.

2 **Indudharan R**, Dharap AS, Ho TM. Intra-aural tick causing facial palsy. *Lancet*. 1986; **348**: 613.

3 **Indudharan R**, Ahamad M, Ho TM, Salim R, Yan Naing Htun. Human Otoacariasis. *Ann Trop Med & Parasitol*. 1999; **93**(**2**): 163-167.

4 **Sri Novianti N**, Raja Ahmad RLA. Intra-aural tick infestation: The presentation and complications. *Int Med J*. 2003; **2**(**2**) (Online journal at http://www. e-imj. com/vol2-No2. htm).

5 **Indudharan R**, Dharap AS, Yan Naing Htun. An unusual differential diagnosis of myringitis bullosa haemorrhagica. *Trop & Geogr Med*. 1995; **47**(**5**): 227-228.

6 **Yeh M**, Bak JM, Hu R, Nicholson MC, Kelly C, Mather TN. Determining the duration of Ixodes scapularis (Acari: Ixodidae) attachment to tick-bite victims. *J Med Entomol*. 1995; **32**(**6**): 853-858.

7 **Miller MK**. Massive tick (Ixodes holocyclus) infestation with delayed facial-nerve palsy. *The Med J Australia*. 2002; **176**(**6**): 264-265.

8 **Needham GR**. Evaluation of five popular methods for tick removal. *Pediatrics*. 1985; **75**(**6**): 997-1002.

9 **Petney TN**, Keirans JE. Ticks of the genera Boophilus, Dermacentor, Nosomma and Rhipicephalus (Acari: Ixodidae) in South-east Asia. *Trop Biomed*. 1996; **13**: 73-84.

10 **Hoogstraal H**, Wassef HY. Dermacentor (Indocentor) atrosignatus (Acari: Ixodoidea: Ixodidae): hosts and distribution in the Malay Peninsula, Indonesia, Borneo and southern Philippines. *J Med Entomol*. 1985; **22**: 644-647.

11 **Wassef HY**, Hoogstraal H. Dermacentor (Indocentor) steini (Acari: Ixodoidea: Ixodidae): hosts, distribution in the Malay Peninsula, Indonesia, Borneo, Thailand, the Philippines, and New Guinea. *J Med Entomol*. 1988; **25**: 315-320.

12 **Gothe R**, Kunze K, Hoogstraal H. The mechanism of pathogenecity in tick paralysis. *J Med Entomol*. 1979; **16**: 357-369.