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Research Note

The Posture of Rats Affects Larval Migration of *Strongyloides ratti*

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Key words: *Strongyloides ratti*, migration, gravity, posture

Tada *et al.* (1979) demonstrated quantitatively that the third stage larvae (L3) of *Strongyloides ratti* migrated subcutaneously from the inoculation site of subcutis to the cranial cavity and nasofrontal portion, and eventually reached the small intestine of rats. Murrell (1980) and Hattori (1981) reconfirmed the above pathway. Furthermore Tindall and Wilson (1987) demonstrated statistically that the nasofrontal portion was at least one indispensable pathway taken by this parasite. Recently Bhopale *et al.* (1992) noted that the proportion of migrants through the head route was at least 50%, and probably more than 80%. Nobody, however, has shown yet how the larvae could find the head as their first destination. We therefore examined the effect of rat's posture on larval migration to elucidate the finding mechanism of their destination.

TMDU strain of *S. ratti* used in this study has been maintained in the authors' laboratory by a serial passage in rats for more than 18 years. L3 were collected by filter paper culture method (Tada *et al.*, 1979). The larvae were recovered from the fecal culture, washed several times with distilled water, arranged to be 100 larvae/10 µl water, and used for infection of rats. Eight 5-week-old male Wistar rats were used in this experiment, and 3,000 larvae in 0.3ml distilled water were inoculated subcutaneously into the abdominal site of the right femur in each rat. These rats were divided into two groups according to their postures. First group of four rats were forced to be head-up posture (head up and tail down vertically) (HU) and another four, lay-down posture (head and tail were laid down horizontally) (LD). Each rat was restricted by wire-mesh pouch, provided with water arbitrarily but no food. The general condition of each rat was good during this experiment. These rats were killed by bleeding under mild ether anesthesia. We examined the number of larvae migrating in the rats at 20 and 44 hours post inoculation (PI) according to the migration timing observed previously (Tada *et al.*, 1979). After autopsy, skin was separated from the body and divided into three; the head skin, upper and lower parts of skin. The naked head was removed from the body, and separated into four; the cranial cavity, brain, nasofrontal and basicranial portions. The separated tissues were minced in petri dishes and incubated for 90 minutes with 0.9% saline at 36°C, and the larvae appearing in each saline solution were counted under dissecting microscope. The number of larvae was expressed as the mean value in the two rats of each experimental group.

At 20 hours PI, 1,116.5 larvae were obtained from the head of LD rats, while only 258.0 from HU; the number of larvae migrated to the head in LD rats was 4.3 times as many as that in HU. 138.5 larvae were recovered from the head skin of LD rats, whereas 35.0 in HU. Only 36.0 larvae were recovered from the upper half skin of LD rats, while 330.5 from HU. Only 7.0 larvae remained in the lower half skin of LD rats, while 99.0 remained in HU. There were no larvae in the digestive canals (stomach plus small intestine) of both groups and about 8.5 and 10 larvae were collected from the lungs of HU and LD

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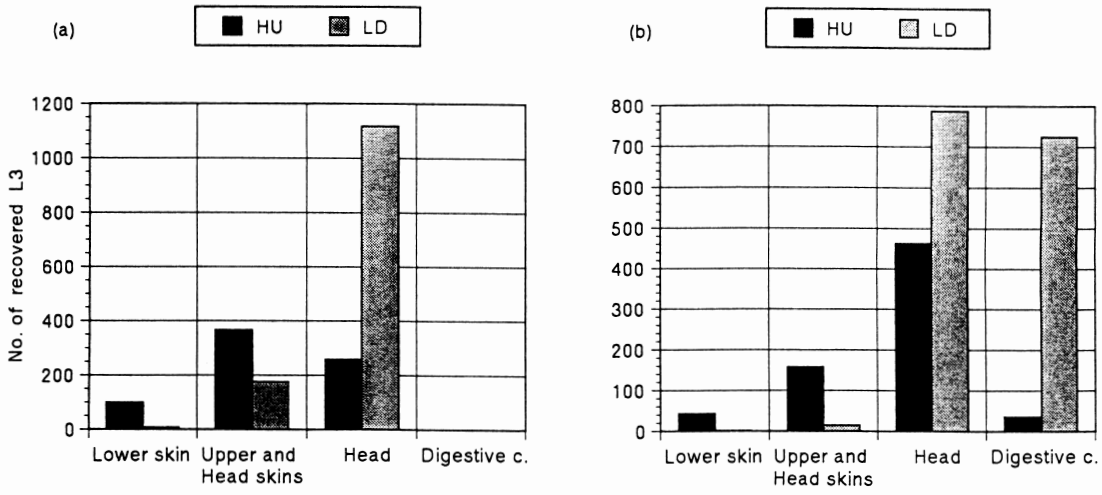

Fig. 1 Recovery of larvae from infected rats at 20 hours PI (a) and 44 hours PI (b) from head-up posture (HU) rats and lay-down posture (LD) rats.

rats respectively (Table 1, Fig. 1a).

At 44 hours PI, 724.5 larvae reached the digestive canal of LD rats, while only 35.5 in HU; the number of larvae migrated to the digestive canal in LD rats was 20.1 times as many as that in HU. 787.0 larvae were found in the head of LD rats, whereas 462.5 in HU rats. The total number of larvae migrated to the digestive canal and head in LD rats was 3.0 times as many as that in HU rats. There were 15.0 larvae in the skin in LD rats, whereas 200.0 in HU rats (Table 1, Fig. 1b).

There were apparent differences in the number of larvae migrated to the head and small intestine between the two groups counted at each of 20 and 44 hours PI. The migrating time for larvae to reach the head in HU seems much slower than that in LD rats, and many larvae still remained in loose subcutis in HU rats. Further, the larval recovery is usually very low during larval migration between the skin and the head. This would be the reason why total number of recovered larvae in HU was less than in LD rats. The effect of gravity will be one factor on the delay in larval migration. The ratio of larvae migrated to the small intestine from the head between 20 and 44 hours PI was much different between LD and HU rats. In LD rats, the rate of L3 found in the digestive canal at 44 hours PI was 64.8% of L3 found in the head at 20 hours PI. On the other hand, this rate was only 14.0% in HU rats, which was about one-fifth of the rate expected from the result in LD rats. It seems that the head-up posture of rats apparently suppresses larval migration from lower skin to the head and eventually to the small intestine. In vitro study with the vertical agar assay, the L3 did not tend to migrate up the agar against the gravity (not published). As a conclusion, the migration of L3 is remarkably retarded by the head-up posture of infected rats. This evidence shows that the ability of the third stage larvae to find and reach the head will not be caused by the fact that the position of the head is relatively higher than the femur where larvae were inoculated.

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Table 1 Recovery of larvae from various body portions of infected rats at 20 and 44 hours PI in HU and LD rat groups

Hours post inoc.	Posture of rats	No. of rats examined	Skin			Head				Digestive canal		Lungs	Total No. of larvae recovered
			Lower	Upper	Head	Cranial cavity	Brain	Naso-frontal portion	Basi-cranial portion	Subtotal No. of larvae from head	Stomach	Small intestine		
20	HU*	2	99.0	330.5	35.0	71.5	22.5	113.5	50.5	258.0	0.0	0.0	8.5	731.0
	LD†	2	7.0	36.0	138.5	424.0	49.5	501.5	141.5	1116.5	0.0	0.0	10.0	1308.0
44	HU	2	42.5	130.0	27.5	196.0	50.0	161.0	55.5	462.5	3.5	32.0	51.0	749.0
	LD	2	1.0	6.0	8.0	88.0	102.0	556.5	40.5	787.0	10.0	713.5	15.5	1541.0

*HU (head-up posture); head was up and tail was down vertically. †LD (lay-down posture); head and tail were laid down horizontally.

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会　　報

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1994年度国際交流委員会は一部委員の交代と評議員からの参加を得て新らたに発足いたしました。交通・通信の発達により，益々国際化が進行すると予測される中，会員各位の研究活動の国際交流もまた一層の発展が期待されています。世界各国との研究・調査活動についての情報の交換を進める必要も出てきました。会員各位の御意見・提案を得て進みたいと考えますので御協力をお願いいたします。

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国の研究機関にあっては研究者招へい，派遣，ワークショップ開催など科学技術庁の支援システムに応募して実行し，大学にあっては日本学術振興会の上記関係支援システムに応募して協力・交流を進める手はずになりますが，二国間協力協定にのっとった申請である事実があれば優先的に考慮される原則という事ですので，二国間科学技術協力協定の締結されている国，テーマに合致すれば，申請の際，その旨申告することができます。
関係者に相談されると良いと思います。

二国間科学技術協力協定の例

1）　日英科学技術協力協定

上記につき医療分野，プロジェクトNo.2J-19，「マラリアに関する研究」が，英国側：Prof. R. E. Sinden, Imperial College, University of London, 日本側；国立予防衛生研究所・寄生動物部，石井明部長により，1991年から準備され，1992年４月英国よりProf. R. E. Sinden と Prof. G. A. T. Target, London School of Hygiene and Tropical Medicine, University of London の２名が来日しました。東大医科研でマラリアのシンポジウムを開催すると共に全国各地の研究施設を訪問し研究者と交流しました。その后三重大学鎮西康雄教授グループが学術振興会から研究者派遣を支援されています。

2）　日米科学技術協力協定

上記においてテーマNo.A36，「寄生虫病に関する基礎的研究」がコンタクトパーソンとして米側：Prof. D. G. Colley, Center for Dicease Control and Prevention, Atlanta, 日本側：国立予防衛生研究所・寄生動物部石井明部長により，1993年より合意開始されています。