

A preliminary observation on watery content of small intestine in *Metagonimus yokogawai* infected dog

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Watery diarrhea is one of the main symptoms in human metagonimiasis together with abdominal pain and fatigue. In connection with watery diarrhea in man, watery contents in small intestine has been recognized in experimental metagonimiasis in rats (Chai, 1979) or in cats (Lee *et al.*, 1981). In experimental cats, small intestinal lumen was filled with foamy, translucent, greenish, sometimes tarry-looking serous liquid. The amount of watery content seemed to depend on both the doses of metacercariae and the duration of infection. The amount reduced after 4 weeks of infection (Lee *et al.*, 1981).

Because heavy metagonimiasis induced shortening, fusion and blunting of intestinal villi, especially in upper half of small intestine (Lee *et al.*, 1981) the absorptive surface of villous tip reduced. The watery content in experimental metagonimiasis, therefore, may be considered as a product of poor absorption of intestinal secretions normally produced by secretory crypt cells (Sanford, 1982). Such presumptive mechanism of watery diarrhea in metagonimiasis is different from that of cholera in which isotonic diarrhea is produced by enterotoxin accelerating the adenylcyclase of mucosal cells to pump out Cl^- ions (Sanford, 1982).

In this preliminary study, we observed the amount and osmolarity of watery content by intestinal segment in experimental dogs.

We infected two dogs with 70,000 metacercariae of *M. yokogawai* collected from naturally infected *Plecoglossus altivelis*. On the 4th and 8th weeks, each dog was killed after 3 hours

of a rice meal. Small intestine was cut into 6 equal segments, opened along mesenteric border. The luminal contents in the respective segments were collected using spoid pipettes, and their amounts were measured. After centrifugation, the amount of supernatants were measured; pH and osmolarity of supernatants as well as concentrations of Na^+ , K^+ , Cl^- , HCO_3^- and protein were also measured. Along these measurements, we counted the number of adult worms in each intestinal segment.

The results from a dog infected for 4 weeks were shown in Table 1. The dog infected for 8 weeks did not revealed any watery content in the lumen up to the 3rd segment; from the 4th to 6th segments, only mushy chyme filled the lumen, although we collected 49,372 adult *M. yokogawai* (6,856 in 1st segment, 29,426 in 2nd, 12,911 in 3rd, 113 in 4th with 1 *Heterophyopsis continua*, 3 in 5th with 2 *H. continua* and 63 in 6th segment).

The results for 4 weeks old infection showed that the amount of watery content changed in almost parallel pattern with numbers of adult worms in respective segments (Fig. 1). Unlike the results of amount, however, the osmolarity were not different along segments; they were all isotonic. Along the segments, pH and ionic concentration of watery content reflected the normal pattern in human being (Fordtran and Ingelfinger, 1968).

The relative composition of Na^+ , K^+ , Cl^- and HCO_3^- ions in osmolarity decreased from above downwards along the segments. Probably the

Table 1. Adult worm recovery, amount, pH, osmolarity, protein and electrolytes concentration in watery content in the lumen of small intestine by 6 equal division (40cm each)

Division of small intestine	No. of adult worms recovered	Intest. content		Supernatant		Concentration in supernatant				
		total	ppt./spnt. (ml)	pH	osmolarity (mOsm/kg)	protein (mg/dl)	Na ⁺	K ⁺ (m Eq / ml)	Cl ⁻	HCO ₃ ⁻
1	5,952	1.7	0.2/1.5	n.d.*	328	554	133	14.6	114	n.d.
2	7,688	9.4	0.9/8.5	6.9	330	149	122	12.2	116	1.7
3	8,618	9.7	1.1/8.6	7.2	327	149	114	12.2	105	5.0
4	4,836	5.3	0.8/4.5	7.5	340	148	91	11.2	80	9.0
5	358	6.4	1.1/5.3	7.6	324	148	80	10.4	70	10.1
6	47	5.4	4.5/0.9	n.d	330	360	90	17	50	n.d.
Serum	—	—	—/—	n.d.	304	5,108	150	5.1**	100	18.4

* n.d.: not done

** : partly haemolysed

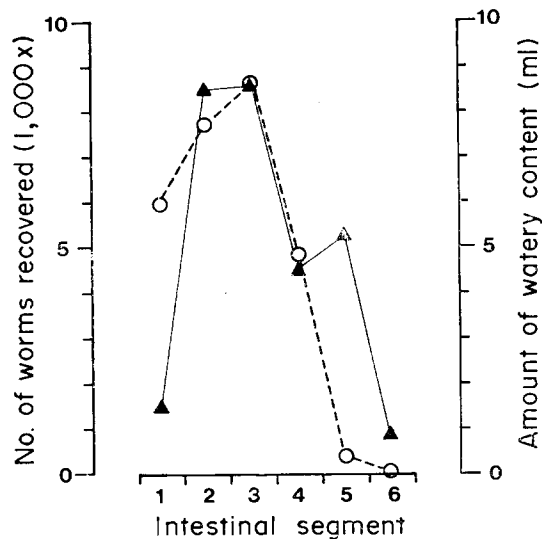


Fig. 1. Relationship between the number of adult worms(○···○) and the amount of watery content(▲—▲) in each segment. The dog was killed on the 4th week of the experimental infection.

gap between total osmolarity and that contributed by major ions in ileal watery contents may be replaced by ionized organic acids which were produced by intestinal flora (Torres-Pinedo *et al.*, 1966).

The distribution of watery content as well as other data along each segment suggested that the watery content was a product of poor absorption of intestinal secretion from crypt cells because it was closely related with the number of worms and villous changes (Lee *et al.*, 1981)

in each segment. Also it suggested that the poor absorptive function was reversible whenever the villi resumed the normal architecture either by reducing the number of worms or by compensatory hyperplasia of crypt cells.

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=우리말요약=

요꼬가와흡충에 감염된 개의 소장내 액상 장내용물 관찰

조승열 · 김석일(중앙의대 기생충학) 엄응의 · 호원경(서울의대 생리학)

요꼬가와흡충의 피낭유충 70,000개씩을 개 2마리에 실험감염시키고 4주일 및 8주일에 각각 관찰한 바 8주일 감염된 개의 소장에서는 액상 장내용물을 관찰할 수 없었다. 그에 비해 4주일간 감염된 개의 소장에는 액상 장내용물이 장관에 있었고 그 양은 소장을 6등분하였을 때 각등분에서 분리한 요꼬가와흡충의 수와 비례하였다. 액상내용물의 삼투질 농도는 부위에 관계없이 등장성이었다. 장내용물의 부위별 pH, 단백질량 및 이온의 농도는 정상에서와 같이 변하고 있었다.

이상의 결과에서 요꼬가와흡충증의 액상 장내용물은 감염으로 소장용모의 길이가 짧아지면서 흡수면적이 감소하고 따라서 장은와의 분비액을 충분히 흡수하지 못하여 형성되는 것으로 생각할 수 있었다. 그리고 이러한 병적상태는 가변성인 것으로 생각하였다.