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POPULATION OF MAST CELLS AND GLOBULE LEUKOCYTES IN THE
BRONCHOPULMONARY SYSTEM OF GOATS EXPERIMENTALLY-INFECTED
WITH DICTYOCAULUS FILARIA

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SUMMARY

The population of the mast cells (MCs) and globule leukocytes (GLs) in bronchi of goats infected with D.Filaria was studied as well as the histochemical changes occurring in goblet cells and mucosal glands in the airways of goats during postpatent of Dictyocaulus infection. It was shown that the population of these cells was associated with parasitic infection and they play a role in the immune response of host against parasitic infection. Histochemical studies showed that the mucosubstance of the airways of parasitic goats was a mixture of sulphomucin and sialomucin.

INTRODUCTION

It is clear that certain factors may play role in the population of mast cells (MCs) and globule leukocytes (GLs) of many organs in various animal species. The number of these cells increases during the intestinal phase of nematode infection in rats and sheep (1, 2, 3) and patent stage of D. filaria (4).

In magnesium deficiency, Cantin and Veillenux (5) found that the number of these cells in the urinary tract of rats increases while Dawson (6) reported these cells in the lymph node of dogs which were exposed to x-ray irradiation.

The aim of the present study was to determine the relationship between these cells and the development of the resistance against infection with D.filaria.

MATERIALS AND METHODS

Seven groups of two kids each (3-4) months of age, were used. All animals were prophylactically treated orally with dl-te-tramisole at 15mg/kg body weight and were kept under observation for (two) weeks and then experimentally infected with third stage larvae (L3) of D.filaria.

First group received an oral dose of 1000 L3 and Killed (five) weeks later. The 2nd, 3rd and 4th groups were given 1000 L3 intravenously and were given a challenge dose of 2000 L3 by the same route at 2, 3 and 4 weeks postinfection respectively, and killed (six) weeks after the first dose. The 5th and 6th groups were subjected to the dose of 1000 L3 (orally) and were challenged with the same dose orally at five and six weeks after first dose respectively. The 7th group was not given anything and kept as control. The lungs of each animal were stripped from its attachments and histological samples were taken from six sites in the right bronchi (Fig.1) and were stained with alcian blue-Safranin (7). The subepithelial mast cells and intraepithelial globule leukocytes were counted according to the method described by Mahmoud (4) and the number of these cells was expressed as mean value/centimetre of bronchial lumen length with a standard error and the data were statistically evaluated employing student t-test.

For histochemical studies, sections were stained with the following stains:

1. Periodic acid Schiff-PAS (8)
2. Alcian blue PH2.5 (ABPH2.5) (9)
3. Alcian blue PH1.0 (ABPH1.0)-PAS (9)
4. Methylation - AB (10)
5. Methylation- Saponification-AB (10)
6. Acid hydrolysis (0.1 N H₂SO₄, 2hr, 60 C) - ABPH1.0, 2.5 (11).

RESULTS

The results of the cells counts (per/centimetre of bronchial length lumen) in the six standard sites are shown in tables 1 and 2, as well as the mean/cm and standard error values. It is evident that the numbers of these cells in bronchi of uninfected animals especially the GLs were very few. However, the numbers of these cells increased after parasitic infection. The mean MCs/cm length of bronchial lumen in the 1st group (1.47 + 0.02) was significantly higher ($P < 0.01$) than that of control animals (0.26 + 0.09) but the numbers of these cells increased by (9) folds in 2nd group (2.90+0.37) as compared with those of the control animals.

In the 3rd group, the mean MCs/cm (5.59+1.4) and GLs/cm (3.38+0.7) was significantly higher than that of control animals ($P < 0.01$) and 2nd group animals ($P < 0.05$) but the mean number of GLs/cm (0.73+0.14) and MCs/cm (1.35+0.22) declined in the 4th group by 3.5 ($P < 0.05$), 1.5 folds, respectively, when compared with the 2nd group. However, the 5th group had a significant reduction of mean value of GLs/cm (0.45+0.06) in comparison with the 1st group animals ($P < 0.01$) whereas no significant reduction of mean value of MCs/cm (0.7+0.12), as compared with 1st group animals, was recorded.

The animals of the 6th group which were exposed to a challenge dose at 6 weeks after 1st dose, showed a sharp drop in the mean number of MCs/cm (0.41+0.06) and GLs/cm (0.17+0.97) as compared with those of 1st group ($P < 0.01$).

Histochemical properties of the mucosubstance are shown in table 3. It is evident that the granules of goblet cells and mucosal gland cells of the airways of the 5th and 6th group animals contain a mixture of sulphomucin and sialomucin.

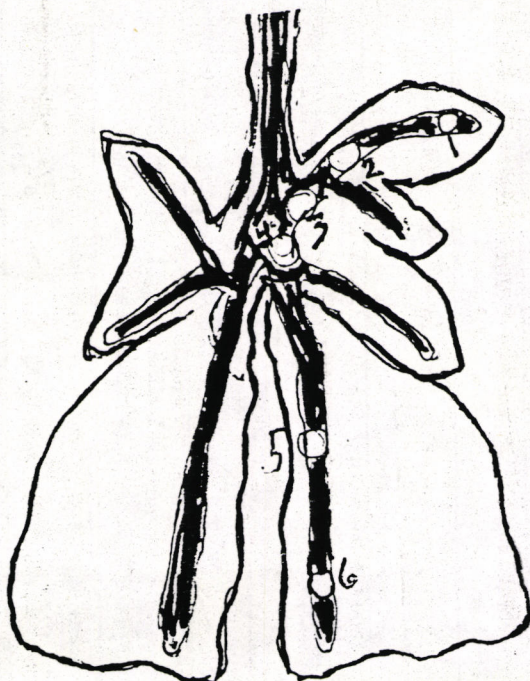


Figure 1. Diagram of the tracheobronchial tree of goats indicating standard sites for sampling.

Table 1: Numbers of GLs/cm length of bronchial lumen at the six standard sites of 14 lungs. An overall mean GLs/cm and standard error values are included for each animal.

Experimental group	animal No.	R C L R D L						Mean + S.E
		1	2	3	4	5	6	
A	1	1.03	1.00	1.85	3.00	2.68	3.33	2.15±0.22
	2	1.50	1.86	1.66	2.00	2.70	3.20	
B	3	1.65	2.00	2.50	3.10	3.35	1.81	2.58±0.36
	4	5.00	2.08	1.03	4.60	2.67	1.26	
C	5	6.60	1.40	2.50	1.88	8.70	2.20	3.38±0.7
	6	1.23	4.00	0.50	5.26	0.98	5.41	
D	7	0.25	0.57	1.86	0.47	1.20	0.72	0.73±0.14
	8	1.20	0.00	0.20	1.00	0.45	1.00	
E	9	0.24	0.28	0.00	0.82	0.00	0.73	0.45±0.6
	10	0.58	0.63	0.65	0.70	0.62	0.24	
F	11	0.00	0.16	0.00	0.16	0.38	0.17	0.17±0.07
	12	0.15	0.00	0.27	0.46	0.18	0.13	
G	13	0.00	0.00	0.10	0.00	0.02	0.00	0.01±0.008
	14	0.02	0.01	0.00	0.00	0.00	0.03	

R C L = Right cranial lobe
R D L = Right diaphragmatic lobe

Table 2: Numbers of MCs/cm length of bronchial lumen at the six standard sites of 14 lungs. An overall mean MCs/cm and standard error values are included for each animal.

Experimental group	animal No.	R C L R D L						Mean ± S.E
		1	2	3	4	5	6	
A	1	1.13	0.92	2.20	1.10	1.13	1.00	1.47±0.02
	2	2.00	1.92	1.20	1.50	1.11	2.46	
B	3	2.25	8.40	1.00	0.65	0.25	0.25	2.09±0.37
	4	3.5	3.00	1.00	2.44	3.70	3.00	
C	5	1.92	4.00	8.00	10.0	13.0	3.40	5.59±1.4
	6	8.20	6.75	1.92	7.00	3.00	10.0	
D	7	0.00	0.75	1.17	3.07	1.53	1.80	1.85±0.22
	8	1.12	0.70	1.60	1.57	2.20	0.77	
E	9	0.48	0.32	0.55	1.66	0.75	0.62	0.7±0.12
	10	0.68	0.25	0.00	1.14	0.90	1.14	
F	11	0.13	0.45	0.53	0.35	0.37	0.88	0.41±0.06
	12	0.20	0.50	0.70	0.37	0.00	0.35	
G	13	0.50	0.25	0.00	0.35	0.11	0.00	0.26±0.09
	14	0.03	0.00	0.40	0.13	0.71	0.37	

R C L = Right cranial lobe
R D L = Right diaphragmatic lobe

Table 3: Histochemical properties of goblet cells and mucosal gland cells in the bronchopulmonary tract of animals of the 5th and 6th groups.

STAINING METHODS	GOBLET CELLS	MUCOSAL GLAND CELLS
PAS	+++ R +++	+++ R +++
ABPH2.5-PAS	B +++	B +++
ABPH1.0-PAS	B ++	B ++
METHYL-AB PH2.5, 1.0 METHYL. SAPON	R - - +	R - - +
ABPH2.5, 1.0	B ++	B ++
Acid hydrolysis ABPH 2:5, 1.0	B -	B -

B: blue, R: red, ++: strong reaction, +++: Moderat reaction + reaction, -: negative reaction.

DISCUSSION

The results showed that the population of MCs and GLs in airways of goats infected with D.filaria correlated with the stage of parasitic infection. Some authors explained that the presence of these cells is associated with the self-cure phenomenon (1, 12).

The significant increase in the number of these cells in the 3rd group, as compared with, the control and 2nd group animals, might be due to intense immunological responsee. Similar observation was reported carlier (13) in bovine schistosomiasis.

The declination in the number of these cells in the 4th group is in accordance to that shown by Michel (14) who reported that acquired resistance in calves infected with D.viviparus was elevated at the 10th day postinfection and continued so until day 100 postinfection. The diminished number of MCs and GLs in the 5th and 6th groups might be due to development of strong immunity which prevented migration or establishment and development of the larvae. This idea was supported by results of the histochemical study which revealed that the secretion of goblet cells and mucosal gland cells shifted to the normal nature. Previous study (15) showed that the secretion of these cells consisted of sulphomucin and sialomucin in the case of normal goats and it was shifted to neutral mucosubstance and sialomucin in heavily parasitized goats.

The results of this study have shown that the population of MCs and GLs was associated with the development of resistance against infection with D.filaria.

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عدد الخلايا البدينة وخلايا الدم البيض الكروية في
الجهاز التنفسي للماعز المخمخ تجريبيا بديدان الرئة
Dictyocaulus filaria

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الخلاصة

أجريت هذه الدراسة على (١٤) معاز محلي بعمر (٣-٤) شهور قسمت بالتساوي الى سبعة مجاميع واصيبت بجرع أولية وجرع تحدي تراوحت مابين (١٠٠٠-٢٠٠٠) يرقة خمجية من ديدان الرئة Dictyocaulus filaria بطرق مختلفة حيث اصيبت المجموعة الاولى بجرع أولية عن طريق الفم واصيبت المجاميع الثانية، الثالثة والرابعة بجرع أولية وجرع تحدي عن طريق الوريد الودجي أما المجموعتان الخامسة والسادسة فقد اصيبتا بجرع أولية وجرع تحدي عن طريق الفم لدراسة علاقة عدد الخلايا البدينة وخلايا الدم البيض الكروية والاصابة بديدان الرئة .

لقد أوضحت هذه الدراسة عمق العلاقة بين عدد هذه الخلايا ومرحلة الاصابة بديدان الرئة كذلك بينت وجود علاقة بين عدد هذه الخلايا والتغيرات الكيمياوية النفسية للممرات الهوائية والاصابة بديدان الرئة مما يشير الى دور هذه الخلايا في ظاهرة الشفاء الذاتي.