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激活的补体对清醒山羊肺内液体交换的影响——超氧阴离子的作用

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提 要 作者采用山羊慢性肺淋巴瘘模型，在输入酵母多糖活化的血浆后，观察清醒山羊肺内液体和蛋白质交换以及中性粒细胞释放超氧阴离子能力的改变。结果表明输入酵母多糖活化的血浆可激活中性粒细胞，使之释放超氧阴离子的能力增强；肺淋巴流量增加及肺淋巴与血浆蛋白比值增大。提示中性粒细胞释放超氧阴离子能力增强，可能是激活的补体致肺微血管壁受损的原因之一。

关键词 补体；淋巴；肺循环；过氧化物

近年来，激活的补体和白细胞在急性肺损伤中的作用，已引起广泛注意。体外实验证明活化的补体可使中性粒细胞释放超氧阴离子增加[1]，血管内皮细胞受损[2]。用超氧自由基清除剂(超氧歧化酶和过氧化氢酶)，可以减轻活化补体所致的肺损伤[3]。静脉输入活化的补体，对中性粒细胞释放超氧阴离子能力的影响尚未见报道。作者采用山羊慢性肺淋巴瘘模型，在输入酵母多糖活化的血浆后，观察清醒山羊肺内液体和蛋白质交换以及中性粒细胞释放超氧阴离子能力的改变，用以说明活化的补体对中性粒细胞释放超氧阴离子能力的影响及其在损伤肺微血管壁中所起的作用。

材 料 和 方 法

健康山羊8只，体重17～26kg（平均20.25kg）。按照Stothert的改良法[4]，经胸导管建立慢性肺淋巴瘘模型。术后第三天，动物一般情况良好，肺淋巴流量稳定，淋巴中无血，方可进行实验。

制备酵母多糖活化的血浆：实验前从颈总动脉采血60ml，肝素（5u/ml）抗凝，分离血浆。将血浆与酵母多糖按2.5mg/ml的比例混合，在37℃水浴中温育30分钟后，再次离心，其上清液即为酵母多糖活化的血浆（ZAP），其中含有活化的补体。

超氧阴离子生成的测定：在输入ZAP前和输入后1小时末，分别从颈总动脉采血10ml，肝素抗凝（20u/ml）。分离出中性粒细胞（PMNs）后，用Hanks平衡盐溶液制成悬液，浓度约为5×10^6细胞/ml。

采用Shigeoka[5]稍加改进的Babior的方法测定超氧阴离子的生成量，结果表示为：nmol细胞色素C还原/5×10^6PMNs/30min。

实验方法和步骤：实验当天在局麻下，经右侧颈外静脉将心导管插至肺动脉。待肺动脉压和肺淋巴流量稳定后开始实验，在15分钟内将30ml ZAP经心导管匀速输入上腔静脉。每30分钟记录一次肺动脉压，同时收集肺淋巴液，记录肺淋巴流量，从颈总动脉采血测动脉血液气体参数、血浆总蛋白浓度和白细胞计数，历时4小时。用换能器（Statham P23ID）测肺动脉压，通过生理记录仪(OEC3200，Nihon Kohdon）显示和记录其波形和数值。用双缩脲法作血浆和淋巴总蛋白浓度测定，用血气分析仪(ABL_3，Radiometer Copenhagen Denmark)测定动脉血液气体参数，在显微镜下作外周血白细胞计数。

在实验过程中，动物自然站立或俯卧在观察架上，始终处于清醒状态。

结 果

一、肺动脉平均压（Ppa）及肺淋巴参数的改变 输入ZAP后，Ppa立即增高，由对照值17±0.3mmHg增至32±1.4mmHg（$P<0.01$），接着迅速下降，30分钟末已恢复至对照水平。肺淋巴流量（QL）和肺淋巴蛋白清除率（LLPC）增加，30分钟末达最高值，QL由5.6±0.8ml/h增至10.1±0.6

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ml/h (P<0.01)，LLPC由3.2±0.4ml/h增至6.0±0.9ml/h (P<0.01)。肺淋巴与血浆蛋白比值 (L/P) 增大较为缓慢，两个半小时末较对照值显著增大，3小时末达最大值，由0.57±0.03增至0.67±0.03 (P<0.01)。此时，QL和LLPC虽较峰值减少，但仍显著高于对照值（表1，图1）。

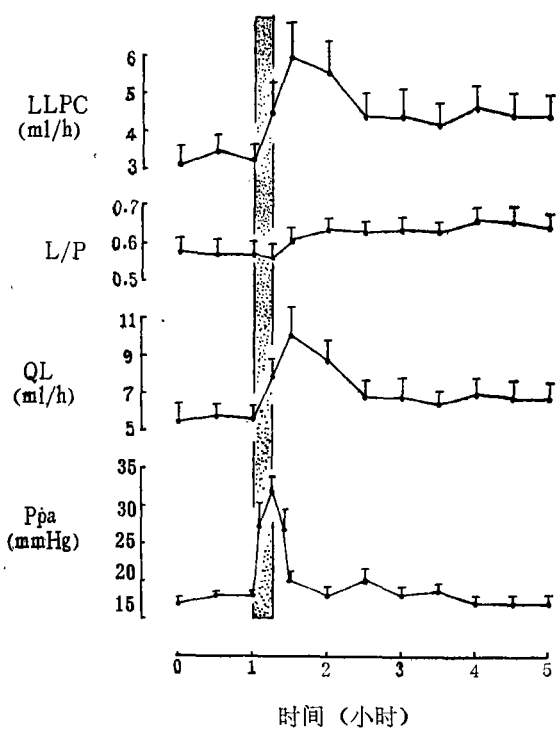


图1 酵母多化糖活化的血浆对肺动脉平均压和肺淋巴参数的影响（$\bar{X}$±SE）

二、白细胞计数的改变 输入ZAP，外周血白细胞计数立即减少，10分钟末达最低值，由对照值5695±1036/mm³ 减至1168±216/mm³ (P<0.01)，以后逐渐回升，一个半小时末已恢复至对照水平。

三、中性粒细胞释放超氧阴离子能力的改变 输入ZAP后1小时末，中性粒细胞释放超氧阴离子增多，使细胞色素C还原量增加，由对照值8.09±0.28 nmol/5×10⁶ PMNs/30min增至14.19±1.67nmol/5×10⁶ PMNs/30min (P<0.01)。

讨 论

肺血管壁对蛋白质具有分子筛的屏障作用，仅有血管内流体静压的增高，只会出现血管内液体滤出增多，而不伴有肺淋巴蛋白含量增加，L/P值应该降低，如肺微血管壁通透性增高，在血管内液体滤出增加的同时，蛋白质滤出也增多，L/P值不变或增大。我们的实验结果表明输入ZAP后，出现短暂的白细胞减少和明显的肺动脉压升高，并伴有肺淋巴流量增加，L/P值逐渐增大，LLPC也明显增高，提示此时的肺淋巴流量增加与肺微血管内流体静压升高和肺微血管壁通透性增高有关。后来，虽然肺动脉压已降至对照水平，但QL、L/P和LLPC均显著高于对照水平，可以认为此时的肺淋巴流量

表1 酵母多糖活化的血浆对肺动脉平均压和肺淋巴参数的影响（$\bar{X}$±SE）

	Ppa (mmHg)	QL (ml/h)	L/P	LLPC (ml/h)
对照	17±0.3	5.6±0.8	0.57±0.03	3.2±0.4
注入ZAP后				
15min	32±1.4**	7.9±1.2**	0.56±0.05	4.5±0.8*
30min	20±0.8	10.1±1.6**	0.61±0.03	6.0±0.9**
1 h	18±0.8	8.8±1.1**	0.64±0.02	5.6±0.8**
2 h	18±0.9	6.9±1.0**	0.63±0.03	4.4±0.6**
3 h	18±0.8	7.0±0.8**	0.67±0.03**	4.6±0.6**
4 h	17±1.1	6.8±0.8*	0.64±0.04**	4.4±0.6**

n = 8；*与对照值相比P<0.05；** 与对照值相比P<0.01。

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感性降低是否与此有关，有待进一步阐明。

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增加主要与肺微血管壁通透性增高有关。Meyrick等[6]观察到给绵羊输入ZAP，当肺淋巴流量增加时，可见肺血管内皮细胞受损，随着肺淋巴中蛋白含量增加，可见水肿液在肺内聚集，血管周围有细胞渗出。因此ZAP对肺血管内皮细胞的损伤，可能是导致肺微血管壁通透性增加的直接原因。

在我们的实验中，输入ZAP后外周血白细胞计数减少，这可能是白细胞在肺中淤积的结果。输入ZAP后1小时末，中性粒细胞释放超氧阴离子的能力显著增强。两个半小时末，L/P值显著增大，似可认为白细胞参与了激活的补体对肺的损伤作用。输入ZAP可直接激活中性粒细胞，使之释放超氧阴离子的能力增强。中性粒细胞释放超氧阴离子增多，可能与肺微血管壁通透性增加有关。

中性粒细胞释放超氧阴离子能力增强时，肺动脉压已降至对照水平。Havill先给绵羊使用超氧歧化酶，在输入ZAP时，未出现明显的肺血管壁通透性增高，而早期的肺动脉压升高不受影响。表明中性粒细胞释放超氧阴离子的能力增强，不会导致肺动脉压升高。

上述结果提示ZAP激活中性粒细胞，使之释放超氧阴离子增多，可能是激活的补体损伤肺微血管壁的原因之一。

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antigen in human are able to be depleted from epidermal grafts by epidermal cell culture, and suggest that the ECs cultured in our culture system can prolong their survival period as they are used as allografts.

Key words: Culture of human Human Epidermal cells; Langerans cells; Mixed epidermal cell-lymphocyte cnlture response (p.5)

Ultrastructural Pathology of Experimental Encephalitis B and Morphogenesis and Release of Encephalitis B Virus in Mice

Chen Liming Tutors: Yan Liansui and Liang Yanjie (Department of Pathology, Third Military Medical College)

An animal model of encephalitis B was successfully established with Jin Wei Yan I strain virus in mice, which made it possible to study the ultrastructural pathology as well as the morphogenesis and release of encephalitis B exerimentally.

The ultrapathological changes occurring to the brain tissues especially in the neuron cells were described systematically. A preliminary hypothesis about the morphogenesis and release of encephalitis B virus (Jin Wei Yan I strain) was proposed on the basis of these changes. Replication of the virus was also found to occur in the oligodendroglia but not in the microglia, which maintained its phagocytic function. This fact evidently shows that the micrioglia is not controlled by the mRNA of the virus.

According to the literature available to the authors, it seems that the ultrastructural pathological changes of encephalitis B with typical histological lesions in animals had not been reported previously.

Key Words: Encephalitis B virus; Ultrastructural pathology; Encephalitis B (p.9)

Effects of Activated Complement on Lung Fluid Exchange in Conscious Goats: Dependency on Superoxide Anion

Xie Zhonglin, et al (Department of Pathophysiology and Institute of Hypoxia, Third Military Medical College)

The effects of zymosan-activated plasma (ZAP) on lung fluid exchange and superoxide anion production by granulocytes were studied in 8 conscious goats with chronic lung lymph fistula. It was found that the circulating granulocytes were activated and the superoxide anion production was markedly enhanced af-

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ter the infusion of ZAP. Consequently, there was an increase in the amount of lung lymph flow and the protein concentration in the lung lymph. The results indicate that the superoxide anion released by the activated granulocytes may be one of the causes through which the activated complement can induce lung injury.

Key words: Complement; Lymph; Pulmonary circulation; Superoxide anion

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Changes of protein Metabolism in Rat Soleus Muscle after Burus and Effects of Leucine and Insulin

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This paper is to report the changes of the protein metabolism in the rat soleus muscle in vitro after 37% TBSA full-thickness burns covering one hindlimb and the effects of leucine and insulin on the burned muscle.

It was found that there werea significant decreases of the protein content and marked exaggeration of the rates of tyrosine incorporation, tyrosine release and tyrosine net release in the burned muscle. No changes of the above-mentioned parameters could be revealed in the muscle of the unburned limb and the controls. Elevation of leucine concentration in the medium could not improve the protein metabolism of the burned muscle. 0.1 u/ml of insulin could significantly stimulate the tyrosine incorporation in the muscle of the unburned limb and the controls, but no similar effect was observed on the burned muscle.

The results indicate that increased protein degradation of the local burned muscle is responsible for the postburn negative nitrogen balance; administration of leucine alone cannot improve the protein metabolism in the local burned muscle; and the sensivity of the burned muscle to insulin is suppressed.

Key words: Burns; Soleus muscle; Protein metabolism; Leucine; Insulin

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