磁场对电解铝作业工人免疫功能影响的研究

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提　要　对某铝厂电解车间采用CT_3-A型交直流特斯拉计测定了电解槽近场区不同高度、不同距离及人体表面不同部位的磁场强度。结果表明作业场所及人体体表的磁场强度为自然界磁场强度的数倍至数十倍。对接触磁场、工龄在20年以上的工人，进行了免疫功能的测定。结果表明该场所的磁场强度对工人免疫功能有抑制作用。由于该作业场所除磁场外，还有其他化学、物理因素的危害，因此，这种免疫功能的改变，可能是磁场等综合因素所造成的。

关键词　磁场　免疫功能　职业危害　神衰综合征

长期以来，对电解铝作业工人的职业危害只注意到氟及其化合物所致的工业性氟病[1]。但是电解槽在正常生产中能发出较强的稳定性磁场，尚未引起人们的关注。我们对某电解铝厂，经十多年的健康动态观察，发现电解作业者神衰综合征与植物神经功能紊乱的发病率较高，其特点表现为工人在生产中精神不振、昏昏欲睡、食欲差。体检中突出的是心动过缓、血压偏低和性功能减退。这与毒物所致神衰综合征有一定的不同，考虑到是否与磁场有关。为此，对电解铝车间进行了全面的磁场强度测定和工人的免疫功能检查[2]，期望能观察到电解铝作业生产中磁场对工人健康早期影响的资料，为采取有效的防治措施而提供科学依据。

磁场强度的测定及结果

于正常生产条件下，采用上海制造的CT_3-A型交直流特斯拉计，测量电解槽内的工作电流、电压分别为60kA和157～160V，而每个电解槽的电压则为4.5V，各槽可串连起来。生产用的直流电源是从工频交流电经硅整流供给，电源母线顺车间电解槽长度方向引入，从电解槽侧面接槽内阳极棒，而电解槽体则作为阴极。生产时在母线、阳极棒等处，可产生强大的稳定性磁场。根据磁场发射源不同的距离按水平和垂直位置进行实测，同时还对电解铝工人身体各部位磁场强度进行了测定，测定结果见表1、2、3。

表1　电解槽水平磁场强度（mT）

测定地点	槽边	距槽0.5米	距槽1.0米	距槽2.0米
电解车间	17.5	12.3	6.9	4.58

表2　电解槽垂直磁场强度（mT）

测定高度	槽边	距槽0.5米	距槽1.0米	距槽2.0米
高1米	12.2	9.5	6.0	4.0
高2米	8.0	6.0	4.5	3.0

表3　人体表面磁场强度（mT）

测定部位	头	手	胸	腹	膝	脚
距槽0.5米	3.0	4.0	3.5	5.0	6.0	3.5
距槽1.0米	2.0	3.0	3.2	4.0	5.0	4.0
距槽2.0米	1.2	1.5	3.0	3.6	2.0	3.0

母线转角处磁场强度为42.0mT。

免疫指标的检测与结果

一、对象：磁场暴露组电解作业工人全部为男性，20名，年龄40～49岁，平均年龄为44.4±2.44岁，工龄20～24年，平均工龄为20.65±4.82年。对照组为同一生活环境的非磁场暴露人员，男性17名，年龄32～50岁，平均年龄为38.53±5.76岁，两组人员均排除对免疫功能有影响的因素。

二、检测指标和方法：对检测对象进行了外周血白细胞数目、中性粒细胞吞噬能力[3]、淋巴细胞转化能力[4]的检测。

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三、结果

（一）外周血白细胞数目的变化

暴露工人外周血象检测结果，其白细胞数目与对照组相比，无明显差异（$P>0.05$）。

（二）外周血中性粒细胞吞噬功能检测结果（见表4）

表4　吞噬细胞百分率、吞噬指数（$\bar{X}\pm SE$）

组别	例数	吞噬率（%）	吞噬指数
暴露组	20	49.7±13.30	1.65±0.53*
对照组	17	55.9±12.65	2.45±1.06*

* $0.01<P<0.05$

表4所示，暴露组外周血中性粒细胞的吞噬能力低于对照组（$0.01<P<0.05$），但吞噬细胞百分率两者之间无明显差异。

（三）外周血淋巴细胞转化能力检测结果（见表5）

表5　外周血淋巴细胞转化情况（$\bar{X}\pm SE$）

组别	例数	cpm（脉冲数）	SI（刺激指数）
暴露组	20	51241±9318*	98.45±43.11*
对照组	17	71811±6176	126.4±15.6

* $P<0.01$

表5所示，暴露组工人的淋巴细胞转化功能，说明该作业环境磁场强度具有抑制外周血T淋巴细胞转化的作用。

讨　论

根据电解铝车间磁场强度的实测和作业人员体表磁场强度测得的数据，表明电解铝冶炼生产时，产生的稳定性磁场强度为自然界磁场强度的数倍至数十倍。长期处于此环境中的作业人员所反映的神衰综合征及植物神经功能紊乱[5]与磁场强度有一定关系。

中性粒细胞、巨噬细胞以及补体均属机体天然防御体系，在机体的非特异性免疫功能中担负着重要的作用，我们对磁场暴露工人外周血中性粒细胞吞噬能力的检测结果表明，磁场对它具有一定的抑制作用，表现为中性粒细胞的吞噬指数下降，但吞噬百分率无明显变化，这可能是吞噬指数较吞噬百分率更为敏感，机理如何，有待进一步去探讨。

机体内T淋巴细胞在受到抗原刺激后增生分化成致敏淋巴细胞数目，依赖于T淋巴细胞的数目及其功能。本研究通过用 ^3H-胸腺嘧啶同位素检测了磁场暴露工人外周血淋巴细胞转化情况，发现暴露组的淋巴细胞脉冲数（cpm）以及刺激指数（SI）均明显低于对照组。为此我们认为该作业磁场对机体的T淋巴细胞功能有一定的影响。

综上所述，可以认为磁场对电解铝作业工人的免疫功能有一定影响，但电解铝车间所产生的职业性危害如氟化物等也具有免疫毒性作用[6,7]，因而不得不考虑工人免疫功能的影响，是多种因素综合作用的结果。

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2. 烟花制作工尘肺发病与工种的关系：尘肺发病在不同工种间，差别具有高度显著性，碾硝工高于其它工种，其原因可能与下列因素有关：（1）碾硝时无除尘设施，致使粉尘浓度大；（2）粉尘分散度高，5mm 以下的粉尘占86.7%，观察结果表明，烟花粉尘对工人健康有一定的危害。因此，应结合本企业的生产特点，重点对碾硝、和药等工段采用防爆除尘设施或改革工艺，强化个体防护，消除或减轻职业危害。

（参加阅片、现场监测的有欧阳周季、胡元保、徐御华、袁玉华、张瑞芬等同志，一并致谢。）

Abstracts of Original Articles

Health Risks Evaluation of Acrylamide Exposed Workers

Zhang Shoulin, et al

The effects of occupational exposure to acrylamide were studied in 41 workers from a factory producing acrylamide and its polymers. Eighty unexposed healthy adults served as the control group. Neurological examinations showed distal impairments of vibration and pain sensations in37% and 54% of the acrylamide workers respectively. Diminished ankle reflexes appeared in 34% of the acrylamide group but none in control group. An increase of vibration thresholds was found in 58.5% of the acrylamide group when compared with that of the control group, detected by a Vibraton I vibration sensitivity tester. Thirteen out of 35 acrylamide workers who had neurogenic changes in electroneuromyography were diagnosed as mild occupational acrylamide poisoning. The results clearly indicate the necessity of preventive measures for protection of workers' health.

Key words: acylamide, electroneuromyography, neuropathy, vibration sensation

Changes of Immune Functions of Workers Exposed to the Magnetic Field in Electrolytic Aluminium Workshop

Zhang Mengben, et al

The magnetic field levels of electrolyser radiating nearfield regions in an electrolytic aluminium workshop were measured with Type CT3-A alternate/direct current electric monitor at different levels, distances and human surface parts. The results showed that the magnetic field strength levels of workplaces and human surfaces were as several or tens times of that in nature. Furthermore, the immune functions of the workers who exposed to magnetic field more than 20 years. The results showed that the immune functions of these workers were decreased. Besides magnetic field, there were other chemical and physical factors in the workplace, so it might suggest that the changes of immune functions of the workers were result from several hazard factors in the electrolytic aluminium workshop in combination

Key words: magnetic field, immune function, occupational hazard, neurasthenic syndrome

Study on the Function of Endocrine Glands in Workers of occupational Lead poisoning

Cui Jinshan, et al

In this paper, we studied the function of some endocrine glands in 47 workers of ead poisoning. The results showed that the levels of T_3, T_4, TSH and Cortisol in the serum are markedly lower in the group of lead poisoning than those of the control group and the difference is quite significant ($P<0.001$). All the levels except TSH showed negative correlation with duration of exposure. The results suggested that lead may impair the function thyroid gland, adrenal cortex and anterior lobe of hypophysis, and then lead to a series of clinical symptoms of hypofunction of those glands. In conclusion, the impairement of some endocrine glands by lead may be also one of the important mechanisms of lead poisoning.

Key words: triiodothyronine(T_3), tetraiodothyronine(T_4), cortisol, lead poisoning

Mortality of Cancer Among Tin Miners in Guangxi

Qiu Shenghua, et al

A cohort study of 7849 workers employed during 1972 to 1974 at Da-Chang mines and Li-Mu mine in Guangxi was conducted and several adverse factors in workplace were measured. The results showed that mortality of all cause of death was 632.7/100,000 with SMR = 1.11, 95% CI = 1.03~1.19, which was slightly higher than that expected based on the national general mortality rates. Cancer deaths accounted for 39.3% of total deaths, and ranked the first place in all causes of death. The second cause of death was cerebrovascular and heart diseases. The risk of cancer was significantly elevated (SMR = 1.56), primarily due to lung cancer, liver cancer, and nasopharyngeal cancer. 32.1% of the cancer was lung cancer (SMR = 1.98). SMRs for liver cancer and nasopharyngeal cancer were 1.79 and 3.71 respectively. The findings also suggested that the high risk of lung cancer for Da-Chang miners was significantly related to high dust exposure and respirable arsenic concentration.

Key words: Tin miner, cancer

BALF Analysis in Patients with Pneumoconioses

Jiang Huixin, et al

Many studies documented that the pulmonary inflammatory respondence processes may play a important role in the pathogenesis of silicosis and asbestosis. Bronchoalveolar lavage (BAL) is the sampling of lower respiratory tract by bronchofiberscope technique. Therefor, utilizing BAL to evaluate the changes of cytology and biochemistry of BALF

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