

# 慢性镉中毒早期肾损害指标的探讨

北京医科大学第三医院职业病研究中心(100083) 阿拉塔 韩玉花 陈寿芳

**摘要** 为了探讨慢性镉中毒早期诊断指标,对31名镉作业工人尿 $\beta_2$ -微球蛋白、尿白蛋白、尿镉进行了测定。在尿镉和尿 $\beta_2$ -微球蛋白浓度高的工人中,当尿 $\beta_2$ -微球蛋白与白蛋白比值大于0.1时,肾小管对 $\beta_2$ -微球蛋白的重吸收率明显的降低。所以用尿 $\beta_2$ -微球蛋白与尿白蛋白的比值,可以对肾损害进行早期定位诊断。

**关键词** 镉中毒 诊断指标  $\beta_2$ -微球蛋白 白蛋白

肾小管机能障碍,是慢性镉中毒的典型症状之一,特别是尿中低分子量蛋白排出量增加已被公认<sup>(1)</sup>。为了提高慢性镉中毒早期诊断水平,我们对尿 $\beta_2$ -微球蛋白与尿白蛋白比值( $\beta_2$ -mG/Alb)进行了探讨,结果如下。

## 对象与方法

**一、研究对象:** 锌冶炼厂镉作业工人31名(男28人、女3人),年龄22~62岁,平均38.8岁。接触工龄4~55年,平均16.2年。非镉接触正常人33名(男31人,女2人),年龄23~67岁,平均38.2岁。慢性肾炎患者7名(男3人,女4人),年龄34~63岁,平均47.0岁。

**二、测定方法:** 尿 $\beta_2$ -微球蛋白及尿白蛋白用中国原子能科学院提供的放射免疫测定

盒。尿总蛋白用磷钨酸-双缩脲法<sup>(2)</sup>。尿总氨基酸用TNBS法<sup>(3)</sup>。尿镉用原子吸收分光光度法。尿肌酐用苦味酸法。收集上午一次尿样,对上述指标分别进行测定,测定结果均用肌酐进行了校正。

## 结果与分析

**一、镉接触组与正常对照组的尿镉、尿 $\beta_2$ -微球蛋白( $\beta_2$ -mG)、尿白蛋白(Alb)、尿总蛋白及总氨基酸之比较,见表1。**

由表1可见两组间尿 $\beta_2$ -mG,尿镉有显著差异( $P < 0.01$ )。

**二、镉接触组尿 $\beta_2$ -mG、尿镉、尿白蛋白、尿总蛋白量、尿总氨基酸量之间相关性,见表2。**

由表2可见尿 $\beta_2$ -mG与尿Alb、总蛋白、

表1 镉作业工人与正常人尿中各测定值的比较

	镉作业工人 (31人)		正常人 (33人)		P
	范 围	中位数	范 围	中位数	
尿氨基酸 $\mu\text{mol/g. Cr}$	3.68~14.40	9.50	4.13~14.4	9.07	>0.05
尿蛋白 $\text{mg/g. Cr}$	37.55~481.36	104.17	0.00~239.18	70.45	>0.05
尿白蛋白 $\text{mg/g. Cr}$	4.05~60.26	9.55	3.11~278.95	8.09	>0.05
尿 $\beta_2$ -mG $\mu\text{g/g. Cr}$	46.52~16250.41	312.50	22.67~710.02	58.33	<0.01
尿镉 $\mu\text{g/g. Cr}$	2.44~47.02	11.00	1.02~10.56	4.34	<0.01

尿镉间有相关关系( $P < 0.05$ )。

**三、镉接触组尿 $\beta_2$ -mG/Alb比值与尿 $\beta_2$ -mG、尿镉间的比较,见图1、2。**

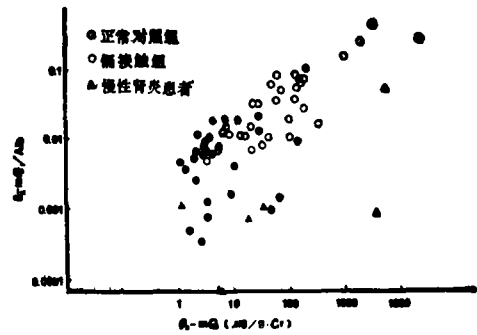
镉作业工人的尿 $\beta_2$ -mG/Alb比值与尿镉、尿总蛋白间有相关关系( $P < 0.0005$ )。

从图1可见正常对照组尿 $\beta_2$ -mG排出量均在

表2 镉作业工人尿中各指标的关系(r值)

	尿白蛋白	尿蛋白	尿氨基酸	尿镉
尿 $\beta_2$ -mG	0.5537	0.5936	-0.0007	0.3336
尿白蛋白		0.5592	-0.0996	0.0300
尿蛋白			0.1678	0.4323
尿氨基酸				-0.1792

500 $\mu$ g/g肌酐以下,尿 $\beta_2$ -mG/Alb比值在0.1以下。尿 $\beta_2$ -mG排出量大于1000 $\mu$ g/g肌酐者有6例(其中镉作业工人4例,慢性肾炎患者2例),尿 $\beta_2$ -mG/Alb比值镉作业工人均在0.1以上,而慢性肾炎患者是在0.1以下。从图2来看正常对照组尿镉大多数人在5 $\mu$ g/g肌酐以下,一般很少有超过10 $\mu$ g/g肌酐的。镉接触组尿镉高于10 $\mu$ g/g肌酐者占镉组受检人数的51.6%,其中有4例尿 $\beta_2$ -mG/Alb比值大于0.1。从表1可见镉接触组尿总蛋白排出量略高于正常对照组,从尿 $\beta_2$ -mG/Alb比值大于0.1的4例来看,有3例超过正常上限值(本室95%正常上限值为206.2mg/g肌酐)。



尿 $\beta_2$ -mG浓度与尿 $\beta_2$ -mG/Alb比值间关系

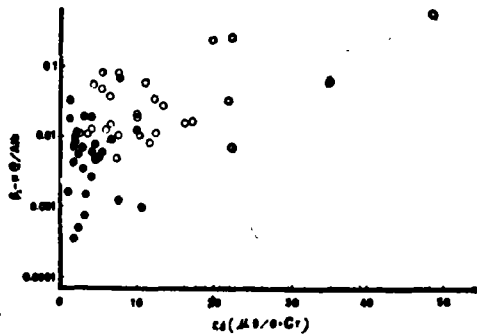


图2 尿镉排出量与尿 $\beta_2$ -mG/Alb比值间关系

表3 4例镉作业工人肾小管机能的状态

性别	年龄(岁)	工种	工龄(年)	尿镉(mg/g·Cr)	尿蛋白(mg/g·Cr)	尿总氨基酸( $\mu$ mol/g·Cr)	尿 $\beta_2$ -mG( $\mu$ g/g·Cr)	尿白蛋白(mg/g·Cr)	尿镉( $\mu$ g/g·Cr)	%TR $\beta_2$ -mG	$\beta_2$ -mG/Alb
男	62	冶炼	30	-	481.36	10.46	4260.12	10.22	47.02	93.31	0.42
男	57	除镉	35	-	374.08	9.16	16250.41	59.91	22.51	79.80	0.27
男	62	精镉	29	-	245.99	10.40	3155.85	12.91	19.85	89.48	0.24
男	38	置镉	17	-	88.06	8.72	1229.74	6.75	32.19	98.24	0.18

四、镉作业工人肾小管对 $\beta_2$ -mG的重吸收率(%TR $\beta_2$ -mG)的测定。我们为进一步了解尿 $\beta_2$ -mG/Alb比值大于0.1的4例工人肾小管机能状态,测其%TR $\beta_2$ -mG,并与比值小于0.1的人(镉作业工人7例,正常人10例)进行了比较,这17例%TR $\beta_2$ -mG均值为99.42%,标准差0.43,范围98.63~99.96%。从表3可见比值大于0.1的4例镉作业工人%TR $\beta_2$ -mG明显降低。

综上所述不难看出有镉接触史,尿镉排出量大于10 $\mu$ g/g肌酐,尿 $\beta_2$ -mG浓度高于1000 $\mu$ g/g肌酐,尿 $\beta_2$ -mG/Alb比值0.1以上,

可以考虑有早期肾小管损害。%TR $\beta_2$ -mG的降低更加有力的支持了这一诊断。

参考文献

1. Tsuchiya K. Cadmium Studies in Japan. Amsterdam, Elsevier biomedical press, 1978.
2. Piscator M. Proteinuria in chronic cadmium poisoning II. The applicability of quantitative and qualitative methods of protein determination for the demonstration of cadmium proteinuria Arch Environ Health 1962; 5, 325.
3. 野见山一生. カドミウム中毒関する実験的研究. 日本医師会雑誌 1974; (72), 963.

## Abstracts of Original Articles

### The Investigation and Experimental Study of Some Human Toxicity of Fenvalerate

Yin Ruoyuan, et al

The Fenvalerate(Fen) concentration in synthetic and assembling shop [air of Fen pesticide plants were 0.023, 0.122mg/m<sup>3</sup> respectively. The workers operated manually and without preventive measures. The major symptom of the exposed was skin itching, and was aggravated on every monday. The visual-response time of the exposed workers was prolonged, which may relate to prolongation of the motor conduction latency rate (MCLR) of rat sciatic nerve. The animal experiment showed that Fen could reduce the ability, in the Y-maze test, of learning and memory and the faculty, in the former limb hanging test, of nerves and muscles coordination and of muscle stamina. The results of micronucleus test showed that Fen make the micronucleus rate in blood cells of workers and mice rise. It revealed that Fen perhaps was harmful to the human genetic effect. It is suggested that local ventilation installations were set up in shops, especially in pouring Fen into ampoule and sealing ampoule shop sections. The skin of the exposed workers coated with Yi-Ling cream.

Key words, fenvalerate nervous system neurobehaviors genetic effects

### A Study of the "Cement Body" of Cement Lung

Zhang Xuqin, et al

In this paper, the round coated bodies that had not been reported in literature were found in the lung cement dust foci, when examining lungs of cement workers at necro-

psy. Its average size is about  $5 \times 8 \mu\text{m}$ . The orange-yellow outer layer appears was determined containing ferritin in histochemical technique. The core of body is black and opaque. With the help of the energy dispersive X-ray analysis and X-ray diffraction analysis, the results showed that the chemical elements of the body core were the same as the cement dusts. But these bodies were different from asbestos bodies and mica bodies in elements and form. Therefore, we called them "Cement Body". More cement bodies exist among all 15 autoptic cases of cement lung. In addition, the bodies themselves were bigger, their formal property were clear and they were easy to be found. So, we think that "Cement Body" can be used as the index for exposure to cement dusts.

Key words, cement dusts pneumoconiosis cement body

### Discussion on an Early Diagnostic Indicator of Renal Damage in Chronic Cadmium Poisoning

Alata, et al

To investigate the early diagnostic indicators of chronic cadmium poisoning, cadmium (Cd),  $\beta_2$ -microglobulin ( $\beta_2$ -mG) and albumin (Alb) in urine were measured in 31 workers-exposed to Cd. In workers with higher concentration of urinary Cd and  $\beta_2$ -mG, the renal tubular  $\beta_2$ -mG reabsorptive capacity significantly decreases when the ratio of urinary  $\beta_2$ -mG to Alb is above 0.1. We conclude that the ratio of  $\beta_2$ -mG to Alb is sensitive to renal tubular damage, and is useful in early diagnosis of site of renal damage.

Key words, cadmium poisoning diagnostic indicators  $\beta_2$ -microglobulin Albumin