

# 血清前白蛋白作为TNT肝损害 敏感指标的探讨

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**提要** 本文对42名接触低浓度(低于国家最高容许浓度 $1\text{mg}/\text{m}^3$ )三硝基甲苯(TNT)的男性工人进行了血清前白蛋白(PA)测定,结果发现这些工人的Hb、TTT、ZnTT、ALT均在正常范围,而PA却非常显著低于对照组( $P<0.01$ ),PA低于95%正常下限值( $248\text{mg}/\text{L}$ )24例(占57.1%),低于99%正常下限值( $230\text{mg}/\text{L}$ )12例(占28.6%),异常例数均极显著高于对照组( $P<0.01$ )。本研究提示,接触低浓度TNT能引起PA降低,PA是反映TNT对肝功能影响的敏感指标,有临床应用价值。

**关键词** 前白蛋白 三硝基甲苯

三硝基甲苯(TNT)是剧毒类亲肝性毒物<sup>[1]</sup>长期较高浓度接触除引起白内障、贫血或再生障碍性贫血外,还能引起肝脏肿大、肝功能异常,严重者引起肝硬化。近年来由于我国劳动条件的逐渐改善,TNT引起的肝脏损害逐渐减少。由于常规肝功能化验检查不易发现其低剂量接触者很轻微的肝功能异常,因此需要一种敏感的反映肝功能异常的化验指标,基于这种目的,本文对某厂42名长期接触低浓度TNT(平均浓度 $<1\text{mg}/\text{m}^3$ )的男性工人进行了血清前白蛋白(PA)测定,同时还测定了Hb、TTT、ZnTT、ALT含量,并与对照组进行统计分析,现报道如下。

## 对象与方法

### 一、研究对象

1. TNT组:为某厂从事TNT压药、检验、现场管理的男性工人,共42人,年龄范围24~55岁,平均年龄38.7岁。工龄2~13年,平均工龄7.1年。经内科检查均无肝脏肿大,HBsAg全部阴性。

2. 对照组:为年龄与TNT组配对的42名男性献血员和本院部分健康职工,年龄范围24~55岁,平均38.6岁。体检无肝脏肿大,用ELISA法测定乙型肝炎五项血清学指标(HBsAg、

HBeAg、抗-HBs、抗-HBe、抗-HBc)全部阴性。

### 二、方法

1. TNT空气浓度测定:用滤膜抽气采样,乙醇氢氧化钠比色法<sup>[2]</sup>,对TNT组各工作点呼吸带进行TNT浓度测定。

2. 常规肝功能和Hb测定:对TNT组和对照组分别进行TTT(比浊法)、ZnTT(比浊法)和ALT(赖氏法)测定;Hb用氰化高铁血红蛋白法测定。

3. PA测定:用Beckman ICS-I分析仪(散射比浊法)分别测定TNT组和对照组PA含量。

## 结果

### 一、车间工人呼吸带TNT浓度

1988年~1990年连续3年(每年上半年和下半年各1次)对车间各工作点工人呼吸带进行TNT浓度测定,各年TNT平均浓度分别为 $0.93\text{mg}/\text{m}^3$ 、 $0.85\text{mg}/\text{m}^3$ 和 $0.43\text{mg}/\text{m}^3$ 。每年TNT平均浓度均低于我国车间空气中TNT最高容许浓度 $1\text{mg}/\text{m}^3$ 。

### 二、TNT组和对照组肝功能及Hb比较

测定结果,TNT组和对照组TTT、ZnTT、和ALT各项均无1例超过正常值。但是经t检

验, TNT组 TTT〔范围2~6u (正常值≤6u),  $\bar{X} \pm SD$  为  $4.0 \pm 1.8u$ 〕非常显著高于对照组 (范围1~5u,  $\bar{X} \pm SD$ 为 $3.0 \pm 1.20u$ ),  $t = 3.00, P < 0.01$ ; TNT组 ZnTT〔范围4~12u (正常值≤12u),  $\bar{X} \pm SD$  为 $8.7 \pm 1.93u$ 〕也非常显著高于对照组 (范围 2~11u,  $\bar{X} \pm SD$  为  $6.6 \pm 2.32u$ ),  $t = 4.51, P < 0.01$ 。TNT组 ALT〔范围 4~20u (正常值≤35u),  $\bar{X} \pm SD$ 为 $14.2 \pm 2.70u$ 〕与对照组 (范围 3~26u,  $\bar{X} \pm SD$ 为  $13.5 \pm 5.27u$ ) 无显著性差异,  $t = 0.77, P > 0.05$ ; TNT组 Hb〔范围122~159g/L (正常值≥110g/L),  $\bar{X} \pm SD$  为  $146 \pm 9.78g$

/L〕与对照组 (范围 125~168g/L,  $\bar{X} \pm SD$  为  $147 \pm 10.64g/L$ ) 也无显著差异,  $t = 0.45, P < 0.05$ 。

### 三, TNT组与对照组PA含量和PA异常率比较

PA测定结果, TNT组极显著低于对照组 ( $P < 0.01$ )。在异常率方面 TNT组 PA低于我院95%正常下限值248mg/L者24例, 占57.1%; 低于99%正常下限值 230mg/L者 12例, 占 28.6%。而对照组无一例低于 248mg/L, 和 230mg/L, 经 $\chi^2$ 检验,  $\chi^2$ 分别为33.60和14.00,  $P$ 均 $< 0.01$ 。见下表。

表 TNT组与对照组PA含量和PA异常率比较

例数	PA(mg/L)	PA<95%下限值 (248mg/L)		PA<99%下限值 (230mg/L)	
	$\bar{X} \pm SD$	例数	%	例数	%
TNT组 42	$247 \pm 33.9$	24	57.1	12	28.6
对照组 42	$303 \pm 22.9$	0	0	0	0
$t$ 或 $\chi^2$	8.87		33.60		14.00
$P$	$< 0.01$		$< 0.01$		$< 0.01$

## 讨 论

血清 PA 是肝脏合成的一种分子量为 61000 的蛋白质, 半减期为1.9天。据文献报道, PA 是真正反映肝功能的较特异的敏感性指标<sup>(3~6)</sup>。当各种原因引起肝细胞受损害时, 由于PA半减期短, 它在血中含量的减少在短期内就能反映出来, 特别是在病毒性肝炎的急性期和肝硬化时下降最明显<sup>(4,6)</sup>。

国内有四氯化碳引起作业工人PA下降的报道<sup>(1)</sup>, 但尚未见 TNT引起PA减少的报道。本研究结果显示, 42名长期接触低于国家卫生标准(1mg/m<sup>3</sup>) TNT的工人中, 尽管无一例发生贫血和肝功能异常, 但在作群体计量分析时TTT和 ZnTT 仍然非常显著高于对照组 ( $P < 0.01$ ), 说明低浓度TNT对肝功能仍可能有轻微影响, 只是由于这些指标不太敏感, 对每个受检者来说均在正常范围。但从预防医学的观点出发, 为了尽早发现和防止TNT对肝脏的损害, 亟待需要一种反映工人低浓度接触后肝功能改变的敏感指标。本结果发现, 在长

期低浓度TNT接触后, PA不仅极显著低于对照组 ( $P < 0.01$ ), 而且PA异常发生率低于95%和99%正常下限值分别为57.1%和28.6%, 异常率均极显著高于对照组,  $P < 0.01$ , 见表。

作者认为, 虽然PA和其它肝功能指标一样, 无特异性<sup>(4,6)</sup>, 但在反映低浓度TNT对肝功能的影响方面, 较目前常用的肝功能指标, 如TTT、ZnTT、ALT等都敏感。因此, 可将PA作为 TNT肝损害早期敏感性肝功能化验指标, 这对防治TNT肝损害有实用价值。

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## Abstracts of original Articles

### Effect of Sodium Para-Aminosalicylate on Brain Enzymes in Manganese Treated Rats

Ge Lihui, et al

Rats pretreated for 60 days with Mn as  $MnCl_2 \cdot 4H_2O$  in a dose of 15mg/kg/day through intraperitoneal route, and then treated with sodium para-aminosalicylate (PAS-Na) in a dose of 80 or 120mg/kg, daily for 16 days. Acid phosphatase and adenosine triphosphatase activities inhibited by manganese in some brain regions, acetylcholinesterase activity inhibited by the metal in all regions of rats were restored in different degrees. The higher dose of PAS-Na appeared to be more effective. The results suggested that the mechanism of PAS-Na treatment may be restoration of normal functions of neural cells and decrease of synaptic function of the central cholinergic system through restoration of activity of related enzymes.

Key words, sodium para-aminosalicylate manganese toxication enzymes

### The Metabolic Activation of Cyclophosphamide in Hydra Assay

Fu Lijie, et al

The proteratogen cyclophosphamide (CP) was tested in the hydra assay in the presence and absence of an in vitro metabolic activation package (MAP) consisting of rat hepatic microsomes (0.06 nmol P-450/ml), 500um NADPH, and 25um  $MgCl_2$ . Bioactivation of CP was confirmed under standard hydra assay conditions of pH7.0 and 20°C, and compared with activation at 37°C. The results show the bioactivation increased the toxicity of CP by two orders of magnitude. The minimal effective concentration (MEC) in the adult and "artificial embryo" of the assay were decreased from 4000  $\mu g/ml$  to

20 $\mu g$ CP/ml and from 1000 $\mu g/ml$  to 4.0  $\mu g$  CP/ml, respectively. Since hydra attenuate apparently lacks MFO capacity thereby facilitating comparative studies employing microsomes of humans or any of the laboratory mammals routinely used in developmental toxicity safety evaluations.

Key words, cyclophosphamide proteratogen in vitro bioactivation hydra assay

### Prevalence Study on Hypertension of Heat Exposure Workers in Tangshan Steel Plant

Wang Zongyi, et al

3816 steel workers (male 3484, female 332) exposed to heat from Tangshan Steel Plant, and 1047 architectural and installing workers (male 811, female 236) from the same plant, as control group, were investigated. The prevalence rates of hypertension for female workers in exposed and control groups were 4.52% and 3.81% respectively, the difference had no significance. The prevalence rates of hypertension for male workers in two groups were 9.24% (adjusted rate 10.30%) and 6.29% (adjusted rate 5.01%) respectively, the significant difference was found ( $\chi^2 = 7.25$ ,  $P < 0.01$ ), and the rate also increased with the standing and the degree of heat exposure

Key words, heat exposure hypertension prevalence steelworkers

### Study on Serum Prealbumin as a Sensitive Index in TNT Hepatic Damage

Wang Renyi, et al

The serum prealbumin of 42 workers exposed to low concentration (<MAC) trinitrotoluene (TNT) were studied. The results showed that Hb, TTT, ZnTT, ALT all were

in normal ranges, but PA was significantly lower than that of the control ( $P < 0.01$ ). The number of abnormal PA level in TNT group was significantly higher than that of the control ( $P < 0.01$ ). The study suggested that low concentration TNT could induce reduce of PA, therefore PA might be a sensitivity index of TNT hepar damage and was useful in clinic.

Key words: prealbumin (PA) trinitrotoluene (TNT)

### Detection of Numbers of Lymphocytes and Humoral Immunity Response of Workers Exposed to Fluoride

Song Shizhen, et al

The numbers of lymphocytes and humoral immunity response to tetanus toxoid of

workers, who have continually exposed to fluoride for more than 12 years at a aluminium plant, were measured with McAb technique and ELISA. The results were compared with unexposed workers and showed reduction in numbers of  $T_3, T_4, T_8$  cells and levels of specific antibody. The number of B cells between the exposed and unexposed groups showed no significant difference. It suggested that detection of immune function of workers exposed to fluoride may be useful in evaluation of the hygienic condition of working environment, discovering subclinical damage to workers after exposure to fluoride on time and early diagnosis of industrial fluorosis.

Key words: fluoride lymphocyte humoral immunity response

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