

An investigation report about the lack of VB₁

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Abstract: From August 1 to September 26, 2012, 30 workers who had the symptom of edema in both lower limbs were reported in Yancheng. Four severe edemas in both lower limbs workers were sent to the hospital, and one person of the workers died. The epidemiology investigation and laboratory testing (in the urine loading tests, the concentration of VB₁ of the workers living in the factory for more than half of the year decreased far below the normal values) were conducted to explore the cause. Furthermore, after one-week intramuscular injection of thiamine treatment, the clinical symptoms of the workers had been improved greatly. Finally, the lack of the thiamine (VB₁) was considered to be the reason of this incident.

Keywords: Report; lack of VB₁

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Introduction

From August 1 to September 25, 2012, several workers were reported in Yancheng, Jiangsu Province due to the edema of both lower limbs. Some severe workers were sent to the hospital. On 26th September, one patient died in hospital unfortunately. The diagnosis of the patient was severe viral myocarditis, and sudden cardiac death. On the same day another three severe patients were taken to the hospital. The government began to pay attention to this accident. The professionals of the Center for Disease Prevention and Control (CDC) were invited to investigate this incidence. After physical examination in the factory, 30 workers had same symptom with edema in both lower limbs.

General situation

There are 1,630 workers in the dressmaking factory. A total of 1,300 workers live in the factory, and others go back home after work. The environment of the mess hall is clean the CDC take the environmental hygiene detection once

a year. The workers have their meals in the mess hall, they often have rice porridge and steamed bun with screw and olla-podrida at breakfast, and have rice, meat, vegetables with a soup every lunch and dinner. In addition, workers can choose extra food such as drumstick for themselves. According to the data of the mess hall, the consumption of pork is 1.5 kg per month per person, poultry is 1 kg per month per person, and fish is 1 kg per month per person.

Epidemiological survey

Pathogenetic condition

The written informed consents were obtained from the patient for publication of this brief reports. The clinical situations of patients were shown in *Table 1*. These 30 workers, aged between 20 and 60 years old, and the average age is 36.87±11.11 (years). All the patients were the workers who lived in the factory. The clinical symptoms of the 30 workers included edema of both lower limbs, numbness of limbs, difficult to squatting, myalgia, leg weakness, feebleness and

formication.

Auxiliary examinations had found that three workers had leukocytosis, and two workers had aleucocytosis. Furthermore, three workers' physical condition was serious.

- (I) Their lung marking was increase;
- (II) Two patients had cardiomegaly;
- (III) Two patients had sinus tachycardia.

Analysis of possible risk factors

We selected 30 healthy workers (all the indexes are normal, these were defined as control group) to be compare with the case group (workers had the clinical symptoms). All the healthy workers lived in the factory, they all had a similar living environment with the 30 patients. As presented in *Table 2*, after statistical analysis, we observed that the distribution of extra food consumption was significantly

Table 1 Clinical symptoms

Symptom	Number of cases	Number of positive cases	%
Edema of both lower limbs	30	30	100.00
Numbness of limbs	30	26	86.67
Difficult to squatting	30	18	60.00
Myalgia	30	13	43.33
Leg weakness	30	11	36.67
Feebleness	30	9	30.00
Formication	30	7	23.33

Table 2 Analysis of possible risk factors

Factors	Classification	Case group (%)	Control group (%)	χ^2	P ^a
Extra food consumption	Regular consumption	5 (17.2)	24 (82.8)	25.819	0.000
	Occasional consumption	2 (50.0)	2 (50.0)		
	Never consumption	23 (85.2)	4 (14.8)		

^a, two-sided χ^2 test for the extra food consumption between case group and control group.

Table 3 Urine loading tests in different groups

Classification	Subjects	Before taking VB ₁ (μg/mL)	4 hours later after taking VB ₁ (μg/mL)	^a P (<i>t</i> -test)
Workers go back home	11	0.117	0.244	0.176
Workers live in the factory whose working time less than one week	11	0.020	0.255	0.002
Workers live in the factory whose working time more than half year	13	0.020	0.163	<0.001

^a, two-sided *t*-test for the extra food consumption between case group and control group.

different between the case group and the control group.

Laboratory testing

VB₁ is a water-soluble vitamin, so we use urine loading tests (which is widely used to evaluate the reserve level of VB₁ in human) to evaluate the VB₁ absorbed situation of these workers, the results were shown in *Table 3*.

Urine loading tests was taken in 35 subjects before taking VB₁ and 4 hours after taking VB₁. In the before taking VB₁ group, the concentration of VB₁ in urine was highest in the workers who go back home (0.117 μg/mL). The concentration of VB₁ in urine was lower in workers whose working time less than one week and workers whose working time more than half year (0.020 and 0.020 μg/mL respectively). However, in the four hours later after taking of VB₁ group, the concentration of VB₁ in urine was higher in the workers who go back home and workers whose working time less than one week (0.244 and 0.255 μg/mL separately), the concentration of VB₁ in urine was lower in workers whose working time more than half year (0.163 μg/mL). The requirement of VB₁ for the workers whose working time more than half year were higher compared to other two groups.

Interventions of the patients

As shown in *Table 4*, after one-week intramuscular injection of thiamine treatment, the clinical symptoms of the 30 patients showed a clinical improvement. Because of

Table 4 Clinical symptoms after one-week intramuscular injection of thiamine treatment

Symptoms	Cases	Positive cases	%
Edema of both lower limbs	30	0	0.00
Numbness of limbs	30	18	60.00
Difficult to squatting	30	4	13.33
Myalgia	30	21	70.00
Leg weakness	30	1	3.33
Feebleness	30	12	40.00
Formication	30	0	0.00

application of large amount of glucose and adrenal cortical hormone which can make VB₁ inactivated and prevent pyruvic acid oxidation (1), they need more time to recover.

Conclusions

It has been shown that the lack of VB₁ may lead to this accident. the nutrient intakes of the patients' diet were lack of VB₁. Water-soluble VB₁ plays an important role in carbohydrates and fat metabolism and is essential for normal growth and development of the human body. It also maintains basic function of the heart, nerves, and digestive system (2). It occurs as a part of our diet and is present in some diets like cereals, rice, nuts, meats, and legumes. A field investigation at the time found that chefs in the mess hall use a large amount of water to wash rice for a long time. Chefs used to poach meat first for about 10 minutes in the meat process. Furthermore, the vegetables were immersed in water for about half an hour. Water-soluble nutrients are particularly vulnerable. It is easier for the workers who stay in the factory and have a monotonous diet without extra food consumption to be lack of VB₁ for a long time.

Myocardial tissue must have enough glucose and pyruvate during the metabolism. When lack of VB₁, it is difficult

to enter the Krebs cycle and oxidize. Amount of lactate and pyruvate salt decrease the oxygen of utilization by myocardium (3). It can cause cardiac pump failure, decrease heart rate and reduce myocardial contraction force which contributed to the death of worker from heart disease.

The CDC has advised the mess hall of this factory to make food diversification and change recipe frequently to prevent the same accident.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: The written informed consents were obtained from the patient for publication of this brief reports.

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