

Introduction of Neurobehavioral Toxicology in China: Theories and Applications

LIU Ping, LI Jian, HE Chaoyang

Faculty of Public Health
Kunming Medical College
191 Renminxilu, Kunming 650031, P. R. China

Background:

With the rapid growth of industrialization in China, environmental and occupational exposure to chemicals has increased in frequency and in types of chemical exposures. A growing number of Chinese researchers are showing a special interest in exploring the effects of chemicals on the central nervous system. This paper presents the development of neurobehavioral toxicology in China.

Theories:

The central nervous system is more sensitive to toxicants in the environment than other systems. And the developing nervous system is particularly vulnerable to neurotoxicants. Neurobehavioral Toxicology is the study of toxicants on neurobehavior and use of neurobehavioral methods for the monitoring of toxic substances in the environment. While, Neurobehavioral Teratology is the study of the effects of prenatal exposure to chemical or physical agents on the developing central nervous system, it includes the evaluation of postnatal behavior and functioning. The threshold limit values (TLVs) to many neurotoxicants from the methods of neurobehavioral toxicology / teratology is much lower than other toxicological methods.

Applications:

1) Animal experiments:

Testing Batteries to examine animals' motor function, sensory function, cognitive behaviors, social behaviors.

Example 1: Neurobehavioral Teratological Effects of Methylmercury in Rats

Methylmercury in doses of 0.00, 0.01, 0.05 and 2.00 mg/kg/day were force fed to pregnant rats at the 6th~9th day after conception. The early developing landmarks of all 201 offspring were measured. Then at the age of 10 weeks, 32 offspring were randomly selected to test in Skinner Boxes with the operant conditioning programs. Compared with the control group,

the body weight, physiological and neurobehavioral development of offspring in exposure groups were delayed ($P<0.05$ or $P<0.01$); the performances in operant behavior test of offspring in all exposure groups were worse ($P<0.05$ or $P<0.01$), especially in high dose group. The dose-response relationships were observed. And there was no difference between male and female rats. It is concluded that methylmercury could affect the growth and development of central nerve system, the neurobehavioral functions of the rat offspring was greatly damaged.

2) Population epidemiological surveys:

World Health Organization-recommended Neurobehavioral Core Test Battery (WHO-NCTB) and other evaluation systems.

Example 2: A Survey of the Psychological State and Neurobehavioral Function of Traffic Policemen

In Kunming City, 202 male traffic policemen (the exposed group) and 171 male non-traffic policemen (the control group) completed SCL-90 questionnaire (symptoms self-evaluation scale) and were tested with the neurobehavioral core test battery (NCTB) simultaneously. The numbers of positive responses were 36.56 in the exposed group and 28.82 in the control group in the SCL-90 questionnaire. This difference was highly significant ($p<0.01$). The mean values of the nine subgroups of symptomatic factors were all higher in the exposed group than in the control group. These differences were significant ($p<0.05$). The results of NCTB test showed that compared with the control group, the exposed group had lower scores in Digit Span ($p=0.001$), Benton Visual Retention ($p=0.095$), Digit Symbol Substitution ($p=0.108$) and Pursuit Aiming ($p=0.073$) tests. Also, a link between the length of service years in the exposed group and scores of NCTB test was found: the longer the length of service years, the lower the NCTB scores. This study suggests that the job role would lead to adverse effects on the psychological state and neurobehavioral functions of traffic policemen.