Neurology and Toxicology Service and Unit

The Neurology and Toxicology Service and Unit headed by Professor Yoram Finkelstein, are directed independently, admitting patients to various hospital departments when required. Ongoing services are provided in the neurology and IDF outpatient clinics. Neurological consultations are provided to the hospital departments. Academic instruction and research activities are performed at the Hebrew University of Jerusalem and other universities in Israel and abroad.

The clinical activity in the field of neurology and neurotoxicology is combined with basic, clinical and epidemiological research. Neurotoxicology provides a means for a better understanding of the relationships between exposure to toxic compounds, the amount of the compounds that reach the brain and other target tissues, and the development of clinical manifestations of toxicity (e.g. Parkinsonism, dementia). Understanding the mechanisms of nervous system toxicity may enable better predictions of the toxic outcomes in different types of exposure situations. Neurobehavioral evaluation and tests of higher cognitive functions may find application in risk assessment in both environmental and occupational settings. Useful tools are the advanced imaging techniques (e.g. CT, MRI and fMRI) and electrophysiological assessment (e.g. EEG, Nerve Conduction Studies and Evoked Potentials). This combined approach of clinical neurology and basic neurotoxicology promotes the diagnosis, prevention, and treatment of diseases of occupational toxicity in the individual patient. It also furthers improves monitoring of environmental health hazards at the Israeli national level. Public medical activities include consulting community groups exposed to industrial pollution hazards, mainly in the Bay of Haifa and Kishon River Basin.

Areas of research activity

Based on original clinical and basic research, the Neurology and Toxicology Service and Unit have established a widely-accepted standard clinical protocol for the treatment of severe acute cases of organophosphorous pesticides. Studies deal with the underlying nature of pesticides and their specific patterns of intoxication in the human brain. Other studies have examined lead poisoning in children and movement disorders, e.g. the possible association of mercury, manganese with Parkinson's disease and the possible association of selenium, heavy metals and pesticides with motor neuron disease (Lou Gehrig's disease).

The Neurology and Toxicology Service and Unit has carried out a project for re-assessing the neurobehavioral status of a cohort of several hundred kibbutz workers, residents and their children who have continuously been exposed to pesticide drift. The same cohort was initially examined three decades ago. Genetic determinants of each individual were studied. Current exposures were assessed by measuring urinary metabolites of pesticides. Simultaneously, atmospheric stations monitored the levels of pesticides and their degradation products in the air, in collaboration with the Technion – Israel Technological Institute in Haifa.
These three studies are pioneering, insofar, from many aspects. Means of clinical evaluation, neurobehavioral examination and didactic tests, electrophysiology, biochemistry, genetics, biological parameters of exposure and epidemiology have been employed. We have collected data and built a unique and extensive database on three different populations living in this rural area, alongside an additional population of children being raised in a rural area in which organic agriculture is employed.
The studies were presented in two consecutive meetings of the American Academy of Neurology and selected as "Highlights in the Field". All of these complex projects have provided a firm scientific and institutional basis for clinical neurotoxicology in Israel. Prof. Finkelstein organized and chaired the 12th Meeting of the International Neurotoxicology Association on gene-environment interactions. This meeting in Jerusalem was a critical tipping point for advancing neurobehavioral toxicology in Israel.

Representative Research

Parents and children: two generations of exposure to organophosphorous pesticides in Israeli kibbutzim and its long-term neurobehavioral effects

Hula Valley has been extensively cultivated since 1957. Organophosphorous (OP) pesticides have been widely used for pest control in orchards and crop fields in Hula. Previous studies in 1984-1991 showed in-season reversible neurobehavioral effects of low-level, long-term exposure to OP pesticides in a cohort of 214 residents and agricultural workers in several kibbutzim in the Hula

Valley. The study assessed several health effects and neurobehavioral, cognitive, electrophysiological and genetic outcomes in: (a) Individuals in the original adult cohort (n=139). Eighty-seven (62.5%) of them are still residing in the valley; (b) A cross sectional study of cognitive and neurobehavioral functioning in 8-12 years-old "second generation" schoolchildren (n=135) in families with 30-year exposures in these communities.

Cognitive tests were performed and subjective symptoms questionnaires were administered. Questionnaire for exposures and health effect were employed as well. The school children's study included the same cognitive tests, and psycho-didactic tests. Features of the electrical activity were measured along the neural pathways of both Central and Peripheral Nervous Systems in the adults. Blood or saliva was sampled in both studies to measure Paraoxonase-1 (PON1) gene polymorphisms that may affect individual susceptibility to OP toxicity. Urinary samples were collected in both studies during and following the spraying seasons in three years in order to measure the quantities of OP metabolites.

The results showed that neurotoxic effects of chronic exposure of adults and children to pesticides. Manual dexterity was more impaired in adults than in children. Implicit signs of polyneuropathy (impaired function of peripheral nerves) were observed in the adults. There were suggestions of environmental-susceptibility interactions mediating risk for Attention Deficit Hyperactivity Disorder (ADHD) in children with low-level endemic exposure to pesticides.

Parents and children: two generations of low-level exposure to pesticides in a rural area and its long-term neurobehavioral effects.
Note the proximity of the houses to the fields (50-100 meters in many cases).

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