Review Article

A critical and comprehensive review on toxicovigilance

Abstract

Toxicovigilance is the active process of identifying and evaluating the toxic risks existing in a community and evaluating the measures taken to reduce or eliminate them. It should be viewed as a useful complement to prevent poisoning. The section serves to enhance epidemiological surveillance for identification of poisoning/risk of poisoning in the community, the substances, circumstances, and the population involved in and to strengthen investigation of poisoning incidences of public health significance so as to implement control measures in a timely manner. Data mining of large databases, such as those of poison centers, can be extremely helpful by triggering signals for health authorities. So far, very few countries have set up structured toxicovigilance systems and it is anticipated that in future, national and international initiatives will help bridging this gap in our knowledge of the toxicity of many chemicals and commercial products to human beings.

Key words:
Poisoning, toxic effect, toxicovigilance

Toxicovigilance

The general approach of toxicovigilance comprehends the effective exposure, authentication, and follow-up of clinical adverse events associated with poison exposure in human beings by means of house-hold, intentional or unintentional, occupational or environmental chemicals, and products.[1]

Scope of Toxicovigilance

Distinct case reports are beneficial and important sources of data. It acknowledges medical history, circumstances from being exposed, and consequences of adverse event. It evolves from general physicians, clinical toxicologists, poison information center, or any other healthcare professionals. An attentive validation of data is absolutely necessary. It provides the motivation for education of medical toxicologists. It provides the foundation for the environmental medicine and toxicology in the programming of medical and clinical pharmacy students.

Toxicovigilance is considered likely to examine series of standardized clinical case reports for the determination of hazard recognition and risk assessment. It allows particular follow-up of sub-groups (e.g., children, cultural, life-style factors) of the general population. The toxicovigilance approach is used for the detection, identification, and validation of clinical adverse events occurring in more susceptible sub-groups. It serves as a movement for epidemiologic studies. Diagnosis is consistent with toxicological plausibility. Toxicovigilance is able to generate signals that can be used to elabolarate pathogenic hypothesis.[2]

Need of Toxicovigilance

Toxicovigilance plays a main role in order to decrease both mortality and morbidity from poisoning. It improves in the diagnosis, prevention, and management of poisoning. It illustrates the recognition of toxic etiology either from the environment or unexplained pathological conditions. It consists of providing the emergency services with the means

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of prevention and management of poisoning. It is used for the detection of unknown safety poison information. It helps in the identification of risk factors and quantifying the risks. Poisoning is the harmful effect that occurs when a toxic substance is swallowed, inhaled, or comes in contact with the skin, eyes, or mucous membrane such as those of mouth or nose.[3]

Poisoning is one of the most common cause of nonfatal accidents that occurs at home. Prescriptions, non- prescriptions, and illegal use of drugs are one of the most common sources of serious poisonings and poison-related deaths. Other common sources of poisons include gases, household products, agricultural products, plants, industrial chemicals, vitamins, and foods (particularly certain species of mushrooms and fishes). However, almost any substance ingested in large quantities can be toxic. In parts of the developing world, pesticide poisoning results in large number of death rather than infectious diseases. Also, their easy availability makes them a popular method of self harm.

The prevalence of deliberate self-harm appears to be increasing, especially among younger cohorts, with the less difference between men and women. It is required for systematically identifying and correlating toxic substances and side effects and takes corrective actions. It promotes understanding, education, and clinical training in toxicovigilance and its effective communication to the public.

Roles and Responsibilities of Toxicovigilance

The principal goal of the toxicovigilance is to proscribe and prohibit poisoning. It carry out functions in order to put forward epidemiological supervision for recognition of poisoning risk of exposure in the community, the substances, circumstances, and the populations mired, and to build up investigating of poisoning relative incidences of public health significance to enforce control measures in appropriate and in timely manner. Roles are responsible for monitoring, controlling, processing, and reporting of clinical adverse event associated with poison exposure. Responsibilities then progress to senior specialist or management roles often with an in-depth knowledge of special area.[4]

Surveillance

Doctors can report cases of public health significance to Center for Health Protection via Central Notification Office (CENO). Capturing all the poisoning cases from intensive and acute medical care units, general accidental and emergency departments, and at causality of all the public healthcare hospitals and getting poisoning cases from local and oversea media reports plays a main role for a better understanding of poisoning risk in the population. Use of computerized laboratory data as a detection support tool of toxic reactions in hospital plays a major step for easy identification of risk factors and improves patient medical care. Categories of information include the patient, the caller, the exposure, the substance, clinical toxicity, treatment, and medical outcome. For example, the toxic exposure surveillance system (TESS) database was initiated in 1985, and provides a baseline of more than 36.2 million cases through 2003.

Investigation

Identification and investigation should start immediately upon acknowledge of notification of poisoning incidents of public health implication and consequences. For investigation, efforts should be made from both the government departments and other healthcare services for implementation of effective control measures. The Government laboratory supplies a comprehensive analytical service to the Department of Health in the testing of drugs and poisons to alleviate the investigation of poisoning incidents. Investigation of the phenomenon of reported clinical adverse reactions should be initiated by the competent authority.

Risk Communication

Press release will be issued as appropriate on current health issues and concerns. Health education materials in the form of electronic publications entitled "Poisoning Watch," and fact sheets are uploaded onto the community health profile website to keep the public and health professionals informed of the latest development. A notification and alert system on major poisoning incidents has been established among Department of Health, automatic external defibrillator, hospital laboratories, and other clinical laboratories. It holds monthly meetings and exchange information during investigations.

An online quarterly publication "poisoning.com" has been publishing since January 2006. Each issue consists of feature articles on poisoning agents, case reports, and surveillance statistics. The publication is mainly for consumption by local healthcare professionals. Press briefing is held when each issue of "poisoning.com" is published. Important messages are disseminated to the public through the distribution of pamphlets, fact sheets, posters, and health talks. Public announcements on poisoning cases are made as appropriate to raise the public's alertness to possible poisoning risks.

Risk Assessment of Toxicovigilance

The International Program on Chemical Safety has well-established programs for the risk assessment of chemicals and has taken the initiative to use the existing human data in a better way. A multicenter feasibility study for collecting

information from poison centers for risk assessment purposes was carried out with seven poison centers from different regions.[5] Collection of aggregated human data from poison centres that need an indepth study could contribute to the accuracy of risk assessment. Identification of the quantification of the dose, good recording of clinical effects, and identifying in recognizing chemical as product compounds. Conducting prospective multicenter studies of human data on specific chemicals was recognized as a way to improve the quality of data. Improvement of compatibility of linking databases between countries was also recommended. The first toxicovigilance methods implemented were designed to detect the following steps:

1. Increases in total or human exposure case volume at each poison center
2. Increases in national reporting of individual toxic (clinical) effects
3. Cases that meet surveillance case definition.

The world health organization programme on chemical safety document entitled "Guidelines for poison control" describes some of the activities that may be undertaken by poison centers with respect to identifying serious poisoning risks in local communities and identifying changes in the incidence of poisoning, pharmacovigilance, toxicovigilance, and monitoring of the effectiveness of preventive measures developed.[6]

Role of Poison Information Centers in Toxicovigilance

Poison information centers have a fundamental role, in partnership with others, in toxicovigilance and prevention. Toxicovigilance consists of the active observation and evaluation of toxic risks and phenomena in the community – an activity that should result in measures aimed to reduce or remove risks.[7,8] Thus, its main goal is prevention.

The role of poison information centers in toxicovigilance includes

1. Identifying life-threatening poisoning risks in the local community, and the substances, circumstances, and population groups involved
2. Identifying changes in the incidence of poisoning, e.g., different substances of abuse, application of new pesticides, and seasonal variations in the incidence of poisoning, such as carbon monoxide poisoning from heating appliances
3. Monitoring the toxicity of commercial products, such as house-hold, industrial, and agricultural chemicals, as well as pharmaceuticals (by any route of administration), for acute, medium-term, and chronic effects, with particular regard to new products and formulations (e.g., overuse of analgesics, occupational exposure to solvents)
4. Monitoring the toxic effects of drug over dosage and taking appropriate measures
5. Identifying substances that cause significant morbidity and mortality, and cause specific effects on target organs (e.g., high incidence of renal insufficiency, fetal malformations)
6. Reporting about safety standards and appropriate measures to be taken to health authorities and other relevant bodies and, where appropriate, calling an alert
7. Monitoring the strength and potency of safety standards.

A poison center could initiate its preventive activities by reporting information on toxic hazards, identified by toxicovigilance, to those with the authority to take appropriate action, and by giving information and advice to those involved in health education. Further preventive activities could include educational campaigns, producing educational material and planning, in partnership with others, the implementation and evaluation of preventive measures.[6]

The principal types of preventive action that should be initiated by poison information centers are as follows:

1. Education, which is the most important part of any action and should be aimed at particular groups at risk, as well as the general public and professional healthcare workers
2. Reports to, and collaboration with, various organizations and institutions on such matters as the development of safer products, safety measures relating to the packaging, design, labeling, transport, handling of hazardous products, and withdrawing or limiting the availability of selected toxic substances
3. Collaboration among all partners in a poison control program should be strengthened in order to enhance the efficacy of toxicovigilance and preventive actions. The essential partners are Poison information centers, facilities for toxicological analysis, and clinical toxicology services, which have a key role in identifying and studying toxicological risks and problems
4. Medical and paramedical professionals, such as hospital physicians, general practitioners, occupational physicians, coroners and medico legal experts, psychiatrists, and pharmacists, all of whom are in a position to collect data that supplement and complement those generated by poison information centers
5. Government and local authorities, which have the power to ban or control the use of high-risk chemicals
6. Industries, including manufacturers, transporters, and users of chemicals, who should provide the necessary data on the chemicals they handle and cooperate in the implementation of preventive measures
7. Universities and research institutions, particularly those concerned with experimental clinical toxicology, which may provide valuable data on chemicals and contribute to their identification and control

8. Specialists in mass communications and sociologists, who, in the event of a toxicological emergency, should advise on the appropriate message to the public and its dissemination in a manner that will avoid misunderstandings and alarmism.

Examples of Toxicovigilance

Toxicovigilance to both hazard identification and risk assessment can be illustrated by the following two examples.

Pregnancies and toxic exposures

An adverse effect of both alcohol abuse and maternal smoking in pediatric population is well established. Characterization and assessment of reproduction risks in human beings can be done by epidemiological studies which is the most reliable and dependable method. As the toxicovigilance approach is based on individual medical analysis, it is restricted to few classes of toxicants (organic solvents) such as household, environmental, and occupational exposure.[9] Risk assessment and hazard identification is based on the available literature which should be searched and critically reviewed as they are available only on household, environmental, and occupational. Based on signs and symptoms, level of toxicity on exposure can be identified. In case of insufficient available exposure data, analytical methods are recommended. Analysis of aggregated case reports of exposed pregnancies can contribute to global risk assessment.[10]

Lung toxicity of leather waterproofing sprays

Use of waterproof sprays on leather and other clothes or shoes in a confined room leads to the development of acute alveolitis. Causative role of aerosolized floroalcene was observed experimentally and adverse reaction was found to be acute fever induced by polytetrafluoroethylene inhalation; fluoroalkane resins which are more soluble in isooctane solvents are replaced for floroalcene waterproofing resins to protect the ozone layer. Poison centers along with other institutions are absolutely necessary for the hazard identification and risk assessment, particularly for the substituted products.[11,12]

Conclusion

Toxicovigilance is a critical evolution, which should be viewed as a useful complement to prevent poisoning. The section serves to enhance epidemiological surveillance for identification of poisoning risk in the community, the substances, circumstances, and the populations involved, and to strengthen investigation of poisoning incidents of public health significance so as to implement control measures in a timely manner. Poison centers can be extremely helpful by triggering signals for health authorities. So far, very few countries have set up structured toxicovigilance systems and it is anticipated that in the future, national and international initiatives will help bridge this gap in our knowledge of the toxicity of many chemicals and commercial products to human beings.

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