ICEH CISA PORTO 2014

3rd INTERNATIONAL CONGRESS ON ENVIRONMENTAL HEALTH 2014

PORTO, 24th to 26th SEPTEMBER 2014

PROCEEDINGS BOOK

EMERGING RISKS AND CHALLENGES ON ENVIRONMENT, HEALTH AND SAFETY

Allied Health Sciences School of Polytechnic Institute of Porto, Portugal

Title:
3th International Congress of Environmental Health: Proceedings Book
3º Congresso Internacional de Saúde Ambiental: Livro de Resumos

Edition:
1st Edition / Book in 1 Volume, 520 pages

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Publisher:
(ESTSP-IPP)
Scientific Area of Environmental Health of Allied Health Sciences School of Polytechnic Institute of Porto
Área Científica da Escola Superior de Tecnologia da Saúde do Instituto Politécnico do Porto

Design / Layout:
4CS

Local / Date:
Porto / November 2014

ISBN:
978-989-20-5086-7

Legal Deposit:
384046/14

(ESTSP-IPP)
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Occupational and environmental exposure to anticancer drugs

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INTRODUCTION:

The use of anticancer drugs is not restricted to a single type of drug (Connor *et al.*, 1999; Suspiro & Prista, 2012). These are varied and present diverse mechanisms of action, which may be causes of occupational exposure. Despite the restricted and controlled use of cytotoxic agents, the risk involved is not confined to individuals who administer them but also to all health care professionals and general population directly or indirectly in contact with them (Suspiro & Prista, 2012).

The presence of pharmaceuticals products in natural surface waters and in the effluent sewage treatment plants have been reported since 1980s. More recently, these products have been detected in ground and drinking water. However, there is little information about the risks these drugs and their metabolites in the water, have, for the human health (Ferrando-Climent*et al.*, 2013).There are few published studies with detailed information about the significance of pharmaceuticals compounds in water for humans (Ferrando-Climent*et al.*, 2013). The major concern with genotoxic/carcinogenic pharmaceuticals compounds is a cancer risk, at any level of exposure because there is no threshold dose below which no carcinogenic effect may occur (Garcia-AC *et al.,* 2011). The pharmaceutical compounds are excreted to wastewater and become potential water contaminants. Currently, very little is known about the presence and elimination process of cytostatic drugs in wastewater treatment plants. The lack of methods and knowledge about the specific risk of pharmaceutical products in aquatic environment may be consider a public health problem.

OBJECTIVES:

The aims of this work was to identify and characterize the most commons anticancer agents involved in occupational exposure and environmental contamination, as well as to identify the most common methods in the assessment of occupational and environmental exposure.

MATERIALS AND METHODS:

A literature review has been performed using articles published in several electronic databases, namely the National Center for Biotechnology Information (NCBI) and B-On on the subject using as key-words: Cytostatic drugs; occupational exposure; environment; cytostatic metabolites and cytostatic measurement methods in water. Articles were selected due to their relevance to their proposed aims.

RESULTS AND DISCUSSION:

Based on the literature on this subject, we can highlight some drugs as the most commonly evaluated in terms of their occupational exposurerisk and environmental contamination: cyclophosphamide, ifosfamide, cisplatin, methotrexate, 5-Fluorouracil (5-FU), gemcitabine, vincristine, vinolrrebine, etoposide, doxorubicin and epirubicin. Currently, a new set of drugshas emerged on which no studies are yet available, as far as the risk of occupational exposure and environmental contamination is concern.

Given the serious toxic effects which may result from exposure to cytotoxic agents, several authors have been addressing the risk assessment of occupational exposure of health workers to these agents. In Hospital, site of primary consumption of such drugs, there are various professional classes and patients in contact with

anticancer agents; among them, nurses stand out - tasked with administration of such drugs— and pharmacy professionals, responsible for preparation of formulations. Although these two classes are the most exposure, risk of exposure may occur at any given point during handling of these drugs, affecting all professionals involved. Forms of exposure to anticancer agents are varied, the most typical being inhalation, dermal or oral exposed.

Assessment of occupational exposure is made using different methods. Among these, chromatographic ones stand out. HPLC-MS/MS analysis or, in some cases, other chromatographic techniques are also considered (e.g. GC-MS/MS).

We observed a scarcity of information about the concentration of these drugs in the environment, more precisely in water. This fact is due to the lack of analytical methods for environmental control. The instrumental methods of analysis more used in wastewater, are gas chromatography, capillary electrophoresis, and high-performance liquid chromatography (HPLC). The confirmation and qualification of these techniques is commonly performed by mass spectrometry or tandem mass spectrometry because these methods are sensitive and selective for the typical levels of these pollutants in environment. However, one can also use the UV and fluorescence detectors because, usually are much more accessible.

CONCLUSION:

Evaluation of occupational exposure to anticancer agents is widely documented, but studies conducted in this field do not cover all types of anticancer drugs available and used. Health professionals, are the most affected population group, a fact that is due to direct contact with patients and affects all professionals, especially those who handle, prepare and/or administer such drugs.

Despite the presence of cytostatic drugs and its metabolites in the environment have been considered a public health problem, few or any solutions have been adopted.

The costs of methodologies and difficulties to identify the metabolites are the most important problems. There is no information available about the drugs metabolization and metabolites form in the environment, when wastewaters containing these drugs are dumped in effluents.

ACKNOWLEDGMENTS:

This project had financial support from Banco Santander Totta, research grant to Luís Teles and Sara Fernandes.

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