Occupational exposure to cytostatic drugs: combined environmental and biological monitoring in a Spanish hospital

J. A. Lema-Atán[1], E. Lendoiro[1]*, A. Cruz[1], B. Bernardez[2,3], M. Cobo-Golpe[1], N. Mayo[4], M. Blanco-Ces[1], M. Tourís[2], Á. López-Rabuñal[1], I. Zarra[2,3], M. López-Rivadulla[1], & A. de-Castro-Ríos[1]

[1] Servicio de Toxicología, Instituto de Ciencias Forenses "Luis Concheiro", Universidade de Santiago de Compostela, Santiago de Compostela, Spain
[2] Unidad de Farmacia Oncológica, Servicio de Farmacia, Hospital Clínico Universitario de Santiago de Compostela, Santiago de Compostela, Spain
[3] Grupo de Farmacología, Instituto de Investigación Sanitaria de Santiago de Compostela (IDIS), Santiago de Compostela, Spain.
[4] Servicio de Oncohematología, Hospital Clínico Universitario de Santiago de Compostela, Santiago de Compostela, Spain
* elena.lendoiro@usc.es

Occupational exposure to cytostatic drugs in healthcare workers has been associated with acute and chronic adverse effects. The increasing use of these agents in clinical practice may increase the risk, particularly due to repeated exposure to multiple compounds over time.

This study aimed to evaluate occupational exposure to multiple cytostatic drugs in a Spanish hospital using a combined environmental and biological biomonitoring approach.

Surface samples were collected across three monitoring campaigns in Pharmacy and Onco-Haematology services of the Clinical University Hospital of Santiago de Compostela (Spain), including preparation areas, equipment, materials and patient-care settings. Additionally, during the third campaign, forearm bracelets worn by workers throughout the work shift and urine samples were collected. All samples were analysed with a validated LC-MS/MS method for detection of 12 commonly used cytostatic drugs (gemcitabine, dacarbazine, methotrexate, cyclophosphamide, doxorubicinol, doxorubicin, epirubicin, irinotecan, vinorelbine, etoposide, docetaxel and paclitaxel) with limits of detection of 5-100 pg/cm^2 for surfaces and 5-250 pg/mL for urine, depending on the analyte.

A total of 153 surface samples were collected. Contamination was detected in 57.6% of samples from the Pharmacy service and 32.3% from the Onco-Haematology service. All monitored compounds were identified at least once, with cyclophosphamide and gemcitabine being the most frequently detected. Most contaminated samples (≥76%) showed low levels (<100 pg/cm²), except in patient-area bathrooms, where less than 40% were below this threshold and all samples were positive. Contamination was also observed in 60.7% of vials, blisters and infusion bags (0.6-1,631.5 ng), with cross-contamination detected in 7 out of 17 cases. Only 2 out of 82 bracelets showed contamination, both with cyclophosphamide (7.4 pg/cm^2 and 31.4 pg/cm^2). Finally, all urine samples (n=165, from 29 workers) were negative.

Overall, cytostatic drugs were widely distributed across monitored hospital settings, although generally low contamination levels were found. These findings highlight the need for continued biomonitoring as a preventive strategy to assess occupational exposure.