

CONTAMINATION WITH CYTOSTATICS IN PHARMACIES AND HOSPITALS IN THE CZECH REPUBLIC

L. Dolezalova¹, L. Blahova², S. Kozakova¹, L. Blaha²

¹ Masaryk Memorial Cancer Institute, Zlutý kopec 7, Brno, Czech Republic (email: dolezalova@mou.cz)

² RECETOX, Masaryk University, Kamenice 5, Brno, Czech Republic



Introduction

The monitoring of contamination with cytostatic drugs (CD) has been required by law in the Czech Republic for several years. However, it was introduced into practice only thanks to CYTO project that was managed by Masaryk Memorial Cancer Institute pharmacy in 2006-2010 (www.cytostatika.cz).

The use of CD has been rising in our country. While in 2010 our pharmacy compounded 23000 bags and syringes, this increased to 38000 in 2015. Therefore, regular monitoring contamination at all work sites concerned in compounding or CD administration is important. The level of contamination should be monitored both in the pharmacy and in the wards (Odraska et al. 2014).

Since 2007, the methods for analyses of cyclophosphamide (CP) and platinum cytostatics (Pt) contamination were available. Since 2015, the analyses of 5-fluorouracil (FU) were also introduced. These drugs belong to the most frequently used CD (together, they represent 49.0 % of compounded units). Recommended limit values for contamination by particular CD are based on the results of long-term monitoring as well as experience in other countries (Schierl et al. 2009, Sessink 2011). The limits were derived by statistical methods considering 75th percentile of measured contamination of surfaces (67 pg/cm² for CP, 12 pg/cm² for Pt, 38 pg/cm² for FU).

By the end of 2015, 840 samples of surface contamination have been collected in pharmacies and hospitals throughout the Czech Republic. In total, 644 samples were analysed on CP, 663 on Pt, and 96 on FU. During 2016 the database was updated with analyses of further 131 samples.

Methods

Sampling procedure utilized wiping of selected surfaces with nonwoven swabs moistened with acetate buffer (20mM, pH = 4). Contamination was monitored mainly on working tables, floors and objects with frequent hand-surface contact (telephones, computer mice, door handles, etc). Used wipers were extracted in acetate buffer and analyzed for CP and FU by high performance liquid chromatography (Waters UPLC System equipped with C18 column) with mass spectrometry detection (Waters Xevo TQ-S). Pt containing drugs were analysed as a sum of elementary platinum by inductively coupled plasma mass spectrometry (Agilent ICP-MS 7500ce).

Results

Considering the results available until 2015, CP was detected above the limit of detection in 321 out of 644 samples (49.8 %), for platinum, the limit was exceeded in 413 out of 663 samples (62.3 %), FU was positive in 53 out of 96 samples (55.2 %). Table 1 shows that higher contamination was generally found in hospital wards and compounding units. The highest detected contamination values exceeded the derived safety limits by several orders of magnitude. When comparing median values, there is a clear distinction – while in pharmacies (compounding room, storage area) the median values do not exceed recommended safety limits, clear excursion was observed in outpatient clinics and facilities for nurses.

Discussion

When compounding CD, the pharmacists are well protected (Czech regulations demand negative pressure cabinets). On the other hand, the nurse who administers the infusion is usually protected only by standard gloves. To improve the safety during the administration of CD we recommend wall-connected infusion poles (instead of stands) that allow for easier and more thorough cleaning of floor (Figure 1). For the administration of CD, we recommend the use of branched infusion lines (Figure 2), which allow rinsing of venous access with clean medium whenever during the administration, thus preventing the nurse from exposure to CD. To minimize floor contamination in patients' toilettes we recommend the use of self-cleaning toilet seats that motivate the patient to sit down during urination (Figure 3).

Conclusion

The regular measurement of contamination brought information about the level of contamination and consequent health risks of healthcare personnel handling CD (pharmacists and nurses). Hospital pharmacists are able to reduce the contamination on their work sites and they should contribute to the education of nurses and co-operate with wards. Preventive measures that are able to decrease the contamination include branched infusion lines, wall-connected infusion poles and self-cleaning toilet seats. The pharmacist is required to take over the responsibility for safety measures when handling CD. He or she should implement methods for safe handling, educate, and check personnel involved in the compounding and the administration.

Table 1: Surface contamination of CD in pharmacies and hospitals in the Czech Republic

	Cyclophosphamide			Platinum			5-Fluorouracil		
	N/Npos.	Median	Min/Max	N/Npos.	Median	Min/Max	N/Npos.	Median	Min/Max
N=840	644 / 321	<1	<1 / 33853	663 / 413	1.1	<0.2 / 7343	96 / 53	13.4	<7 / 234905
Preparation room in pharmacies									
table	135 / 83	7.1	<1 / 33853	144 / 97	1.3	<0.2 / 5333	29 / 20	16.1	<7 / 234905
floor	89 / 57	5.8	<1 / 638	72 / 47	0.9	<0.2 / 84	10 / 5	3.6	<7 / 564
handle, phone, keyboard	89 / 39	2.2	<1 / 4656	63 / 43	1.5	<0.2 / 450	3 / 1	<7	<7 / 61
Storage area in pharmacies									
table	105 / 29	<1	<1 / 1466	95 / 40	<0.2	<0.2 / 7343	3 / 0	<7	<7 / <7
floor	79 / 23	<1	<1 / 235	61 / 28	<0.2	<0.2 / 57	3 / 1	<7	<7 / 25
handle, phone, keyboard	35 / 11	<1	<1 / 1184	38 / 22	0.8	<0.2 / 23	3 / 1	<7	<7 / 15
Outpatient clinic in hospital									
table	16 / 12	15.5	<1 / 1324	9 / 9	2.6	1.1 / 96	4 / 3	135.7	<7 / 262
floor	34 / 32	101.9	<1 / 3244	62 / 59	47	<0.2 / 5390	9 / 8	189.7	<7 / 775
WC	13 / 12	4.5	<1 / 144	13 / 13	673.7	0.5 / 4220	6 / 3	6.7	<7 / 220
Facilities for nurses in hospital									
table	29 / 16	2.2	<1 / 221	55 / 23	<0.2	<0.2 / 227	14 / 11	119.2	<7 / 49510
Administrative areas in pharmacies and hospital									
table, keyboard, phone	29 / 6	<1	<1 / 142	20 / 4	<0.2	<0.2 / 3.7	11 / 1	<7	<7 / 38



Figure 1: Wall-connected infusion pole

Figure 2: Branched infusion line



Figure 3: Self-cleaning toilet seat



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