

Are current cleaning methods effective against Hazardous Drugs?

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Background

This work was part of a quality improvement project to reduce occupational exposure risks to staff handling Systemic Anti-Cancer Therapies (SACT) (and anyone else) within Chemotherapy Outpatients at Gloucestershire Oncology Centre. Recent legislation in America, USP General Chapter <800> (2019), sets out enforceable standards for cleaning in areas where SACT is prepared or administered. With no legislation in the UK, guidelines from the NHS (2018) and HSE (2019) are vague on correct cleaning procedures and it is up to individual Trusts to implement their own methods.

For oncology patients, the potential benefits of treatment outweigh the risks; whereas for healthcare workers the significance of unintentional exposure is directly related to the toxicity of the drug and the level of exposure (NIOSH 2010). Vyas et al (2014) cited studies showing a direct relationship between exposure to cytotoxic drugs and DNA damage among nurses. In the UK, healthcare workers are monitored if they are exposed to radiation, but not following exposure to hazardous drugs. Nurses working in oncology and haematology are vulnerable to contamination due to the frequent administration of cytotoxic drugs in these areas, varying levels of personal protective equipment (PPE) and the perception that the risk of health effects is low (Ziegler et al 2016).

In 2015, the International Agency for Research on Cancer (IARC) and the World Health Organization (WHO) re-evaluated the carcinogenic potential to humans of more than 1,000 chemical drugs, many of which are cytotoxic drugs used to treat cancer and so are deemed hazardous (IARC and WHO, 2015). Cyclophosphamide, a drug widely used in haemato-oncology and many cancer regimens was categorised as a high risk agent and so poses an occupational risk to all healthcare workers who may come into contact with the drug, at any stage of its journey. It is not currently known what level of exposure to hazardous drugs is safe. It is therefore recommended to reduce the exposure as far as possible. Professional standards from the Royal Pharmaceutical Society (Beaney, 2016) state that residues of cytotoxic drugs on surfaces should be routinely monitored (at least annually) and ‘trending’ carried out. Cleaning regimens should be demonstrated to effectively remove chemical contamination. If residues persist, prompt use of additional cleaning and/or use of alternative products should be considered. The chemistry and solubility of the residue should be taken into account to ensure effective removal.

Aims and methods

To assess if the current cleaning methods in chemotherapy outpatients were effective against Hazardous Drug (HD) contamination, surfaces were swabbed before and after a thorough clean.

Cleaning methods

Healthcare workers need to be aware that the sampling only captures a moment in time and that many variables such as the technique of the last person to work in the area, recent spills, and improper cleaning can greatly affect the sampling results (Conner, Zock and Snow, 2016). A range of chemical structures make up the various chemotherapy drugs delivered in the outpatient setting and no single agent is known to deactivate them all. A study by Roberts et al (2006) on cyclophosphamide and 5FU compared detergent wipes and bio-quelling. Both wipes soaked in water and detergent removed 95% of 5FU and cyclophosphamide in one wipe, but could take 2-3 wipes to remove all traces. Bio-quelling however had no effect on contamination from either of the chemotherapies. Sodium hypochlorite showed the highest overall effectiveness with 98% contamination removed, but this cannot be used on stainless steel (Roberts et al, 2006). Solutions containing 10–2 M anionic surfactants and 20% isopropyl alcohol had the next highest global effectiveness at highest (94.8%) in one wipe. Lamerie et al, (2012) study found detergents were effective against all 10 chemotherapies tested but no cleaner removed all traces. This is supported internationally as well, without access to all deactivation agents NIOSH (2004) recommends mechanical removal by using disposable wipes.

Table 1: Cyclophosphamide (CP) and 5-fluorouracil (5FU) in wipe samples from the Chemo Day Unit

Sample Code	Description Surface	Surface Area (cm ²)	Total Volume NaOH (ml)	[5FU] (ng/ml NaOH)	5FU (ng)	5FU (ng/cm ²)	[CP] (ng/ml NaOH)	CP (ng)	CP (ng/cm ²)
23 April 2019 (before cleaning)									
1	Chair 7 seat	1600	100	ND			0.26	26	0.02
2	Floor under drip stand chair 7	3600	100	ND			2.60	260	0.07
3	Floor under drip stand chair 1	3600	100	ND			1.68	168	0.05
4	Chair 1 seat and armrest	2100	100	1.27	1.27	0.06	0.36	36	0.02
5	Floor in front of bins	4900	100	ND			2.09	209	0.04
6	Floor in front of bins by chair 10	4200	100	ND			7.28	728	0.17
24 April 2019 (after cleaning)									
1	Chair 7 seat	1600	100	0.14	14	0.009	0.35	35	0.02
2	Floor under drip stand chair 7	3600	100	ND			3.24	324	0.09
3	Floor under drip stand chair 1	3600	100	1.09	109	0.03	1.37	137	0.04
4	Chair 1 seat and armrest	2100	100	1.38	138	0.07	0.31	31	0.01
5	Floor in front of bins	4900	100	0.70	70	0.01	3.56	356	0.07
6	Floor in front of bins by chair 10	4200	100	ND			6.10	610	0.15

ND: Not Detected: (CP and 5FU < 0.01 ng/ml NaOH)

Discussion

These results imply that current cleaning processes are not sufficient to remove or reduce HD contamination. Whilst they are effective against microorganisms that have potential to cause infection, they may be spreading HD contamination rather than removing it.

Implications for Practice

Since this piece of work we have created a business case to introduce a range of extra precautions:

- 1) Purchasing HD Clean Wipes to remove any HD residues in the departments (Cox et al, 2017).
- 2) Using disposable mop heads vs washable as contamination levels were highest on the floors (NHS, 2018).
- 3) Introducing various Closed Systems (CS) for delivering HD via intravenous (IV) infusions and boluses.
- 4) Introducing Closed System Transfer Devices (CSTD) for preparing subcutaneous Monoclonal Antibodies.
- 5) Re-swabbing yearly.
- 6) Rolling educational awareness programme with staff.
- 7) Review of current cytotoxic disposal methods.

Table 2: Alert and action levels for environmental contamination with cytostatic drugs in The Netherlands

Contamination (ng/cm ²)	< 0.10	0.10 – 1.0	1.0 – 10	> 10
Actions	Repeat annually	Alert: Perform risk assessment Repeat wipe tests after 3-6 months If necessary, take extra precautions		Action: Take extra measures and check with repeat wipe tests

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