

Central Management System for Cancer Therapy incorporating Safety and Quality Control in Chemotherapy

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Background

For patients undergoing chemotherapy (CTx), medication errors may have an impact on their clinical outcome. Adverse drug events occur frequently - especially in older patients - which may affect morbidity, mortality and increase healthcare costs.^{6,7,9} The following precautions - as single elements or in combination - are suitable for avoiding CTx ordering and administration errors:

1. Detailed CTx protocols, including recommendations for comedication⁵ (Fig. 1)
2. SOPs / clinical pathways^{2,4,5}
3. Implementation of a multidisciplinary team for error/CTx screening, incl. (pharmacy) control system (Fig. 2)
4. Electronic CTx database and CTx ordering system^{5,8} (Fig. 2)

All these elements are implemented in the electronic central CTx management system 'Freiburg system'³

Table 1. Literature review: Medication errors and the importance of their prevention

1. Wooten JM et al. South Med J. 2012; 105:437-45	Pharmacotherapy mishaps occur commonly in older adults which affects morbidity, mortality and health care costs
2. Pretorius RW et al. Am Fam Physician. 2013; 87:331-6	Adverse drug events occur in 15% or more of older pts and are potentially preventable in up to 50%
3. Patanwala AE et al. Ann Emerg Med. 2010; 55:522-6	Medication errors are common and occur in the prescribing and administering phase
4. Latif A et al. Crit Care Med. 2013; 41:389-93	Medication errors occur frequently in the administration phase in the ICU-setting; pts and caregivers are rarely informed
5. Walsh KE et al. Pediatrics. 2013; 131:e1405-14	Medication errors are common in outpt pediatric patients and rates of preventable medication-related injuries in outpt population are comparable or higher than those in hospitalized pts
6. Singh H et al. Arch Intern Med. 2009; 169:982-9	Inconsistent communication in computerized provider order entry poses a significant risk to safety
7. Weingart SN et al. Cancer. 2010; 115:2493-64	Oral CTx safety requires improvement in the way these drugs are ordered, dispensed, administered and monitored
8. Georgiou A et al. Ann Emerg Med. 2013; 61:644-653	Computerized provider order entry with decision support systems is related to significant decreases in prescribing errors and potential adverse drug events
9. Merry AF et al. BMJ. 2011; 343:d5543	Multimodal system is associated with a reduction in errors in the recording and administration of drugs in anaesthesia (attributable mainly to a reduction in recording errors)
10. Patanwala AE et al. Ann Emerg Med. 2012; 59:369-73	Pharmacists review of written or computerized medication orders accounts for 1/3 of medication error interception; most medication error interceptions occur during consultative activities
11. Avery AJ et al. Lancet. 2012; 379(9823):1310-9	Pharmacist-led information technology intervention is effective for reducing a range of medication errors
12. Kripalani S et al. Ann Intern Med. 2012; 157:1-10	Clinically important medication errors are present among 1/2 of pts after hospital discharge and were not significantly reduced by a health-literacy-sensitive, pharmacist-delivered intervention.

Medication errors occur frequently and effective interception is needed

'The Blue Book'

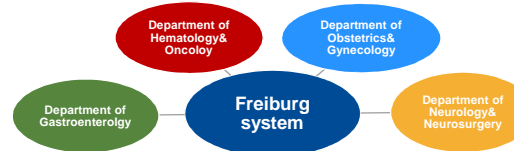
Fig. 1. Detailed CTx protocol including recommendations for comedication

Protocol name (1), indication (2), protocol day (3) with corresponding CTx medication (4) incl. dosage (5), essential comedication (6) with precisely defined administration schedule for each protocol day

Das Blaue Buch, Ed.: Engelhardt, Berger, Duyster, Mertelsmann, Springer 2014, 5th edition

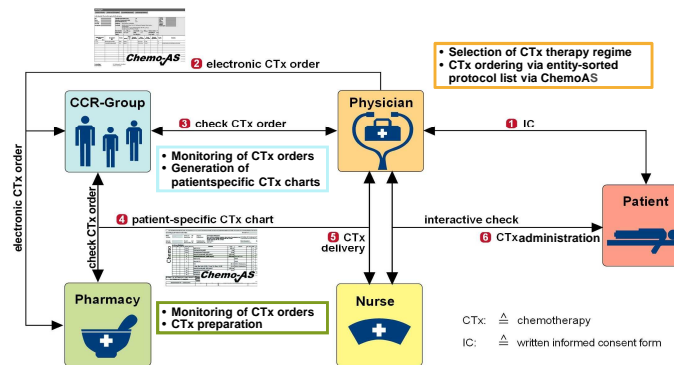
Features of the Freiburg system

- Database Chemo-AS includes > 600 detailed CTx protocols and CTx charts
- Expert team 'Clinical Cancer Research (CCR)-Group' dealing with all questions around CTx for the University Medical Center and external partners/physicians
- Interconnected with Sever Adverse Event (SAE) management system (Fig. 4)
- Access to the 'Blue Book'/CTx library for the entire University Medical Center
- Centralised CTx ordering and monitoring established for hematology and oncology specialties at the University Medical Center Freiburg:



- Technical background database Chemo-AS: web-based PHP application running on Apache server and SAP MaxDB database, client access via an ordinary web browser

Fig. 2. Workflow of CTx ordering and monitoring via Freiburg system



- Selection of CTx therapy regime
- CTx ordering via entity-sorted protocol list via ChemoAS

CTx: chemotherapy
IC: written informed consent form

Effective error avoidance

Table 2. Impact of the Freiburg system on error frequency 2005-2013

	2005	2006	2007	2008	2009	2010	2011	2012	2013
# CTx orders	10885	11331	10674	11420	11429	8510	8956	8888	10155
Error free	9138 (84%)	9406 (83%)	8843 (82.8%)	10049 (88%)	10046 (87.9%)	7520 (88.4%)	8353 (93%)	8194 (92.2%)	9326 (91.8%)
Total correction rate*	1811 (16.6%)	1978 (17.5%)	1691 (15.8%)	1429 (12.5%)	1406 (12.3%)	1076 (12.6%)	632 (7%)	763 (8.6%)	829 (8.2%)
Correction rate* Type A: CTx	445 (4.2%)	409 (3.6%)	201 (1.9%)	222 (1.9%)	213 (1.9%)	112 (1.3%)	140 (1.6%)	128 (1.4%)	186 (1.8%)
Correction rate* Type B: patient data	485 (4.5%)	507 (4.8%)	519 (4.9%)	537 (4.7%)	563 (4.9%)	746 (8.8%)	310 (3.5%)	323 (3.6%)	341 (3.4%)
Correction rate* Type C: IC	881 (8.1%)	1062 (9.4%)	971 (9.1%)	670 (5.9%)	630 (5.5%)	218 (2.6%)	182 (2.0%)	312 (3.5%)	302 (3.0%)

* errors detected and rectified by CCR-Group prior to reaching the patient

Error identification/recording on CTx ordering:

- Type A (CTx): wrong CTx substance, under-/overdose, neglected dose reduction, wrong clinical trial arm
- Type B (patient data): name, date of birth, weight, height, body surface area, cycle length/number
- Type C: incorrect/missing written informed consent form (IC)

Fig. 3. Effective CTx error avoidance

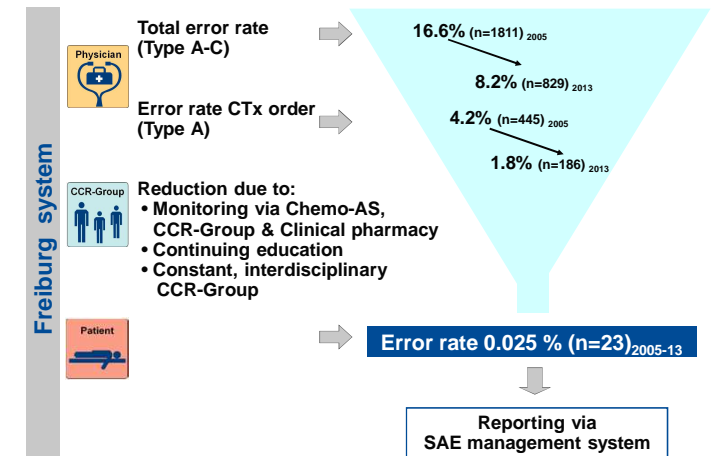
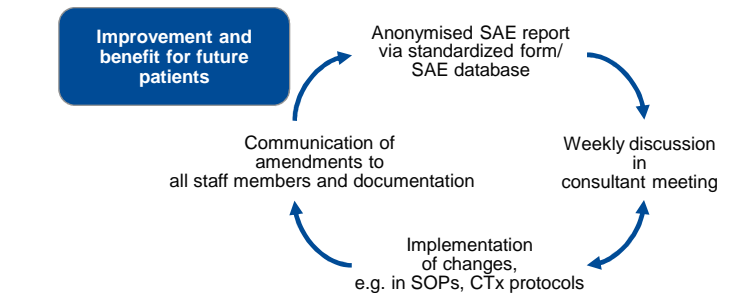


Fig. 4. SAE management system at the University Medical Center Freiburg



Conclusions and future prospects

- Freiburg system offers state-of-the-art CTx performance according to (and beyond) international standards
- It ensures utmost safety of CTx ordering and administration
- CTx is given without time-lag, even allowing that CTx orders can easily and safely be increased
- Maximum support for physicians, nurses and pharmacy staff
- User-friendly and long-term approved application system
- Transparent documentation and information concerning CTx administration
- Transferable system to other CTx applying units (e.g. gynecology, neurology/neurosurgery, gastroenterology, urology, radiooncology, etc.)
- Our recently obtained BMBF-Grant for software development 'QmacPro' in a cross-functional cooperation of the a) University Medical Center, b) University Marketing and health care management and c) e-health company MPS (all Freiburg) will allow transfer of this system to other external cancer centers (software development in compliance with Medical Device Directive: 93/42/EEC-certificate).

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Zentrales Chemotherapeutisches Management System: awards and cooperation

No conflicts of interest