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QUALITY MANAGEMENT IN HOSPITALS: ANALYSIS OF THE PRESCRIBING PRACTICE OF CARDIOVASCULAR MEDICINES

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ABSTRACT

The goal of this study is to analyse the prescribing practice and risk of drug related errors in a Cardiology clinic of University Hospital. Semi-structured open-ended interview aiming to reveal the risk of potential errors was performed with physicians, nurses, pharmacists, and hospital managers. Observational analysis of 915 prescriptions, prescribed by the physicians in two cardiology departments was conducted. Prescribing practice was evaluated by the means of its complexity, frequency of prescribing of particular pharmacology groups, and the related costs. Most often gaps detected in prescribing and dispensing of medicinal products were associated with missing or incorrect dosages, and unspecified quantity. Our analysis showed preference to combination therapies. Monotherapy was given only in 24.82% of the acute cases treated and in 24% of the cases treated in the internal ward. Two medicinal products were identified in 24.48% of the prescriptions (intensive care unit) and in 19.24% of the prescriptions from the internal ward. The most prescribed medicinal products were bisoprolol and glyceryl trinitrate in a combination. Approximately 45% of the patients were prescribed up to 3 medicinal products.The increase of therapy complexity leads to increase of probability for drug-drug interactions and nearly 30% of prescriptions were evaluated as potentially risky for interactions. The relative shares of potentially risky combinations vary from 4% to 32% out of all prescriptions reviewed. The likelihood of drug-related problems in

the observed Cardiology clinic was determined as high but no practice for recording of ADRs was found in place.

Key words: prescribing practice, cardiovascular medicines, cardiology, drug utilization, medication errors.

INTRODUCTION

Drug prescribing is a major part of the practice of medicine [1,2]. Drug utilisation studies are a necessary tool for assessing prescribing habits in hospitals and for recognizing areas for improvement of prescribing practice in these facilities [3-5]. Moreover, some studies suggested that systematic measurement of drug utilization is a key element of drug prescribing improvement and cost control strategies [6-8]. Hospitalized patients are usually prescribed multiple drug treatment (especially in intensive care unit) which is often associated with potentially harmful drug interactions [9-11]. Potential drug related problems (DRP) for hospitalized patients are therefore a cause of concern [11,12]. Drug related problems are classified into two categories: medication errors (MEs) and adverse drug reactions (ADRs) [11,13,14] MEs could occur at five levels: drug selection, prescribing, dispensing, administration, and therapeutic monitoring. ADRs include unintended clinical effects after administration of a drug. Drug related problems can result in decreased quality of life, morbidity or mortality, as well as in increased cost of therapy [14,15].

The goal of this study is to analyse the prescribing practice and risk of drug related errors in the Cardiology clinic of University Hospital.

The research questions discussed in the study are the following:

- What is the possibility and reasons of DRP occurring in the observed Cardiology clinic?
- Are there differences in the prescribing practice, cost and risk of drug related problems occurring in both departments of the Cardiology clinic?

MATERIALS AND METHODS

A study consisting of interview, retrospective prescribing analysis, analysis of drug interactions and likelihood of errors.

To assess the sources of DRP a structured interview with pre-set questions in a free form was performed with five physicians, ten nurses, three hospital pharmacists, as well as with the hospital director. Health professionals were asked to describe their duties related to

prescription and dispensing of medicinal products, to identify the main difficulties and opportunities to improve the control over the inter-hospital life cycle of medicinal products. In addition they were asked to identify any potential sources of medication errors.

The possibility of DRP was analysed after a retrospective review of medication records of 915 patients, admitted in the two wards of the Cardiology Clinic of the University' Hospital. 286 prescriptions from the intensive care cardiology unit and another 629 prescriptions from the internal cardiology ward were examined. The prescriptions were classified according to their complexity, pharmacology groups of prescribed medicines, prices and pharmacotherapy course costs. Differences in the prescribing practice and cost of therapy were statistically tested with z-test for proportions differences in prescribing and t-test for cost differences.

The risk for drug interactions and likelihood of errors was evaluated through comparison of selected prescription combinations with literature evidences for development of risk interactions. The common prescriptions, errors and possible sources of errors were analyzed and their distribution in both departments was evaluated with t-test.

RESULTS

Interview results

The interview performed with health professionals revealed that the most often sources of medication errors in the prescribing and dispensing practice, were the following:

- missing dosage regimes;
- unspecified dosage form if more than one form was available;
- unspecified or wrong quantity of packs/vials etc.;
- wrong dosages.

Those errors were not recorded because the hospital policy normally requires contact with the physician or nurse and clarification of any missing or wrong data. The hospital pharmacy computer program can screen the dosage regimes and prescription errors and correct them before the delivery to the relevant ward. The dispensing errors are very rare because due to the additional control performed by the hospital pharmacy managers and nurses together before the delivery. During the observed one year period only one error was documented. Due to similarity in the packages' design of two medicinal products, a wrong package was dispensed by the hospital pharmacists and the error was corrected after check by the pharmacy manager and responsible nurse.

Prescribing practice and costs of treatment

The analysis of prescribing practice showed preference to combination therapy. Monotherapy was given in 24.82% of the acute cases and in 24% of the cases treated in the internal cardiology ward. Two medicinal products were prescribed for 24.48% of the patients in the intensive care unit and for 19.24% of the patients in the internal ward (**Table 1**, **Figure 1**).

Approx. 45% of the patients were prescribed up to 3 medicinal products. The rest 55% who take more than 3 medicines were exposed to a high risk of DRP. In the internal department, 1.43% of patients were prescribed ten medicinal products, which were administered concomitantly (**Figure 1**). Although the differences in the complexity of therapy exist they were not statistically significant among both departments (p> 0.05).

Table 1. Pharmacotherapy prescribed in both wards in value and percentage

	Number of prescribed medicinal products							
Ward	**1 medicine**	**2 medicines**	**3 medicines**	**4 medicines**	**5 medicines**	**6 medicines**	**7 medicines**	**10 medicines**
Intensive care	71	70	54	37	35	14	5	0
Internal ward	151	121	85	95	89	53	26	9

The most prescribed medicines in both departments belong to the group of anticoagulants (26%), followed by diuretics. Bisoprolol and acid acetylsalicylic were the most prescribed in the intensive care ward and they were present in almost all combination prescriptions. As part of ditherapy, glyceryl trinitrate was often prescribed (**Table 2**).

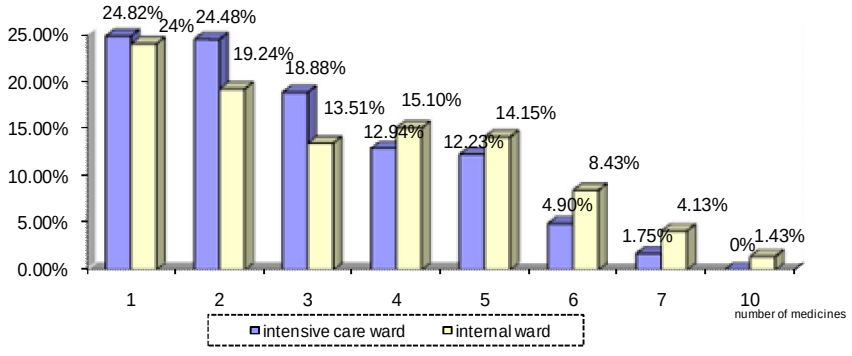

Figure 1. Distribution of patients according to the number of medicines prescribed

The most prescribed pharmacology groups were anticoagulants (26% in both wards), followed by diuretics 21% and 24% respectively (Table 2). The frequency of prescribing of ACE inhibitors differed and it was 18% and 10% in the intensive care unit and internal ward respectively. 19% of prescriptions were prescribed by the intensive unit staff and 14% from internal ward contained beta-blockers and 11% and 6% respectively, vasodilatators (**Table 2**).

Table 2. Prescribing of cardiovascular medicines in both wards

CV pharmacology group	Cardiology clinic/ Intensive care ward	Cardiology clinic/ Internal ward	z-test analysis
Antiarrhythmics	3.10%	3.62%	p> 0.05
Anticoagulants	26.00%	26.07%	
ACE-inhibitors	17.55%	10.21%	
Beta-blockers	13.86%	18.59%	
Vasodilatators	6.05%	11.16%	
Diuretics	23.90%	21.38%	
Antilypidemics	8.26%	8.02%	
Calcium channel blockers	1.33%	0.95%	

Almost all of the pharmacology groups acting on CV system were found prescribed and anticoagulants were at a highest risk of occurrence of DRPs. Although differences in prescribing of CV medicinal products exist in both wards, they were not statistically significant (**Table 2**).

Table 3. Costs of therapy per patient

Average daily costs per therapy in the cardiology clinic (in Bulgarian leva)			
Complexity of therapy	**Intensive care ward**	**Internal care ward**	**t-test analysis**
Monotherapy	1.67	0.88	p>0.05
Ditherapy	2.02	3.12	
3 medicines	1.90	2.03	
4 medicines	2.16	2.35	
5 medicines	3.62	3.38	
6 medicines	5.70	3.96	
7 medicines	9.48	6.15	
10 medicines	-	5.30	

Mean cost of therapy was 1.70 Euro per patient (SD1.5291) in the intensive care ward and 1.7381Euro (SD0.8842) per patient in the internal care ward. Logically, the average daily cost per patient increases with its complexity (**Table 3**), but differences in average cost of therapy among both departments were not statistically significant.

Analysis of drug interactions and likelihood of errors

Because no statistically significant differences in prescribing practice concerning the complexity of therapy, frequency of prescribed cardiovascular medicines, and pharmacotherapy cost were found, we reviewed all prescribed combinations in both departments potentially risky for development of ADR due to literature evidences (Table 4). Combination of diuretics and B-blockers increased the risk of ventricular arrhythmia, digoxin and some diuretics could lead to toxicity or AV block, some combinations with diuretics and ACE inhibitors could change the microelement balance, and some are risky for bleeding. Combination among Heparin and Glyceryl trinitate could be considered as wrong because of their mutual antagonism. The efficacy of Heparin is actually decreased by Glyceryl trinitate. Another improper combination is acid acetylsalicylic + ramipril, which are also antagonists.

Table 4. Identified risks associated with the prescribed combinations

Risk	Combinations
Ventricular arrhythmia	carvediol + furosemide carvediol + spironolacton bisoprolol + hydrochlorthiazide bisoprolol + spironolacton bisoprolol + furosemide
AV block and bradycardia	digoxin + bisoprolol
Intoxication	digoxin + spironolacton
Toxicity	acid acetylsalicylic + hydrochlorthiazide
Hyperkalaemia	hydrochlorthiazide + ramipril furosemide + perindopril furosemide + ramipril heparin + ramipril heparin + perindopril
Hypokalaemia	furosemide + hydrochlorthiazide
Bleeding	heparin + clopidogel acenocoumarin + acid acetylsalicylic
Antagonistic combinations	heparin + glyceryl trinitate acid acetylsalicylic + ramipril

Summarising the risky combinations we evaluated their distribution in both departments in **Table 5**. No significant difference was observed (p>0.05).

Table 5. Identified interactions and possible risks

Type of interaction	N of patients	Share	Intensive care ward	Internal care ward	t-test
Ventricular arrhythmia	9	32.14%	2	7	p>0.05
AV block and bradycardia	1	3.57%	0	1	
Intoxication	1	3.57%	1	0	
Toxicity	5	17.86%	2	3	
Hyperkalaemia	5	17.86%	2	3	
Hypokalaemia	4	14.28%	2	2	
Bleeding	3	10.71%	2	1	

DISCUSSION

We have focused on cardiology clinic for our study as the prescribing practice there is usually complex and lots of combinations are used which increase the risk of errors and/or DRP [16]. In addition there are intensive care patients that are in a higher risk for ADR development. Our analysis showed that the most frequent errors were concerning missing data in the prescriptions and they were corrected promptly. Despite of the high relative share of potentially risky combinations we did not find an evidence for any ADR reporting in the ward.

Analysis of the prescriptions in both departments of Cardiology clinic in Medical University's hospital confirmed the data from similar studies [16], showing that the hospital treatment of cardiovascular diseases is mainly a combined therapy, aimed at integrated approach to improvement of therapeutic outcomes and health status of patients by influencing the different pathogenetic mechanisms of the disease. Co-administration of two or more medicinal products may be useful and necessary when the combination is chosen correctly, prescribing patterns are observed and the risk of drug interactions and errors in administration are taken into account. We did not observe the difference in the combination therapy among both observed departments – intensive care and internal department that might be due to the short period of stay in the intensive care department.

Despite of the fact that the appearance of interactions and ADRs was not documented, the prescription of risky combinations needs to be limited, having in mind the high risk for patients with cardiovascular diseases, which often suffer from complications.

Prevention of this problem is very important [9]. Managing drug interactions in hospitalized patients is challenging and different approaches have been implemented on a hospital level to cope with the potential drug interactions for the benefit of the patients and success of treatment – i.e. greater involvement of hospital pharmacists in drug prescribing and utilization, use of clinical pharmacists, computerized screening etc. [17-19]. We can recommend to the hospital manager educational and evaluation measures to be introduced for better recording of ADRs.

CONCLUSIONS

The possibility of drug related problems in the observed Cardiology clinic is high but no policy for ADRs recording have been found in place. There are no differences in the prescribing practice, cost and risk of drug related problems occurring in intensive care and intensive ward. The risk of prescribing error and/or interactions in the cardiology clinic requires special attention by the clinical and pharmacy staff.

REFERENCES

1. Petrova G, Manova M, Stoimenova A, Savova A, Peikov P. (Cardiovascular medicines prescribing in Bulgaria). Compt. rend. Acad. bulg. Sci., 2011; 64(2): 285-292.
2. Ralph AR, Nathan RE. (A Computerized Intervention to Decrease the Use of Calcium Channel Blockers in Hypertension).J Gen Intern Med, 1997; 12(11): 672–678.
3. Abaci A, Kozan O, Oguz A, Sahin M, Deger N, Senocak H, Toprak N, Sur H, Erol C. (Prescribing pattern of antihypertensive drugs in primary care units in Turkey: results from the TURKSAHA study) . Eur J Clin Pharmacol, 2007; 63 (4): 397-402.
4. Enwere OO, Falade CO, Salako BL. (Drug prescribing pattern at the medical outpatient clinic of a tertiary hospital in southwestern Nigeria). Pharmacoepidem Dr S, 2007; 16(11):1244–1249.
5. Manova M, Stoimenova A, Savova A, Peikov P, Petrova G. (Utilization and price trends in some reimbursed cardiovascular medicines). Biotechnol Biotech Eq, 2011; 25(2): 2424-2431.
6. Macintyre CR, Sindhusake D, Rubin G. (Modeling strategies for reducing pharmaceutical costs in hospital), Int J Qual Health Care, 2001; 13(1): 63-69.

7. Manova M, Stoimenova A, Clerfeuille F, Petrova G. (Impact of the generic competition on usage and process of cardiovascular medicines on the Bulgarian pharmaceutical market). J Public Health, 2010: 19 (1): 91-100.
8. Soumerai SB, McLaughlin TJ, Avorn J. (Quality assurance for drug prescribing). Int J Qual Health Care,1990: 1(2): 37-58.
9. Bochner F, Martin ED, Burgess NG, Somogyi AA, Misan GM. (Controversies in treatment. How can hospitals ration drugs?). Br Med J.,1994: 308: 901–908.
10. Fijn R, Van den Bemt PMLA, Chow M, De Blaey CJ, De Jong-Van den Berg LTW, Brouwers JRBJ. (Hospital prescribing errors: epidemiological assessment of predictors).Brit J Clin Pharmaco, 2002: 53(3): 326–331.
11. Van den Bemt PMLA, Egberts ACG, De Jong-Van den Berg LTW, Brouwers JRBJ. (Drug related problems in hospitalised patients). Drug Safety, 2000; 22: 321–333.
12. Bates WD, Boyle DL, Van der Vliet MB, Schneider J, Leape L. (Relationship between medication errors and adverse drug events). J General Intern Med., 1995; 10: 199–205.
13. Ansari MZ, Collopy BT, Brosi JA. (Errors in drug prescribing). J Qual Clin Pract., 1995; 15: 183–190.
14. Cruciol-Souza JM, Thomson JC. (Prevalence of Potential Drug-Drug Interactions and its Associated Factors In a Brazilian Teaching Hospital). J Pharm Pharmaceut Sci., 2006; 9(3): 427-433.
15. Blix HS, Viktil KK, Reikvam A, Moger TA, Hjemaas BJ, Pretsch P, Vraalsen TF, Walseth EK. (The majority of hospitalised patients have drug-related problems: results from a prospective study in general hospitals). Eur J Clin Pharmacol, 2004; 60(9): 651-658.
16. Ivanova A, Petrova G. Hypertension and common complications-analysis of the ambulatory treatment cost). CEJMed, 2009; 17(4): 223-230.
17. Blix HS, Viktil KK, Moger TA, Reikvam A. (Identification of drug interactions in hospitals – computerized screening vs. bedside recording). J Clin Pharm Ther, 2008; 33: 131–139.
18. Cunningham G, Dodd TRP, Grant DJ, Mcmurdo MET, Richards M. (Drug-related problems in elderly patients admitted to Tayside hospitals, methods for prevention and subsequent reassessment). Age Ageing, 1997; 26(5): 375-382.
19. Shahzad H, Farnaz M, Abdul H, Ghazala P, Fahadya YR, Humayun R, Shazia S, Amina W, Rafique AC. (Pharmacoepidemiological studies of prescribing practices of health care

providers of Pakistan: A crosssectional survey). Afr J Pharm Pharacol. 2011; 5(12): 1484-1493.