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Poisoning with cardiological drugs in patients hospitalized in the toxicological and cardiological department from 04/2013 to 12/2021

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Abstract

Introduction and purpose: Cardiological drugs are widely used in the management of various cardiovascular diseases, such as hypertension, angina, heart failure, and arrhythmias. However, when these drugs are taken in excessive amounts or are not used as prescribed, they can become toxic and cause significant harm to the heart and other organs. Our study aims to illustrate the most frequent causes of poisoning with cardiological drugs in patients hospitalized in the toxicological and cardiological department from April 2013 to December 2021.

Brief description of the state of knowledge: Poisoning with cardiological drugs is a growing concern for healthcare professionals. In 2019, cardiovascular toxins were one of the top 10 categories of poisons evaluated by medical toxicologists. Data collected from the analyzed toxicology and cardiology department include a group of 387 hospitalized patients. The largest proportion were cases intoxicated by beta-adrenoreceptor antagonists. The second most common group was poisonings by angiotensin-converting-enzyme inhibitors. A slightly lower proportion implicated poisonings caused by other, unidentified substances affecting the cardiovascular system - calcium channel blockers and other antihypertensive drugs.

Conclusions: All of the data demonstrated in our study shows the importance of understanding the pharmacology, pathophysiology, and treatment strategies of poisonings caused by cardiological drugs which are one the most widely used medications worldwide.

Keywords: cardiological drugs, poisoning, beta-blockers, intoxication

1. Introduction

Cardiological drugs are widely used in the management of various cardiovascular diseases, such as hypertension, angina, heart failure, and arrhythmias. Therefore, they are relatively common medications. The prevalence of cardiovascular diseases is high globally, with an estimated 17.9 million deaths in 2019 attributed to cardiovascular diseases, according to the World Health Organization [1]. However, when these drugs are taken in excessive amounts or are not used as prescribed, they can become toxic and cause significant harm to the heart and other organs. Calcium channel blockers and beta-blockers in particular can cause toxicity even with a single extra dose [2]. Poisoning with cardiological drugs is a growing concern for healthcare professionals. In 2019, cardiovascular toxins were one of the top 10 categories of poisons evaluated by medical toxicologists. [3]. According to the American Association of Poison Control Centers' National Poison Data System, in 2019, there were 11,527 exposures to cardiovascular drugs reported to US poison control centers, with beta-blockers and calcium channel blockers being the most commonly reported drugs.

This study summarizes the total number of patients hospitalized in a cardiological and toxicological department from April 2013 through December 2021 due to specific cardiovascular drug poisonings based on the ICD-10.

2. Methods

The statistics, collected based on which the present study was made, are based on a database of 387 hospitalized patients in the toxicology and cardiology department of Cardinal Stefan Wyszynski Regional Hospital in Lublin, Poland. The data collection period is from April 2013 to December 2021. The selection of patients was based on the reason for hospitalization. The subjects of interest were patients admitted to the hospital due to poisoning with cardiological medications from different subgroups. The division of patients and analysis was based on the assigned statistical number according to ICD-10 to each patient. As in the study of all drugs, it should be remembered that the primary, first diagnosis was taken into account. Sometimes patients took or abused drugs from several groups, and the diagnosis for the most "toxic" drug in this set, the one that was taken in the highest dose or had the greatest impact on the patient's condition.

3. Statistics

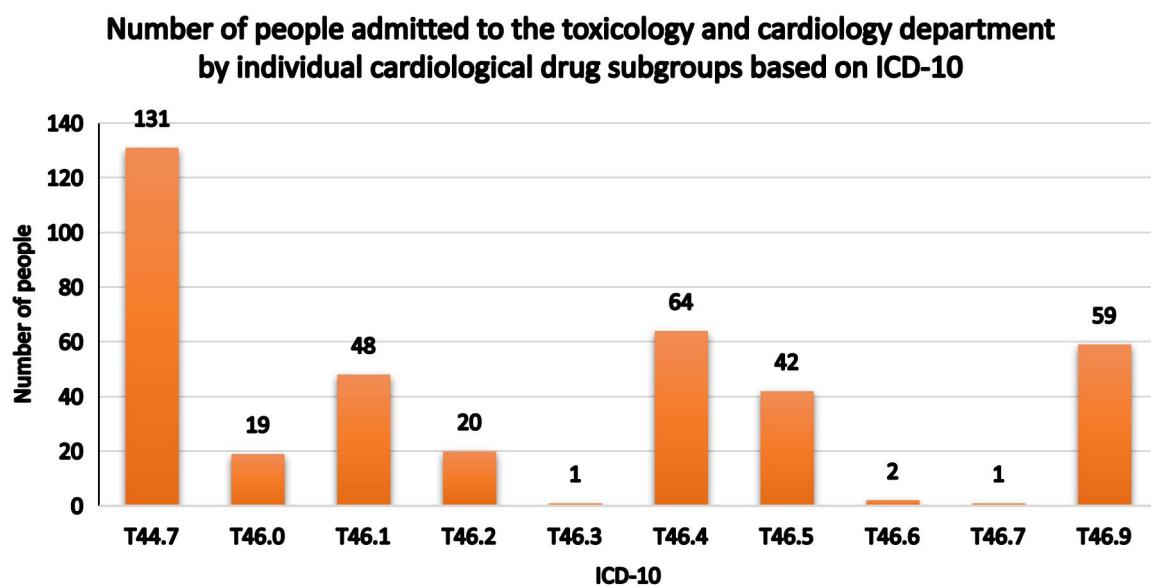
Data collected from the analyzed toxicology and cardiology department include a group of 387 hospitalized patients.

Statistics of the number of people admitted to the toxicology and cardiology department poisoned by individual cardiological drug subgroups based on ICD-10 are presented in the table below.

ICD-10	A subgroup of cardiological medications	Number of people
T44.7	Poisoning by, adverse effect of, and underdosing of beta-adrenoreceptor antagonists	131
T46.0	Poisoning by, adverse effect of and, underdosing of cardiac-stimulant glycosides and drugs of similar action	19
T46.1	Poisoning by, adverse effect of and underdosing of calcium-channel blockers	48
T46.2	Poisoning by, adverse effect of and underdosing of other antidysrhythmic drugs, not elsewhere classified	20

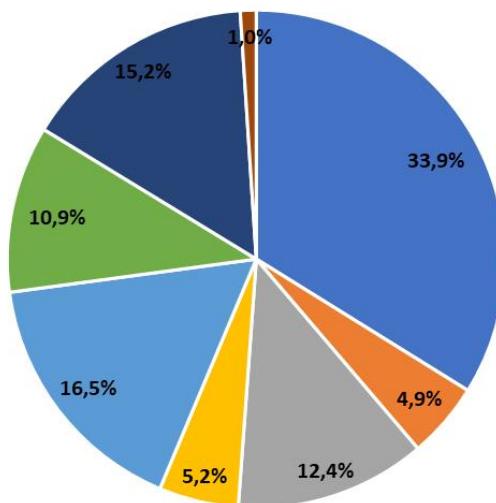
T46.3	Poisoning by, adverse effect of and underdosing of coronary vasodilators	1
T46.4	Poisoning by, adverse effect of and underdosing of angiotensin-converting-enzyme inhibitors	64
T46.5	Poisoning by, adverse effect of and underdosing of other antihypertensive drugs	42
T46.6	Poisoning by, adverse effect of and underdosing of antihyperlipidemic and antiarteriosclerotic drugs	2
T46.7	Poisoning by, adverse effect of and underdosing of peripheral vasodilators	1
T46.9	Poisoning by, adverse effect of and underdosing of other and unspecified agents primarily affecting the cardiovascular system	59

Below is a chart showing the distribution of which drug subgroups are the main causes of hospitalization due to cardiological medication poisoning.



The chart below shows the percentage of each type of cardiological drug poisoning according to ICD-10. Due to the small number in certain subgroups (T46.3, T46.6, T46.7), they have been grouped together.

Percentage distribution of each subgroup according to ICD-10



- T44.7 Poisoning by, adverse effect of, and underdosing of beta-adrenoreceptor antagonists
- T46.0 Poisoning by, adverse effect of and, underdosing of cardiac-stimulant glycosides and drugs of similar action
- T46.1 Poisoning by, adverse effect of and underdosing of calcium-channel blockers
- T46.2 Poisoning by, adverse effect of and underdosing of other antidysrhythmic drugs, not elsewhere classified
- T46.4 Poisoning by, adverse effect of and underdosing of angiotensin-converting-enzyme inhibitors
- T46.5 Poisoning by, adverse effect of and underdosing of other antihypertensive drugs
- T46.9 Poisoning by, adverse effect of and underdosing of other and unspecified agents primarily affecting the cardiovascular system
- Others

4. Discussion

Patients admitted to the toxicology and cardiology department due to poisoning with cardiological drugs accounted for 7,7% of all people hospitalized due to medication poisoning from April 2013 to December 2021. Among the 387 patients hospitalized due to cardiological drug poisoning, the largest proportion were intoxicated by beta-adrenoreceptor antagonists. 131 people were poisoned by these drugs, which represented one-third (33,9%) of all cardiovascular drug poisonings. The second most common medications were angiotensin-converting-enzyme inhibitors – 64 patients (16,5%) were hospitalized for this reason. A slightly smaller proportion were poisonings by other and unspecified agents primarily affecting the cardiovascular system (59 patients; 15,2%). Calcium channel blockers (12,4%) and other antihypertensive drugs (10,9%) constituted a similar number of poisonings - 48 and 42 hospitalizations respectively. The smallest proportion was intoxication by antihyperlipidemic and anti-arteriosclerotic drugs, coronary vasodilators, and peripheral vasodilators - altogether only 4 cases have been reported.

The highest number of beta-blocker poisonings may be due to the high availability and frequency of their use. They contribute to treating very common cardiovascular diseases such as hypertension[4], and heart failure, ischemic heart disease, heart arrhythmia[5]. According to the National Health Fund, nearly 10 million Poles suffered from hypertension in 2020[6] and the number of heart failure patients reached 1.24 million as per a 2018 national report[7].

In a 10-year retrospective analysis of data from the Mainz Poison Center (Germany) 2967 beta-blocker exposures were analyzed, 697 cases were single exposures (most commonly to Metoprolol) and 174 cases were a combination of a beta-blocker and Another antihypertensive drug[8]. Among a prospective group of 399 cases of cardiac drug poisoning registered at the Poison Control Centre of Ain Shams University Hospitals (Egypt) from 1.08.2019 to 31.12.2019, beta-blockers accounted for 50.38%, antihypertensive drugs 33,08% and calcium channel blockers 11,28% of these type of intoxications[9]. In another study, among 70 cases of cardiac drug poisoning in Ahvaz (Iran), beta-blockers represented 45.7%, other cardiac drugs 22.9%, calcium channel blockers 10%, angiotensin-converting-enzyme inhibitors 7.1% of all cases[10].

Similarities were also found in the data reported in the Dokuz Eylul University Drug and Poison Information Centre (Türkiye) between 2014 and 2017, where almost one-third of the cases were beta-blocker poisonings. In this report, there were 16 cases of poisoning by substances affecting the renin-angiotensin system, 9 with ACE inhibitors (13,43% of 67 total cases of cardiovascular drug intoxications) and among them the most common substance was Ramipril. Calcium channel blockers (mainly Amlodipine) accounted for almost 12% of cases and similarly, there were a few cases of intoxication with antihyperlipidemic drugs[11].

In another clinical-epidemiological study, among patients treated in the Toxicology Clinic, Department for adults, UMHATEM "N. I. Pirogov" in Sofia (Bulgaria), poisonings with antihypertensive and antiarrhythmic drugs accounted for 15.2% of all acute exogenous intoxications. More than half were mixed poisonings containing different substances, mainly antidepressants, alcohol, and benzodiazepines. Among these adult patients, the vast majority were intentional poisonings (86,8%) [12]. A single unintentional exposure to common antihypertensive drugs in children causes mild symptoms and often hospital treatment is not necessary[13].

In our summary of cardiological drug poisoning in patients hospitalized in the toxicological and cardiological department from April 2013 to December 2021, the collected data on the poisoning of individual cardiac drug groups are similar to the cases of poisoning with these drugs of the above-mentioned studies from toxicology centers worldwide.

Increasing polypharmacy, an ageing population, patients with multiple medical conditions, taking multiple drugs, are all important factors contributing to poisoning. Many times there are interactions between drugs and symptoms are exacerbated. It is also a problem of frequent patient visits to several specialists. Sometimes patients do not tell the doctor about other appointments, about all the medicines they are taking. Hence, there are situations where patients are taking two drugs from the same group - there is a need for central registers and better supervision of pharmacotherapy. There are attempts to solve these problems by involving pharmacists more, by creating pharmacy assistants who check the medicines taken by patients. Digital patient systems are still being developed and improved.

Another problem is the frequent co-occurrence of mental disorders - mainly depression with cardiovascular disease. This has a significant impact on the number of people hospitalized due to poisoning.

5. Conclusions

The results of our study showed that most hospitalizations in the toxicological and cardiological department due to poisoning with cardiological drugs were caused by beta-adrenoreceptor antagonists which are along with calcium channel blockers most commonly taken drugs. The second most common group was poisonings by angiotensin-converting-enzyme inhibitors. A slightly lower proportion implicated poisonings caused by other, unidentified substances affecting the cardiovascular system - calcium channel blockers and other antihypertensive drugs. All of these data demonstrate the importance of understanding the pharmacology, pathophysiology, and treatment strategies of poisonings caused by cardiological drugs which are one the most widely used medications worldwide. With reference to the results of this publication, it should be noted that it is very important to assess the mental state of patients with cardiovascular disease. It is necessary to sensitize cardiologists and general practitioners about the existing problem among elderly patients with multimorbidity, often developing disabilities as a result, which is conducive to depression and suicide attempts. In addition, increased patient supervision is needed - here the role of general practitioners and pharmacists - for patients with several diseases who additionally receive specialist advice from several doctors.

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