Admissions through the emergency department due to drug-related problems

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BACKGROUND AND OBJECTIVES: Hospital admissions due to drug-related problems (DRPs) have been studied internationally, but local data are limited. Therefore, we undertook a prospective, observational study of all admissions through the emergency department (ED) at a tertiary referral hospital in Saudi Arabia to determine the incidence of admissions through the ED due to DRPs, types of DRPs, length of stay (LOS) in the hospital after ED admissions due to DRPs, and assessment of preventability of admissions due to DRPs.

METHODS: All admissions through the ED over a period of 28 consecutive days were evaluated to determine if they were due to definite or possible DRPs. Data was collected on a daily basis for each admission over the previous 24 hours. Each incident was assessed by three investigators.

RESULTS: Of 557 patients admitted through the ED, 82 (14.7%) admissions were due to DRP (53 definite, 29 possible). The most common types of DRP were failure to receive medication in 25 cases (47.2%), an adverse drug reaction in 13 cases (24.5%), and drug overdose in 6 cases (11.3%). In the definite DRP group, 83.0% were definitely preventable, 3.8% were possibly preventable and 13.2% were definitely non-preventable.

CONCLUSION: DRPs are a serious and costly issue facing health care professionals and health care systems. Most admissions due to DRPs are avoidable.

Over the past 40 years, advances in drug therapy have both improved patient care but led to an apparent increase in the incidence of drug-related problems (DRPs).¹ Drugs are usually prescribed with the goal of achieving an optimal therapeutic outcome. When the outcome is not optimal, a DRP has occurred.^{2,3}

DRPs have been studied internationally, but local, relevant data are limited. Studies in developed countries showed that approximately 5% of all hospital admissions were drug related⁴ and 50% of those were avoidable.⁵ A probability model in 2002 estimated that morbidity and mortality associated with DRPs account for \$76.6 billion in hospital cost, 17 million emergency room visits, and 8.7 million hospital admissions annually in the United States.⁶ We performed a MEDLINE search for the period January 1980 until January 2008 using the following terms: Saudi Arabia, medication errors, adverse drug events, adverse drug effects and adverse drug reactions. A single report of a prospective study of drug-related admissions between 1992 and 1994 in a district referral hospital in Abha, Saudi Arabia, was the only local publication found that was relevant to this issue.⁷ The author

of that study reported 106 admissions due to overdosage and adverse drug reactions (50 and 56 patients, respectively). However, that study had several limitations. For example, the investigator did not evaluate all admissions and the inclusion criteria were limited to two types of DRPs. Therefore, we undertook the present study to evaluate the frequency and types of DRPs at the emergency department (ED) of a tertiary referral hospital.

METHODS

We conducted a prospective, observational study to evaluate admissions due to DRPs through the Emergency Department of King Abdulaziz Medical City, Riyadh, Saudi Arabia, over a period of 28 consecutive days (1 to 28 August 2006). We collected data to determine the incidence of admissions through the ED due to DRPs, types of DRPs, length of stay (LOS) in the hospital after ED admissions due to DRPs, and assessment of preventability of admissions due to DRPs. On a daily basis, the investigators collected demographic and baseline data on a data collection sheet for all ED admissions during the previous 24 hours. The study endpoints were assessed by the investigators on the day of admission,

by clinical pharmacists covering the admitting unit during the admission period, and by the treating physician (consultant level) on the day of discharge. If there was no complete agreement between the three evaluators, a conference was held on the day of discharge among the three evaluators to discuss the issue. A definite DRP was defined as three evaluators in agreement. A possible DRP was defined as only two evaluators in agreement (after holding a conference). Definite preventable and definite non-preventable DRPs were defined as three evaluators in agreement. Possible preventable and possible non-preventable DRPs were defined as only two evaluators in agreement (after holding a conference). Study terms were defined as follows: A *drug-related problem* was an event or circumstance involving drug treatment that actually or potentially interfered with the patient experiencing an optimum outcome of medical care; an *adverse drug reaction* was a medical problem resulting from an adverse effect(s); a *drug interaction* was a medical problem resulting from a drug-drug, drug-food, or drug-laboratory interaction; *drug use without indication* was the taking of a drug for no medically valid indication; *failure to receive drugs* was a medical problem that resulted from not receiving a drug (e.g., for pharmaceutical, psychological, sociological, or economic reasons); *improper drug selection* was the taking of a wrong drug (other than one prescribed by the physician); *drug overdose* was a medical problem treated with too much of the correct drug (toxicity); a *subtherapeutic dosage* was treatment of a medical problem with too little of the correct drug; an *untreated indication* was a medical problem that required drug therapy (an indication for drug use), but for which the patient was not receiving a drug for that indication.

Pharmacists and physicians involved in the evaluation and assessment of this study were well qualified and had a minimum of 8 years of experience. The data from the collection sheets were entered into a Microsoft Access Database program and reports were generated. All admissions during the study period were included in the study with no exclusions. The study was approved by the Research Committee at King Abdulaziz Medical City, National Guard Health Affairs, Riyadh, Saudi Arabia. Simple statistics were used for analysis and description of the data (mean, average, range).

RESULTS

Of 557 patients admitted through the ED during the study period, 82 (14.7%) were due to a DRP, with 53 (9.5%) due to a definite DRP and 29 (5.2%) due to a possible DRP. The male-to-female ratio was 47:35 (57.3%:42.7%). The adult-to-pediatric ratio was 50:32

Figure 1. Types of definite drug-related problems. Percentages are of all definite drug-related problems (n=53).

Figure 2. Numbers of definite and possible drug-related problems (DRPs). Percentages are of all admissions (n=557).

(61%:39%). The most common definite DRP admission was due to failure to receive medications (47.2%), followed by adverse drug reactions (24.5%) and drug overdose (11.3%) (Figure 1). The most common drugs associated with definite DRPs were insulin (n=10), antiasthmatics (n=7), chemotherapeutic agents (n=6),

warfarin (n=4), oral hypoglycemics (n=4), antihypertensives (n=3), paroxetine (n=2), and various others accounted for the remainder (n=17). No definite DRPs were due to drug interactions. The most common diagnoses among the definite DRPs were overdose (n=8), asthma (n=7), febrile neutropenia (n=6), diabetic ketoacidosis (n=6), diabetic foot (n=3), and seizure (n=3), with various other diagnoses accounting for the remainder. Most patients were admitted to internal medicine (n=24) and pediatrics (n=20) departments. The total LOS in the hospital due to a definite or possible DRP was 471 days (range, 1-25 days). The average LOS was 5.74 days/patient (5.69 and 5.80 days/patient for definite and possible DRP, respectively). Most DRPs, both definite and possible, were definitely preventable (Figure 2). Five examples of admitted cases due to definite DRPs and recommendations to prevent the admissions are summarized in Table 1.

DISCUSSION

The results of this study are consistent with international studies suggesting that the incidence of admissions through the ED due to DRPs in Saudi Arabia is similar to that in other countries.^{2,4,5,8-14} The most often encountered DRPs were failure to receive medications, adverse drug reactions and overdosage. In this study, 83% of DRPs were assessed to be definitely preventable while international studies in developed countries

suggest that approximately 50% were preventable.⁵ This brings to attention the importance of patient counseling and reinforcing the proper use of medicine to ensure the best outcomes of pharmacological interventions. The need for direct patient contact by pharmacists and other health care team members is obvious and a collaborative and interdisciplinary patient care model is most beneficial in providing safe and effective therapy.¹⁵ Since the average LOS for admission through the ED due to DRPs is 5.74 days/ patient, avoiding preventable DRP-related admissions is also a very cost-effective tool for health care systems and could help in solving the problem of the bed crisis in hospitals.

Corrective, preventive and educational strategies should concentrate on the most frequently reported populations, diseases and medications. In our study, the total LOS for all patients with definitely preventable DRPs was 344 days. Estimating that the cost of a one-day admission is about 2500 SR, in the 28 days in which this study took place, a saving of 860 000 SR could have been possible. This data is in a single hospital and for a relatively short period of time (28 days). One can imagine the tremendous amount of saving at the level of the century in one year time. Based on our study, particular effort should be made to prevent DRPs in pediatric patients, asthmatic patients, diabetic patients, and in cases of seizure and fever in neutropenic patients. In addition, enforced counseling and education, are needed for pa-

Table 1. Examples of admitted cases due to drug-related problems.

#	Case summary	Comments
1	27-year-old female with non-Hodgkin's lymphoma who received the ABVD protocol the day before in the outpatient chemotherapy clinic admitted due to severe nausea and vomiting. Note: Pre- and post-chemotherapy antiemetics were not prescribed.	This was definitely DRP (untreated indication) and definitely preventable. Could be prevented by prescribing pre- and post-chemotherapy antiemetics or by using standardized pre-printed chemotherapy order forms.
2	56-year-old male, without any documented history of penicillin allergy, admitted due to anaphylactic reaction secondary to ceftriaxone administration in ED.	This was definitely DRP (adverse drug reaction) and definitely non-preventable.
3	12-year-old girl admitted due to anaphylactic reaction secondary to Augmentin prescribed by her primary care physician. Note: this patient had a similar reaction (in the same hospital) to amoxicillin 6 years previously.	This was definitely DRP (adverse drug reaction) and definitely preventable. Could be prevented by proper documentation of previous reaction (flagging the patient file and documentation in the computer system)
4	8-year-old boy admitted due to exacerbation of bronchial asthma. At home, patient used a salbutamol inhaler and was not using his fluticasone inhaler.	This was definitely DRP (failure to receive drugs) and definitely preventable. Could be prevented by stressing patient education.
5	62-year-old female admitted through ED due to GI bleeding with an INR of 7.2. Two weeks prior to admission, the patient developed pulmonary embolism secondary to total hip replacement. At that time, she was started on enoxaparin and a loading dose of warfarin 10 mg followed by 5 mg orally daily. On day 3 of warfarin, the INR was therapeutic (2.3) and the patient had no complaints. Enoxaparin was discontinued, warfarin 5 mg orally daily was continued and she was discharged with a 2-week appointment to check her INR.	This was definitely DRP (drug overdose) and definitely preventable. Could be prevented by stressing patient education, knowing and anticipating warfarin pharmacokinetics and proper INR monitoring after discharge.

tients receiving insulin, antiasthmatics, chemotherapy, oral hypoglycemic agents and warfarin.

A factor limiting the scope of this study was the fact that admissions due to DRPs were not limited to the ED. Some patients with DRP could be directly admitted through outpatient clinics. Also, only patients who were admitted were assessed, so a significant number of patients with minor DRP who were not admitted may have been missed. Another limitation was the short period of the study and the fact that all data were collected in a single institution.

To the best of our knowledge, this is the first study

to quantify the magnitude of DRPs in patients admitted through the ED in a tertiary referral hospital in Saudi Arabia. DRPs are a serious and costly issue facing health care professionals and health care systems. Most DRPs are avoidable through efforts made by all health care team members. More local studies with a prolonged period of monitoring, especially multi-center studies addressing DRPs in Saudi Arabia are needed.

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