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SHORT RESEARCH REPORT

Identify and categorize drug-related problems in hospitalized surgical patients in China

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Abstract

Background Data is lacking on types and severities of drug-related problems (DRPs) in hospitalized surgical patients in China. *Objective* To identify and categorize types and causes of DRPs, and to assess severities of these DRPs. *Setting* An academic teaching hospital in Chongqing, China. *Method* We retrospectively reviewed all medication orders for patients in six surgical departments during a six-month period. DRPs were classified using the Pharmaceutical Care Network Europe (PCNE) classification, and the severity ratings of these DRPs were based on the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) classification. *Main outcome measure* The number, types, causes and severities of the DRPs. *Results* A total of 291,944 medication orders in 10,643 patients were reviewed, and 3548 DRPs were identified. The average DRP number per patient was 0.3. The most common problem was treatment effectiveness (39.9%) and the major cause of the problems was dose selection (47.0%). Total 80.1% of the DRPs were rated at severity categories B to D (causing no or potential harm), whereas 19.9% were rated as categories E to H (causing actual harm). *Conclusion* DRPs are common in surgical patients, and prospective pharmacist medication order review services are needed to improve patients' pharmaceutical care.

Keywords China · Drug-related problems · NCC-MERP classification · PCNE classification · Pharmacist · Pharmacy service

Impacts on practice

- Drug-related problems (DRPs) are common in surgical patients in China.
- Reviews for medication orders conducted by hospital pharmacists can identify DRPs.
- It is desirable that clinical pharmacy services are implemented in surgical departments in China.

Introduction

A drug-related problem (DRP) is defined as "an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes" [1]. It may lead to adverse drug events (ADEs) including medication errors (MEs) and adverse drug reactions (ADRs). To prevent avoidable medication harm, the World Health Organization (WHO) initiated "The Global Patient Safety Challenge: Medication without Harm" [2]. The Pharmaceutical Care

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Network Europe (PCNE) classification system is a validated tool to categorize DRPs in multiple settings [3], and it may be incorporated into the daily pharmacist pharmaceutical care activities to categorize DRPs. Research regarding the incidence and nature of DRPs in Chinese hospitals is limited with one study explored DRPs in hospitalized pediatric patients in Hong Kong (the incidence rate reported was as high as 21.0%) [4]. More studies are needed to demonstrate pharmacist value and to further establish pharmacy services in China.

Aim of the study

The main objective was to identify and categorize types and causes of DRPs at surgical departments in a 3000-bed Chinese hospital. The secondary objective was to assess severities of the identified DRPs.

Ethics approval

The study was considered to be an Exempt Research by the Hospital Ethics Committee.

Methods

Setting

This retrospective study was performed in six surgical departments (neurology, gynecology/obstetrics, hepatobiliary, vascular, endocrine breast and orthopedics) on patients hospitalized from July 1, 2017 to December 31, 2017 at the First Affiliated Hospital of Chongqing Medical University, the largest teaching hospital in Chongqing, a major city in southwest China.

To provide feedback to the WHO Global Patient Safety Challenge, medication safety pharmacists are allocated to promote medication safety in our hospital. The following two measures were conducted to improve patient safety by (1) evaluating the appropriateness of prescription orders such as drug selection, indication, contraindication, dosing, and drug–drug interaction; and (2) monitoring drug therapy on patient's response and side effect. In our study, prescription orders were assessed for DRPs, and the causes and severities of the DRPs were categorized.

Data collection

All DRPs were documented, categorized and entered into a data collection sheet. DRPs were categorized using the PCNE classification (Version 8.02) [1], which was last updated in June 2017. In this study, we focused on the types and causes of DRPs, therefore only the Problem and Cause sections were completed.

Each DRP was given a severity rating, and the rating was based on the potential of the DRP to result in an ADE or inadequate response according to the National Coordinating Council for Medication Error Reporting and Prevention (NCC-MERP) classification [5]. This classification consists of five categories based on ascending severity of the outcome: (1) circumstances or events that have the capacity to cause error (potential errors, category A); (2) MEs occurred without posing harm to patients (categories B and C); (3) MEs caused potential harm to patients (category D); (4) MEs caused harm to patients (categories E, F, G, and H); and (5) MEs resulted in a patient's death (category I). The assessment of DRPs and severity ratings were performed by two pharmacists independently, and discrepancies were resolved through discussions. These pharmacists had obtained clinical pharmacy training certificates from the China National Health Commission and had an average of five years hospital pharmacy experiences. All statistical analyses were performed using the SPSS (version 23.0). Descriptive statistics were used to characterize the data.

Results

A total of 10,643 patients were admitted to the surgical departments during the study period. A total of 2087 patients (19.6%) had at least one DRP. Among patients who had DRPs, 61.2% (1278/2087) had one, 20.6% (430/2087) had two, 9.2% (191/2087) had three, 3.8% (79/2087) had four, and 5.2% (109/2087) had five or more DRPs. Patients' mean age was 52.6 ± 18.7 years [ranges 12–96], and 38% were males.

Total medication orders reviewed were 291,944, of which the number of DRPs was 3548 (rate 1.2%). The mean number of DRPs per patient was 0.3. Most DRPs (35.1%; 1244/3548) occurred in the hepatobiliary surgical department followed by gynecology/obstetrics (30.8%; 1094/3548), vascular (19.3%; 684/3548), orthopedics (9.5; 337/3548), endocrine breast (3.0%; 105/3548) and neurosurgery department (2.4%; 84/3548), respectively.

Identified drug-related problems

As shown in Table 1, treatment effectiveness P1 was the major type of DRP (39.9%; 1414/3548) followed by treatment safety P2 (35.6%; 1263/3548). Within the "treatment effectiveness" P1 domain, "the effect of drug treatment not optimal" P1.2 was the major sub-category (83.2%; 1177/1414), followed by "no effect of drug treatment" P1.1 and "untreated symptoms or indication" P1.3 categories.

Table 1 Detected drug-related problems (n = 3548) according to the PCNE DRP Classification V8.02

Primary domain	Code	Detailed classification	n	%
1.Treatment effectiveness	P1	Total	1414	39.9
There is a (potential) problem with the (lack of) effect of the pharmacotherapy	P1.1	No effect of drug treatment	139	3.9
	P1.2	Effect of drug treatment not optimal	1177	33.2
	P1.3	Untreated symptoms or indication	98	2.8
2. Treatment safety	P2	Total	1263	35.6
Patient suffers, or could suffer, from an adverse drug event	P2.1	Adverse drug event (possibly) occurring	1263	35.6
3. Others	P3	Total	871	24.5
	P3.1	Problem with cost-effectiveness of the treatment	199	5.6
	P3.2	Unnecessary drug-treatment	597	16.8
	P3.3	Unclear problem/complaint. Further clarification necessary (please use as escape only)	75	2.1

Identified causes of drug-related problems

As shown in Table 2, dose selection C3 was the major cause of DRPs (47.0%; 1669/3548) followed by drug selection C1 (36.7%; 1301/3548) and dose form C2 (10.6%; 375/3548). Within the "dose selection" C3 domain, the main cause was "dosage regimen not frequent enough" C3.3 category (48.8%; 815/1669) followed by the "drug dose too high" C3.2 category (31.1%; 519/1669).

Severities of the identified drug-related problems

The potential severity ratings of the DRPs (n = 3548) were mainly in categories B to H. The proportions from high to low were categories B to D 80.1% (2843/3548), and categories E to H 19.9% (705/3548). Within the drug selection domain C1, 83.1% (1081/1301) of the DRPs were rated as severity categories B to D, and 16.9% were rated as categories E to H (Table 2).

Discussion

This is the first study describing the problems and causes of DRPs using PCNE classification, and the severity of the identified DRPs in surgical departments at a major Chinese hospital. The presence of DRPs was common in this patient population, around 20%. About two thirds of the DRPs occurred in the hepatobiliary and gynecology/obstetrics surgery departments, highlighting the needs for enhanced pharmacy service in these specialty units.

In our study, the rate of DRPs was 1.2% of the total prescription orders reviewed, and the average number of DRPs per patient was 0.3. This number was close to a study conducted in 14 surgical wards in Germany by pharmacy interns using the APS-Doc classification, 0.6 [6]. However, our number was lower compared to two other studies. Numbers reported in a German orthopedic and accident surgery ward using the APS-Doc coding and in a Swiss cardiovascular surgery ward using a simplified PCNE classification 6.2 were 2.6 [7] and 1.7 [8], respectively. In our study, DRPs presented in about 20% of the patients, and among them about 40% had one or more DRPs. The study in Germany found that about 33% of the patients had at least one potential DRP [6]. The methodological issues of reporting and classification could contribute to the variations of DRP prevalence among studies: the characteristics of the patient population, training of health care professionals detecting DRPs, definition of DRPs, and types and choice of classification systems to detect and document DRPs [9]. In addition, the patterns of drug use and the differences of clinical guidelines used to assess DRPs may also contribute to DRPs detected.

The major causes of DRPs in our study were dose selection and drug selection, which together accounted for over 80% of the problems in this study. This was different compared to the Swiss study [8], where drug–drug interactions were the underlying cause of DRPs, and likely reflects the more frequent use of drugs such as amiodarone and rifampicin in that cardiovascular patient population. Within the "dose selection" domain, "dosage regimen not frequent enough" and "dosage regimen too frequent" were the major causes, accounting for more than half of the causes. This demonstrated the importance for pharmacists to conduct prospective prescription order reviews to ensure appropriate drug selection and dosing for treatment efficacy. Within the "drug selection" domain, "no indication for drug" was the major cause (50.9%). For example, levocarnitine or edaravone injections were given to patients with lower extremity deep venous thrombosis. This may be a unique phenomenon in China as ancillary drugs, traditional Chinese patent medicines, antibiotics and hormonal drugs tend to be overprescribed [10] to promote quick recoveries after surgeries or due to profits-driven prescribing.

Table 2 Causes of DRPs (n = 3548) according to the PCNE DRP classification tool and severities of DRPs based on the NCC-MERP classification

Primary domain	Code	Causes	n	%	Potential severity category B-D (n)	%	Potential severity category E–H (n)	%	Drugs	n	Drugs	n
1. Drug selection	C1	Total	1301	36.7	1081	83.1	220	16.9				
	C1.1	Inappropriate drug according to guidelines/formulary	157	4.4	115	73.2	42	26.8	Ceftizoxime sodium	31	Cefoxitin sodium	25
	C1.2	Inappropriate drug (within guidelines but otherwise contra-indicated)	56	1.6	42	75.0	14	25.0	Ginkgo leaf extract and dipyridamole injection	13	Levofloxacin	9
	C1.3	No indication for drug	662	18.7	561	84.7	101	15.3	Levocarnitine	289	Edaravone	99
	C1.4	Inappropriate combination of drugs or drugs and herbal medication	97	2.7	88	90.7	9	9.3	Vitamin C	12	Water-soluble vitamin for injection	8
	C1.5	Inappropriate duplication of therapeutic group or active ingredient	182	5.1	157	86.3	25	13.7	Magnesium isoglycyrrhizinate injection	22	Sodium ferulate	18
	C1.6	No drug treatment in spite of existing indication	98	2.8	78	79.6	20	20.4	Tramadol	23	Enteral nutrition emulsion	18
	C1.7	Too many drugs prescribed for indication	49	1.4	40	81.6	9	18.4	Piperacillin/tazobactam	7	Imipenem and cilastatin sodium	6
2. Drug form	C2	Total	375	10.6	343	91.5	32	8.5				
	C2.1	Inappropriate drug form (for this patient)	375	10.6	343	91.5	32	8.5	Ambroxol hydrochloride injection	101	Hemocoagulase atrox for injection	91
3. Dose selection	C3	Total	1669	47.0	1243	74.5	426	25.5				
	C3.1	Drug dose too low	89	2.5	53	59.6	36	40.4	Tinidazole	17	Levofloxacin	7
	C3.2	Drug dose too high	519	14.6	370	71.3	149	28.7	Hemocoagulase atrox for injection	201	Ambroxol hydrochloride injection	80
	C3.3	Dosage regimen not frequent enough	815	23.0	600	73.6	215	26.4	Ccefoxitin sodium	211	Cefuroxime sodium	78
	C3.4	Dosage regimen too frequent	119	3.4	95	79.8	24	20.2	Ceftriaxone sodium	22	Azithromycin	16
	C3.5	Dose timing instructions wrong, unclear or missing	127	3.6	125	98.4	2	1.6	Cefuroxime sodium	39	Tramadol sustained release tablet	11
4. Treatment duration	C4	Total	121	3.4	107	88.4	14	11.6				
	C4.2	Duration of treatment too long	121	3.4	107	88.4	14	11.6	Cefuroxime sodium	37	Cefazolin sodium	21
8. Other	C8	Total	82	2.3	69	84.1	13	15.9				
	C8.2	Other cause	82	2.3	69	84.1	13	15.9	Hemocoagulase atrox for injection	15	Polyene phosphatidylcholine injection	14
Total			3548	100	2843	80.1	705	19.9				

About 80% of the DRPs were rated at severity levels of causing no harm or had the potential to cause harm to patients (categories B to D). However, 20% of the DRPs still might have resulted in harm to patients (categories E to H) requiring intervention or prolonged hospitalization. However, due to the nature of this retrospective study, the incidences of actual harms caused by the related DRPs were difficult to analyze.

Our study has several limitations: (1) it was conducted in surgical departments in a single hospital, and the DRP patterns may not be generalizable for other departments or other hospitals in China, and (2) the study focused only on the DRP problems and causes without the analysis of the interventions and clinical outcomes.

Conclusion

DRPs are common in surgical patients. Prospective prescription order review is needed to optimize patients' pharmacotherapy and care.

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Conflict of interest All authors declare that they have no conflict of interests.

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