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RESEARCH ARTICLE

Effect of clinical pharmacist intervention on the treatment of acute pancreatitis

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Abstract

Background The participation of clinical pharmacists in the treatment of acute pancreatitis has rarely been reported. *Objective* The aim of this study was to retrospectively evaluate the impact of intervention of clinical pharmacists on the treatment of acute pancreatitis. *Setting* An academic teaching hospital in Taizhou, Jiangsu, China. *Method* Two hundred and twenty-eight patients with acute pancreatitis were retrospectively enrolled from July 2017 to July 2018 and divided into an intervention group (n = 119) and a control group (n = 109) according to whether a clinical pharmacist was involved. No significant differences in the baseline clinical characteristics were found between the groups. Clinical pharmacists participated in drug formulation and adjustment, pharmaceutical care, and follow-up. *Main outcome measure* Clinical outcomes, average hospital stays, costs, incidence of adverse drug reactions, 1-month subsequent visit rate, and patient satisfaction between the two groups were measured. *Results* The clinical symptoms of patients in both groups were relieved after treatment. There were no significant differences between the groups in computed tomography grades after treatment, incidence of adverse drug reactions, or average hospital stays. However, the intervention group had lower total costs of hospitalization, drugs and antibiotics but higher rates of 1-month subsequent visits and satisfaction compared with the control group. *Conclusion* The intervention of clinical pharmacists in the treatment of acute pancreatitis can effectively reduce costs of hospitalization, drug and antibiotics and improve follow-up compliance and patient satisfaction.

Keywords Acute pancreatitis · China · Clinical pharmacist · Pharmaceutical care · Pharmacist intervention

Impact on practice statements

- Pharmacist's intervention in patients with acute pancreatitis effectively reduces the costs of hospitalization, drug, and antibiotics, and ensures the rational use of drugs for treatment.
- Interventions resulting from the clinical pharmacists' participation in the treatment of patients with acute pancreatitis improve patient follow-up compliance and patient satisfaction.

Introduction

Acute pancreatitis, one of the leading causes of in-hospital death [1], is an inflammatory process that causes a local inflammatory response and systemic inflammatory response syndrome (SIRS) [2]. Although the majority of patients have a mild disease course, approximately 20% develop moderate

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or severe pancreatitis, with necrosis of the (peri-) pancreatic tissue and/or (multiple) organ failure [3]. The annual incidence of pancreatitis ranges from 13 to 45 per 100,000 and has been increasing yearly [4]. Current guidelines for the treatment of acute pancreatitis are limited to supportive treatments, such as fluid therapy, nutritional support and prevention of complications [5], and there are no specific drug treatments available. In China, the cost of drugs accounts for a considerable proportion of the treatment costs of acute pancreatitis, and certain adverse drug reactions (ADRs) have been reported in clinical practice. Thus, it is necessary to optimize the medications used for acute pancreatitis to reduce ADRs and cost.

At present, an increasing number of studies have evaluated the value of clinical pharmacist participation in clinical work and confirmed that clinical pharmacists can optimize the use of antibiotics [6] and reduce ADRs and even treatment costs [7, 8]. However, the role of the clinical pharmacist in acute pancreatitis treatment has not been reported. The clinical pharmacy department at our hospital began to participate in clinical gastroenterology work in July 2017. We retrospectively analyzed patients with acute pancreatitis and evaluated the role of clinical pharmacists in the treatment of acute pancreatitis.

Aim of the study

The aim of this study was to retrospectively evaluate the effect of the participation of clinical pharmacists on the treatment of acute pancreatitis.

Ethics approval

This study was approved by the medical ethics committee of Jingjiang People's Hospital (No. 2018-03-003, date 2018.06.01).

Methods

Study participants

Patients diagnosed with acute pancreatitis and admitted to Jingjiang People's Hospital from July 2017 to July 2018 were retrospectively enrolled. The inclusion criteria were patients who met the criteria for acute pancreatitis [9] and were admitted from the emergency department. The diagnosis of acute pancreatitis was based on two of the following criteria: (1) abdominal pain (acute onset of a persistent, severe, epigastric pain often radiating to the back); (2) serum lipase activity (or amylase) at least 3 times greater than the upper limit of normal; and (3) characteristic findings of acute pancreatitis on computed tomography (CT) or magnetic resonance imaging. The standard treatment for acute pancreatitis consists of supportive care with fluid resuscitation, pain control, nothing by mouth, nutritional support, antibiotics, and sometimes endoscopy or surgery. Patients were excluded if they (1) failed to comply with standard treatment during hospitalization and required early discharge or postponed discharge, (2) were transferred to another department to continue treatment, and/or (3) had other diseases that were not related to acute pancreatitis and required treatment. A clinical pharmacist participated in the treatment of the patients who were admitted to the hospital on odd-numbered dates until they were discharged from the hospital. Patients were divided into an intervention group (clinical pharmacist intervention group) and a control group based on whether a clinical pharmacist was involved in the treatment planning.

Data collection

The following data were collected: demographics (age and sex); previous medical history (smoking status, drinking status, cholecystitis, gallstones, hypertension, hyperlipidemia, fatty liver, diabetes and coronary heart disease); and severity of pancreatitis (including Ranson scores and Balthazar CT grades; CT grades A–E correspond to 1–5 points, sequentially [10]).

Clinical pharmacist interventions

Participation in drug formulation and adjustment

For patients in the intervention group, the clinical pharmacists were actively involved in the formulation of drug regimens. Drug regimens mainly included antibiotics, nutritional support substances, drugs for promoting intestinal function recovery, pancreatic enzyme inhibitors, electrolytes, etc. Individualized dosing regimens were designed based on the characteristics of clinical diagnosis, pharmacokinetics, and pharmacodynamics. According to the patient's clinical symptoms, physical signs and laboratory test results, clinical pharmacists adjusted the types of drugs prescribed for patients, the route of administration, dosage and frequency. They also discovered, resolved, and prevented potential or actual medication problems in clinical practice.

Pharmaceutical care

Clinical pharmacists conducted individualized medication monitoring for patients with acute pancreatitis in the intervention group, monitored for clinical symptoms of abdominal pain, nausea, vomiting, etc. in different patients, assisted nurses in adjusting the infusion rates of different drugs, instructed patients to use drugs correctly, and determined

whether there were ADRs after infusions or oral medications were administered. If ADRs occurred, clinical pharmacists informed the patient of the measures to be taken as follows: (1) promptly notifying the physician, nurse or pharmacist; (2) suspending suspicious drugs; and (3) waiting for treatment in bed. The pharmacist also provided psychological guidance and comfort to the patient to relieve any anxiety and monitored their medication compliance.

Follow-up of discharged patients

Patients with pancreatitis in the intervention group were educated regarding lifestyle, medications, and follow-up when they were discharged from the hospital. The clinical pharmacists suggested lifestyle changes, such as smoking cessation, alcohol abstinence, weight loss, or a low-fat diet. They designed patient discharge education sheets to guide patients on how to continue drug consolidation treatment after discharge and how to handle ADRs if they occurred with specific strategies and consulting methods. The pharmacists explained and emphasized the physicians' recommendations that 1 month after discharge, the patients should have liver and kidney function testing, routine blood tests, abdominal imaging and other evaluations at an outpatient clinic.

Observation indicators

The observation indicators included clinical outcomes (clinical symptoms and posttreatment CT grade), average hospital stay, total hospitalization cost, total drug cost, antibiotic cost, incidence of ADRs, 1-month subsequent visit rate, and patient satisfaction (0 representing "not satisfied", 1 representing "a little satisfied", and 2 representing "satisfied").

Statistical analysis

Statistical analysis was performed with SPSS version 21.0 software (SPSS, Chicago, IL, USA). The data are presented as the mean ± standard deviation (SD). Significant differences between the two groups were evaluated using Student's *t* test for normally distributed variables or Fisher's exact test for dichotomous variables. A paired-sample *t* test was used for comparison of Balthazar CT grades before and after treatment. *P* values less than 0.05 were considered significant.

Results

Clinical characteristics

Two hundred and seventy-three patients with acute pancreatitis were admitted to the Gastroenterology Department at Jingjiang People's Hospital between July 2017 and July 2018. Among them, 25 patients were transferred from other departments or transferred to other departments or medical institutions for treatment, 4 patients were discharged from the hospital during hospitalization, and 16 patients had tumors, lungs infection, pleural effusion, etc. Ultimately, 228 patients with acute pancreatitis were retrospectively included in this study, including 119 patients in the intervention group and 109 patients in the control group. There were 139 males and 89 females with a mean age of 50.5 ± 13.6 years. There were no significant differences between the two groups in terms of sex, age, smoking history, drinking history, past medical history, severity of pancreatitis, or Balthazar CT grade before treatment (Table 1).

Clinical efficacy, ADRs and costs

The clinical symptoms of patients in both groups were relieved after treatment, and their CT grades were significantly lower than baseline. The CT grades in the intervention group decreased from 4.02 ± 0.41 to 2.01 ± 0.31 ($P < 0.001$), and those in the control group decreased from 4.04 ± 0.41 to 2.06 ± 0.37 ($P < 0.001$). There was no significant difference in CT grades after treatment between the two groups ($P = 0.216$). One patient developed an ADR in the intervention group, while 4 cases of ADRs occurred in the control group; the difference was not significant. The average hospital stay among patients in the intervention group was 11.3 ± 3.3 days compared with 11.2 ± 2.9 days in the control group, with no significant difference ($P = 0.807$). The total hospitalization, drug, and antibiotic costs in the intervention group were 13,069.8 ± 4431.7 Ren Min Bi

Table 1 Baseline and clinical characteristics of the two groups (mean ± SD/case, %)

Items	Intervention group (n = 119)	Control group (n = 109)	*P*
Age/year	51.3 ± 13.9	49.7 ± 13.1	0.365
Sex (male: female)/case	71:48	68:41	0.686
Smoking status (case, %)	32 (26.9)	33 (30.3)	0.660
Drinking status (case, %)	26 (21.8)	23 (21.1)	1.000
Cholecystitis (case, %)	35 (29.4)	29 (26.6)	0.661
Gallstone (case, %)	31 (26.1)	31 (28.4)	0.766
Hypertension (case, %)	37 (31.1)	31 (28.4)	0.684
Hyperlipidemia (case, %)	33 (27.7)	32 (29.4)	0.883
Fatty liver (case, %)	27 (22.7)	29 (26.6)	0.539
Diabetes (case, %)	25 (21.0)	22 (20.2)	1.000
Coronary disease (case, %)	2 (1.7)	2 (1.8)	1.000
Ranson score	6.57 ± 0.77	6.67 ± 0.94	0.387
Pre-treatment CT grade	4.02 ± 0.41	4.04 ± 0.41	0.714

CT computed tomography

(RMB), 6893.9 ± 2414.1 RMB, and 956.7 ± 934.2 RMB, respectively, which were significantly less than the total costs of hospitalization (14,436.9 ± 5548.1 RMB), drug (7823.4 ± 3064.6 RMB), and antibiotics (1230.7 ± 916.2 RMB) in the control group ($P = 0.040$, 0.012, and 0.026, respectively) (Table 2).

One-month subsequent visit rate

In the intervention group, 112 of 119 patients (94%) had the specified indicators evaluated and abdominal CT scans performed at an outpatient clinic 1 month after discharge. In the control group, 87 of 109 patients (79.8%) visited an outpatient clinic at 1 month. The difference between the two groups was significant ($P = 0.001$).

Satisfaction

Follow-up satisfaction with hospital services (0 representing "not satisfied", 1 representing "a little satisfied", and 2 representing "satisfied") was also evaluated. As shown in Table 3, in the intervention group, 103 patients were "satisfied" (206 points), 16 patients were "a little satisfied" (16 points), and no patients were "not satisfied" for 222 points in total, with an average score of 1.87. In the control group, 87 patients were "satisfied" (174 points), 13 patients were "a little satisfied" (13 points), and 9 patients were "not satisfied" for 187 points in total, with an average score of 1.72. There was a significant difference between the two groups ($P < 0.001$). Patients' satisfaction with clinical pharmacist participation in the intervention group was good, with 48 patients who were "satisfied" and 2 who were "a little satisfied".

Table 3 Follow-up satisfaction with hospital services of the two groups(mean ± SD/case, %)

Items	Intervention group (n = 119)	Control group (n = 109)	*P*
Not satisfied ("0")	0	9	
A little satisfied ("1")	16	13	
Satisfied ("2")	103	87	
Total score (mean)	222 (1.87)	187 (1.72)	< 0.001

Discussion

Data from the literature highlight the importance of pharmacist participation with regard to improving disease prevention and treatment, reducing medication errors, and many others. The results of this retrospective study show that clinical pharmacist intervention can effectively reduce costs, improve patient follow-up compliance, and improve patient satisfaction without affecting clinical outcomes, suggesting that clinical pharmacists have certain value in clinical work.

Clinical pharmacists worked closely with clinicians and caregivers to promote proper clinical drug use, evaluated the medical recommendations daily and discussed concerning medical recommendations with the attending physician. For example, one patient diagnosed with severe acute pancreatitis in our hospital had a poor general condition. For the initial treatment, piperacillin/tazobactam, amikacin and metronidazole were selected for anti-infective treatment. The antibacterial spectrum of antibiotics for acute pancreatitis should cover gram-negative bacteria and anaerobic bacteria, and the antibiotics should have strong fat solubility and effectively penetrate the blood-pancreatic barrier. Pharmacists suggested that amikacin has a low concentration in the pancreas and is not recommended as the first choice for pancreatitis. After 3 days of treatment, the patient developed a high fever and cough. The pharmacist suggested that the antibiotics should be adjusted, and the broad-spectrum and strong imipenem/cilastatin sodium was selected for treatment. After the change in drug regimen, the patient's body temperature gradually returned to normal, the cough improved, and the white blood cell (WBC) count and blood amylase levels returned to normal. The pharmacists also conducted individualized medication monitoring for patients. Patients were closely monitored for renal function, and the infusion rate was adjusted as necessary to reduce adverse reactions. Through the close collaboration of physicians, nurses, and pharmacists, patient health can be restored more quickly, and the patient's hospitalization experience can be improved.

Table 2 The treatment effects, ADRs and costs of the two groups (mean ± SD/case, %)

Items	Intervention group (n = 119)	Control group (n = 109)	*P*
CT grade after treatment	2.01 ± 0.31	2.06 ± 0.37	0.216
ADRs	1 (0.8)	4 (3.7)	0.196
Average hospital stay	11.3 ± 3.3	11.2 ± 2.9	0.807
Total hospitalization fee (RMB)	13,069.8 ± 4431.7	14,436.9 ± 5548.1	0.040
Total drug charges (RMB)	6893.9 ± 2414.1	7823.4 ± 3064.6	0.012
Antibiotic costs (RMB)	956.7 ± 934.2	1230.7 ± 916.2	0.026

ADR adverse drug reaction

One of the most deadly complications of acute pancreatitis is secondary infection of the pancreas or peripancreatic necrosis [11]. Preventive use of antibiotics does not reduce pancreatic necrosis-associated infections [12]; therefore, antibiotics should be used only when an infection is confirmed or clinically suspected. A study by Najafzadeh et al. [13] showed that pharmacist intervention can save patient costs, and Shayegani [14] demonstrated that pharmacists can improve the reasonable rate of prescription. In the treatment of acute pancreatitis in our hospital, there were cases of irregular use of antibiotics, and some patients who did not clearly have combined infections were administered preventive antibiotics. In patients with coinfections, the antibiotic selection and frequency of dosing were not appropriate. Clinical pharmacists were involved in assessing the patients' drug indications, and patients with secondary infections were offered antibiotic treatment strategies. Compared with cases in which no clinical pharmacists were involved, the use and cost of antibiotics decreased significantly and did not affect prognosis.

In patients with acute pancreatitis, approximately 17–22% of patients develop recurrence, and 8–16% of patients develop chronic pancreatitis [15–17]. Therefore, undergoing a repeated abdominal CT at an outpatient clinic 1 month after discharge is very important for recovery and assessment of additional treatment options [18]. The follow-up rate in the intervention group was higher than that in the control group, which suggests that the intervention group had better compliance. The possible reasons are as follows. Physicians were usually busy elsewhere; thus, when the patients were discharged from the hospital, patient education was provided only in a written form, and the oral explanation was relatively simple. Clinical pharmacists could detail the patient's drug regimens and inform the patient of medication precautions, such as what to do after a missed dose, which drugs should be taken on an empty stomach or after a meal, and which drugs should not be taken with milk, juice, or tea. Clinical pharmacists also informed patients about lifestyle adjustments after discharge, such as a low-fat diet, smoking cessation, and alcohol abstinence, and discussed the relevant indicators that should be evaluated during outpatient follow-up and the significance and importance of the abdominal CT. Clinical pharmacist participation promoted trust and communication between physicians and patients, increased patient compliance and satisfaction, improved the rate of return visits, and potentially reduced the likelihood of recurrent pancreatitis.

Currently, in China, physicians are allowed to write prescriptions, while pharmacists are responsible for monitoring the prescriptions. Therefore, under such a context, the value of pharmacists cannot be maximized. The relevant departments of the State should attach importance to the work of pharmacists and maximize their value. Clinical pharmacists can evaluate the patient's personal physiological and pathological states, drug regimen, and clinical response to assist physicians in optimizing treatment and improving efficacy and safety.

Our study had some limitations that deserve comment. At present, some patients with severe pancreatitis were transferred to an intensive care unit (ICU) because of critical illness; therefore, the patients we enrolled were mostly those with mild to moderate pancreatitis, and fewer severe pancreatitis patients participated. More samples are needed in the future for comparative analysis. Another limitation was the inability to determine causality in retrospective studies as well as a possible lack of power to detect differences in some of the study outcomes.

Conclusion

Clinical pharmacists' extensive knowledge of medications includes a deep understanding of the mechanisms of action, pharmacokinetics, and pharmacodynamics. Their participation in clinical diagnosis and treatment can assist physicians. The participation of clinical pharmacists in the treatment of acute pancreatitis can effectively reduce hospitalization, drug, and antibiotic costs, ensure the rational use of drugs in the clinic, improve patient follow-up compliance, and improve patient satisfaction. To promote a greater participation of pharmacists, a pharmacist rounds system and consultation system could be established to enable pharmacists to perform prescription examinations and ADR monitoring. In addition, the establishment of a consultation service system with clinical pharmacists can also improve the level of rational drug use.

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Conflicts of interest No conflicts of interest are declared.

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