Rationality Analysis of Proton Pump Inhibitors in Cardiovascular Hospitalized Patients

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Abstract

Objective: To investigate the rationality of proton pump inhibitors (PPIs) in cardiovascular inpatients, and to provide data support for clinical rational drug use and drug management; Methods: The use of PPIs in some departments in our hospital in 2021 was retrieved by means of retrospective analysis, relying on the HIS system and HPMS system, and statistics were made on the number of PPIs used, frequency of medication, and distribution of departments. At the same time, 100 patients were randomly opted. Medical records, analysis of drug indications, timing of drug administration and rationality of drug use; Results: (1) The total amount of drugs used by hospitalized patients in the opted departments in 2021 was 210631 million yuan, of which the total amount of PPIs was 393.88 million yuan, accounting for 1.87%, the total amount of PPIs injections in hospitalized patients was 223.32 million yuan, accounting for 56.70% of the total amount of PPIs, and the total amount of oral preparations was 17.0.56 million yuan, accounting for 43.30% of the total amount of PPIs; (2) The cardiology ward, cardiac surgery ward, respiratory ward, and hematology ward were the top 4 PPIs in the inpatient departments; (3) Rabeprazole Sodium Enteric-coated Capsules had the highest sales volume in the cardiology ward and cardiac surgery inpatients; (4) The medical records of 100 patients discharged from cardiovascular hospitalization using PPIs in 2021 were collected, and the analysis showed that 7 of 100 patients had no risk factors for SU, suggesting that they had unindicated medication and 93 patients had 1-4 risk factors; (5) 37 of 100 patients used 1 PPIs, 50 patients used 2 PPIs, and 12 patients used 3 PPIs; (6) 5 of 93 patients with medication indications used PPIs preoperatively, 85 patients used PPIs postoperatively, and the course of SU prevention was 1-18 days, with an average of (4.23±1.12) s. 45 patients continued to use PPIs after the risk factors disappeared, and 7 patients continued to use PPIs from postoperative to discharge; Conclusion: The rationality of the use of PPIs in cardiovascular hospitalized patients is high, but it is still necessary to regulate the use of PPIs and do medication interventions to avoid excessive use of PPIs.

Keywords

Proton pump inhibitors, Cardiovascular hospitalized patients, Rationality of medication, Application analysis

Introduction

Proton pump inhibitors (PPIs), also known as H+-K+-ATPase inhibitors, are drugs that inhibit gastric acid secretion [1]. Omeprazole is the earliest listed drug among PPIs, and other PPIs such as lansoprazole, pantoprazole, and rabeprazole have been used in clinical practice successively [2]. PPIs are mainly effective in acidic environments and can be converted into sulfenic acid and sulfonamides compounds, which combine with semi-light amino acid residues to inactivate H+-K+-ATPase and finally inhibit gastric acid secretion. [3]. PPIs are currently the main drugs for the healing of peptic ulcer, Helicobacter pylori infection, gastroesophageal reflux and other diseases. They

have the characteristics of strong action and long duration of action. Some current studies have confirmed that long-term use of PPIs has good tolerance, and the adverse reactions are milder than other acid-suppressing drugs, and it is a relatively safe acid-suppressing drug [4,5]. In recent years, the prevalence of digestive system diseases has been increasing year by year. PPIs are used by many departments and diseases because of their role in preventing stress ulcers, and the utilization rate is high [6]. However, with the wide application of PPIs, the phenomenon of irrational use of such drugs has become increasingly prominent, such as prophylactic medication for non-difficult and complex perioperative stress ulcers, and the use of PPIs to prevent stress ulcers or stress ulcers in the absence of other combined risk factors. Gastric hemorrhage, etc. [7]. The unreasonable application of PPIs will cause waste of medical resources on the one hand and increase the medical burden of patients on the other hand. Therefore, the evaluation of the application of PPIs has positive significance for improving the rational application rate and reducing unnecessary medical expenses for patients [8]. This study intends to analyze and study the use of PPIs in 2021 by taking cardiovascular inpatients in our hospital as the research objects, to provide clinical reference for optimizing the utilization of PPIs.

Materials and methods

General data

The use of PPIs in some departments of our hospital in 2021 was retrieved by means of retrospective analysis, relying on the HIS information system (hospital information system) and the HPMS Hospital Pharmacy Management System (Hospital Pharmacy Management System). The frequency of medication, the distribution of departments and other information were counted, and the medical records of 100 patients were randomly opted to analyze the indications, timing and rationality of medication [9].

Research methods

According to the daily dose (DDD) method defined by the World Health Organization (WHO) [10], the sales amount of PPIs, the frequency of drug use (DDDs), the average daily cost of drugs (DDC), and the ranking ratio (B/A) were calculated. Refer to relevant guidelines to evaluate the rationality of preventive medication of PPIs (mainly to judge the rationality of the route of administration, usage and dosage of PPIs).

Results

The use and distribution of PPIs in hospitalized patients in the whole hospital in 2021

The total amount of drugs used by inpatients in the hospital in 2021 will be 210.631 million yuan, of which the total amount of PPIs will be 3.9388-million-yuan, accounting for 1.87%. Inpatients used a total of 5 PPIs, including 4 injections with a total amount of 2.2332-million-yuan, accounting for 56.70% of the total PPIs, and 6 oral preparations with a total amount of 1.7056-million-yuan, accounting for 43.30% of the total PPIs.

The amount of rabeprazole sodium enteric-coated capsules ranks first, and the amount of pantoprazole for injections in injections ranks first. Table 1 and Figure 1.

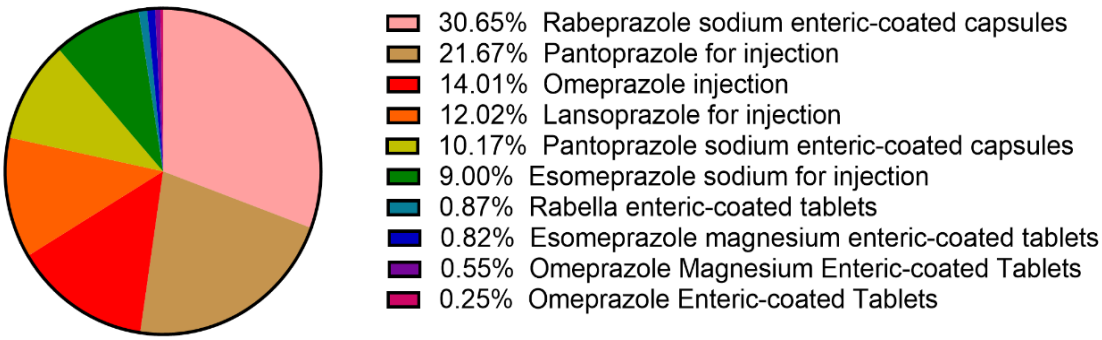

Figure 1. Use and distribution of PPIs in hospitalized patients in the whole hospital in 2021.

Table 1. Use and distribution of PPIs in hospitalized patients in the whole hospital in 2021.

Drug name	Sales amount / million	DDD /mg	DDDs	DDC /yuan	B/A	Proportion of total PPIs / %
Rabeprazole sodium enteric capsules	120.71	20	207107	6.24	1.00	30.65
Pantoprazole for injection	85.37	40	8438	101.22	0.40	21.67
Omeprazole for injection	55.17	20	28487	23.65	1.00	14.01
Lansoprazole for injection	47.34	30	11375	40.25	1.00	12.02
Pantoprazole sodium enteric capsules for injection	40.04	40	8212	4.68	2.50	10.17
Esomeprazole sodium for injection	35.44	40	3512	100.56	0.54	9.00
Rebella enteric tablets	3.42	20	5463	5.26	1.15	0.87
Esomeprazole enteric tablets	3.22	40	1821	18	0.81	0.82
Omeprazole magnesium enteric tablets	2.18	20	1855	12.04	1.00	0.55
Omeprazole enteric tablets	1.00	20	3767	3.62	1.46	0.25

The total amount of PPIs was 3.9388 million yuan, the amount of rabeprazole sodium enteric-coated capsules ranked first in oral preparations, and the amount of pantoprazole for injection ranked first in injections. This indicates that both oral and injectable PPIs play a key role in clinical use, with rabeprazole and pantoprazole showing clear advantages in their respective formulations.

Distribution of usage of PPIs inpatient departments

The inpatient departments are arranged according to the sales sale number of PPIs, and the cardiology ward, cardiac surgery ward, respiratory ward, and hematology ward are the top 4 applied PPIs in the opted inpatient departments. Table 2 and Figure 2.

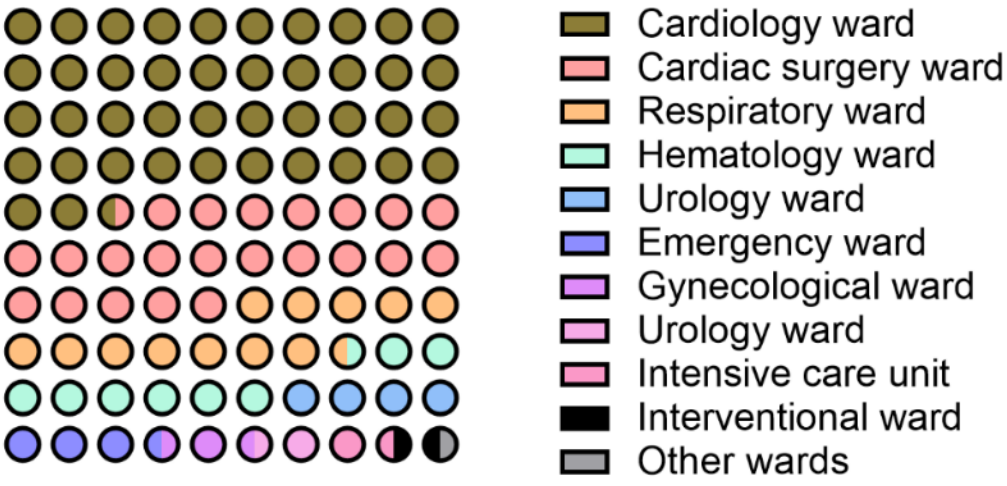

Figure 2. Distribution of PPIs inpatient department usage.

Table 2. Distribution of PPIs inpatient department usage.

Departments	Sales amount / million	Proportion/%	Number of discharges	Number of PPIs used	Usage rate/%
Cardiology ward	167.08	42.42	805	655	81.37
Cardiac surgery ward	89.53	22.73	250	188	75.30
Respiratory ward	48.40	12.29	-	-	-
Haematology ward	33.71	8.56	42	20	47.62
Urology ward	15.40	3.91	53	23	42.77
Emergency medicine ward	13.22	3.36	23	14	60.29
Gynaecology ward	8.84	2.24	30	18	60.67
Urology ward	6.66	1.69	41	11	26.02
Intensive care medicine ward	5.63	1.43	24	10	42.25
Interventional medicine ward	3.74	0.95	-	-	-
Other	1.67	0.14	563	102	18.12

Cardiology wards, cardiac surgery wards, respiratory wards, and hematology wards are the top 4 applied PPIs in inpatient departments. This reflects the high demand for acid suppression therapy in patients with cardiovascular, respiratory, and hematological conditions during hospitalization. Such usage patterns also indicate that PPIs have become an indispensable supportive treatment to reduce gastrointestinal complications and improve overall patient outcomes in these departments.

Analysis of the use of PPIs in cardiovascular hospitalized patients

A separate analysis of inpatients in cardiology showed that rabeprazole sodium enteric-coated capsules had the highest sales in the use of PPIs, and a separate analysis of inpatients in cardiac surgery showed that rabeprazole sodium enteric-coated capsules had the highest sales in the use of PPIs the highest, Table 3, Table 4, Figure 3.

Table 3. Analysis of PPIs usage among inpatients in cardiology department.

Drug name	Amount / RMB 10,000	Proportion/%	DDDs	Proportion/%	Amount / RMB 10,000	Proportion/%
Rabeprazole sodium enteric capsules	108.70	65.06	152286	66.06	146.22	87.51
Pantoprazole sodium enteric capsules	33.71	20.17	70545	30.6		
Rebella enteric tablets	2.07	1.24	4422	1.92		
Esomeprazole enteric tablets	1.70	1.02	1038	0.45		
Omeprazole magnesium enteric tablets	0.03	0.02	24	0.01		
Omeprazole enteric tablets	0.00	0.00	37	0.02	146.22	87.51
Pantoprazole for injection	19.10	11.43	1999	0.87	20.86	12.49

Drug name	Amount / RMB 10,000	Proportion/%	DDDs	Proportion/%	Amount / RMB 10,000	Proportion/%
Esomeprazole sodium for injection	1.74	1.04	168	0.07	20.86	12.49
Omeprazole for injection	0.02	0.01	6	0.003		
Lasoprazole for injection	0.01	0.00	2	0.001		

Table 4. Analysis of the use of PPIs in cardiac surgery in patients.

Drug name	Amount / RMB 10,000	Proportion/%	DDDs	Proportion/%	Amount / RMB 10,000	Proportion/%
Rabeprazole sodium enteric capsules	16.71	18.66	18411	41.33	27.29	30.48
Pantoprazole sodium enteric capsules	8.04	8.98	6563	14.73		
Rebella enteric tablets	0.90	1.00	3023	6.78		
Esomeprazole enteric tablets	0.80	0.90	1714	3.85		
Omeprazole magnesium enteric tablets	0.44	0.49	254	0.57		
Omeprazole enteric tablets	0.40	0.45	385	0.87		
Pantoprazole for injection	23.41	26.14	6266	14.07	62.24	69.52
Esomeprazole sodium for injection	20.51	22.90	2220	4.98		
Omeprazole for injection	12.07	13.49	5008	11.24		
Lansoprazole for injection	6.25	6.98	707	1.59		

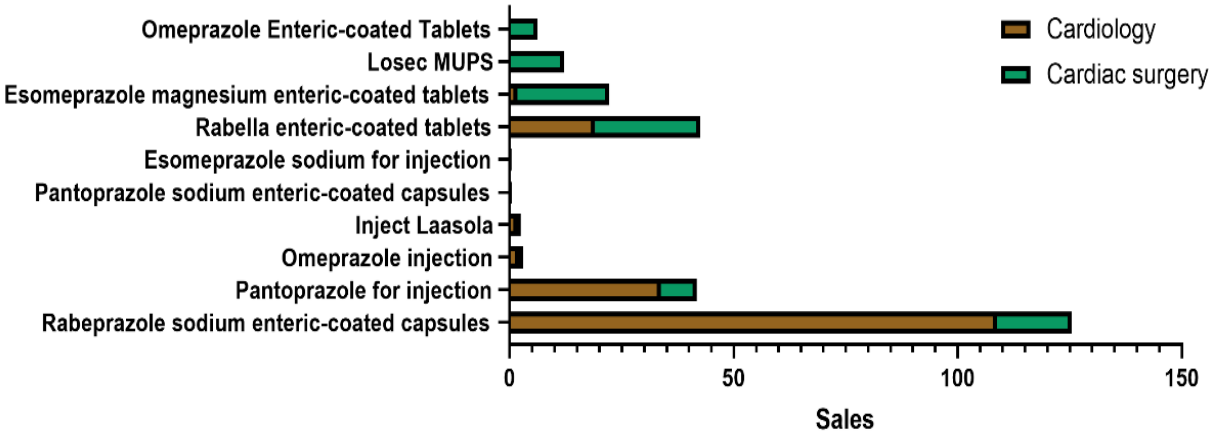

Figure 3. Analysis of PPIs usage in cardiovascular hospitalized patients.

Rabeprazole sodium enteric-coated capsules have the highest sales in the use of PPIs in both cardiology and cardiac surgery inpatients. This suggests that rabeprazole is widely recognized and

preferred for managing gastric acid-related issues in these patient groups. The use of PPIs in these settings highlights their importance in preventing complications such as stress ulcers and acid reflux. Meanwhile, the widespread adoption of rabeprazole in cardiology and cardiac surgery reflects its clinical efficacy and safety. Thus, its dominant position demonstrates not only physicians' trust in its therapeutic value but also its significant contribution to enhancing the quality of care for these high-risk patients.

Rational analysis of the use of PPIs in cardiovascular hospitalized patients

The medical records of 100 patients who were discharged from the hospital using PPIs in cardiovascular hospitalization in 2021 were opted, and the analysis showed that 7 of the 100 patients had no risk factors for SU, suggesting the existence of off-label medication. This finding indicates the need for more stringent guidelines on PPI use to prevent unnecessary prescriptions. Furthermore, 93 patients had 1-4 risk factors, as shown in Table 5.

Table 5. Risk factors and medication indications of patients using PPIs in cardiovascular hospitalization.

Risk factors	Indications for medication	N	Proportion/%
0	None	7.00	7.00
1	Major surgery	49.00	49.00
2	Major surgery, duration of mechanical ventilation >48h	37.00	37.00
3	Major surgery, duration of mechanical ventilation >48h, duration in intensive care unit >7d + parenteral nutrition support	4.00	4.00
4	Major surgery, duration of mechanical ventilation >48h, duration of intensive care unit >7d + parenteral nutrition support, acute renal failure	3.00	3.00

Dosage, route and frequency of PPIs administration in cardiovascular hospitalized patients of the 100 patients investigated, 37 patients used 1 PPIs, 50 patients used 2 PPIs, and 12 patients used 3 PPIs, Table 6.

Table 6. Dosage, route and frequency of PPIs administration in cardiovascular hospitalized patients.

Type of drug	Dose/mg administered	Route of administration	Dosing frequency	n
Omeprazole	40	Intravenous drip	1 time/d	24
	40	Intravenous drip	2 times/d	1
Esomeprazole	20	Oral	1 time/d	1
	40	Intravenous drip	1 time/d	21
Lansoprazole	30	Intravenous drip	1 time/d	23
	30	Intravenous drip	2 times/d	48
Pantoprazole	40	Intravenous drip	1 time/d	25
		drip		

Type of drug	Dose/mg administered	Route of administration	Dosing frequency	n
Pantoprazole	40	Oral	2 times/d	1
Rabeprazole	10	Oral	1 time/d	7
	20	Oral	2 times/d	1

The timing of administration and the rationality of the course of healing 93 patients had medication indications, of which 5 patients used PPIs before surgery, 85 patients used PPIs after surgery, and the course of SU prophylaxis was 1-18 days, with an average of (4.23±1.12) s, and 45 patients after the disappearance of risk factors PPIs continued to be used, and 7 patients continued to use PPIs from postoperative to discharge.

Discussion

Proton pump inhibitors (PPIs) are first-line drugs used clinically for acid-related diseases of the digestive tract system, and such drugs mainly act on the last link of gastric acid secretion and irreversibly inactivate the proton pump by covalent binding to H+-K+-ATPase, ultimately playing a role in inhibiting gastric acid secretion [11,12]. PPIs are currently the most potent class of drugs that inhibit gastric acid secretion and are characterized by long acid suppression time and high efficiency and are widely used in the healing of a variety of diseases, in addition to the healing of Helicobacter pylori infection, such drugs are often used to prevent stress ulcers [13].

Relevant statistics point out that in recent years, the use of PPIs in Western countries and my country has shown an upward trend year by year, but nearly 46%-61% of PPIs use excessive or irrational drug use, which takes up a lot of medical resources and provides medical resources. Patients bring a greater burden [14]. One study found that physicians lacked awareness of the unreasonable use of PPIs, which led to an increase in their related prescribing behaviors. In addition, the education level and income level of patients were also important reasons for the unreasonable use of PPIs [15].

By including hospitalized patients in hospitals in 2021 as the study subjects, it was found that the annual sales number of PPIs accounted for 2.87% of the total amount of hospitalization, of which rabeprazole sodium enteric-coated capsules and pantoprazole for injection ranked first in the sales amount of oral and injectable PPIs. A study of rabeprazole enteric-coated capsules pointed out that this drug has a strong acid-inhibitory effect, while having more targets of action, and can achieve better acid-inhibitory effect in a short time, so it is favored by most medical institutions and patients [16].

The results of this study suggest that rabeprazole sodium enteric-coated capsules have the highest DDDs, but the DDC value is not high, which suggests that the drug has a good economic effect, in contrast to pantoprazole for injection, which has a higher sales amount and DDDs rank fourth, which shows that the drug is more expensive and the use of over healing is more common, and medical institutions should focus on it.

Further analysis of different departments shows that cardiology and cardiac surgery are the departments with the highest sales of PPIs, and their sales of PPIs are 42.42% and 22.73% of the sales of PPIs in the whole year, which is like the research results of other scholars. The results of the analysis of the use of PPIs by inpatients in a tertiary hospital show that the use of PPIs in the cardiovascular department is relatively common in the hospital, and the annual sales of PPIs in the cardiovascular department accounted for 62.01% of the total annual sales of PPIs, which is like the 65.15% in this study [17]. The authors analyzed that the main reason for the use of PPIs in cardiovascular patients is to prevent stress ulcers, which was also mentioned in a 2016 guideline in the United States [18]. After the history of bleeding disorders and other conditions, patients can be evaluated for bleeding risk, and the final

decision on whether PPIs can be used prophylactically.

However, some studies have pointed out that due to the interaction between PPIs and clopidogrel, the use of PPIs with strong effects should be avoided as much as possible, and rabeprazole with less interaction should be used instead [19]. The reason is that this study mainly evaluates the comprehensive use of PPIs. If a representative case is analyzed, it will help to improve the credibility of the data.

Finally, the risk factors and indications of PPIs in cardiovascular hospitalization were analyzed. The results showed that 97 of 100 opted medical records had 1-4 risk factors, and only 3 patients had unindicated medication, which was also contrary to the research results of other scholars. A retrospective study on the use of PPIs in a tertiary care hospital in recent 10 years showed that from 2007 to 2016, the hospitalization rate of PPIs increased from 20.41% to 32.14%, of which the interventional department was the department with the highest use rate of PPIs, while the medical records collected from 500 cases showed that 125 cases were used without indications, accounting for 40.67% [20]. The authors analyzed that the reasons for the above significant differences may be related to the fact that the scholar's study belongs to a large sample and is analyzed across multiple years, with a large time span. In the past, medical institutions did not recognize the irrational use of PPIs, so the use of drugs without indications in the early stage of the study was more obvious. The differences from this study precisely suggest that medical workers have paid more attention to the rational use of PPIs in recent years. However, it should also be recognized that PPIs are currently used more frequently in cardiovascular departments, and management supervision of this class of drugs should be effectively strengthened to eliminate the emergence of medication without indications.

Conclusion

In conclusion, the application of PPIs in cardiovascular hospitalized patients is reasonable, but it is still necessary to standardize the use of PPIs and do a good job of drug intervention to avoid excessive use of PPIs.

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Conflicts of Interest

The authors declare no conflict of interest.

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