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Original Research Article

Inappropriate Proton Pump Inhibitor Prescribing in Hospitalized Patients: Rate and Reasons for Prescription

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Abstract:

Background: Proton pump inhibitors (PPIs) are widely prescribed for acid-related disorders, but inappropriate use in hospitalized patients can increase risks such as Clostridium difficile infection and pneumonia.

Aim: To assess the rate and reasons for inappropriate PPI prescribing among hospitalized patients.

Methodology: A retrospective observational study was conducted at Anugrah Narayan Magadh Medical College and Hospital, India, over six months, including 1,780 adult patients admitted to medicine and allied departments. Data on demographics, PPI prescriptions, indications, and complications were collected from medical records. Appropriateness of PPI use was evaluated based on established clinical guidelines. Statistical analysis was performed using SPSS.

Results: PPIs were prescribed to 820 patients (46.1%), of whom only 280 (34.1%) had a valid indication, most commonly GERD (8.8%) and peptic ulcer disease (6.6%). Inappropriate use was higher in general wards (69.0%) than in ICUs (58.5%). PPI users had higher rates of Clostridium difficile infection (2.9% vs. 0.9%, $p<0.001$) and pneumonia (12.0% vs. 7.5%, $p=0.003$). Chart review revealed 80% of prescriptions without valid indication were for prophylaxis, undocumented reasons, or continuation of home medications.

Conclusion: Inappropriate PPI prescribing is common among hospitalized patients, particularly in general wards, and is associated with increased infectious complications. Enhanced guideline-based prescribing and documentation are essential to improve patient safety.

Keywords: Proton pump inhibitors, inappropriate prescribing, hospitalized patients, GERD, Clostridium difficile, pneumonia.

Introduction

The proton pump inhibitors (PPIs) belong to the category of most frequently prescribed medications and are one of the pillars of the treatment of acid-related GIT disorders. PPIs are the third most prescribed category of medication in the United States where it brings about 13.6 billion in annual sales. The reason why they have so widely been used is not only due to their proven efficacy in the control of gastric acid secretion, but also because of their usefulness in the treatment of such conditions as gastroesophageal reflux disease (GERD), peptic ulcer disease, and prevention of rebleeds in patients with gastrointestinal hemorrhage [1]. Along these thoroughly documented and clinically significant therapeutic advantages, more and more clinicians have expressed concerns about the excess and possible negative pharmacologic effects of PPIs, especially in hospitalized patients.

The clinical advantages of PPIs are proven. They have major effects of decreasing gastric acid secretion that results in healing of erosive esophagitis and ulcerative lesions, as well as positive patient-reported outcomes, e.g. improvement of symptoms in GERD. Additionally, there are indications that in acute care patients, the treatment of gastrointestinal bleeding with PPIs has demonstrated a mortality benefit, stabilized mucosal injury, and prevented recurrent bleeding [2]. Nevertheless, in addition to their therapeutic value, PPIs have a variety of positive adverse effects that also pose significant safety concerns. Interestingly, the use of PPI over long

periods or when not necessary has been associated with increased occurrence of Clostridium difficile infection, [3] a deadly, and possibly fatal, gastrointestinal infection. PPIs are also implicated in less efficacy of clopidogrel in patients with acute coronary syndrome, [4] and higher risk of community-acquired and hospital-acquired pneumonia [5]. The mentioned risks indicate that caution is required when selecting the patient and prescribing medications. In addition, in March 2011, the U.S. Food and Drug Administration (FDA) issued a warning about the possible presumably caused by PPIs provoking hypomagnesemia that may cause muscle spasms, irregular heartbeat, and convulsion. This recommendation amplified the issue of long-term and improper application, especially in vulnerable populations in the hospitals.

Inappropriate prescribing of PPI is still high even with the known risks. According to both primary care and hospital-based research, the vast percentage of patients are prescribed PPIs without a clear, guideline-based indication [6]. As a part of primary care, non-specific dyspepsia routine prescribing of PPIs, stress ulcer prophylaxis in low-risk patients, or as an extension of previous outpatient prescribing has been reported [7]. Similar to the case with hospital-based research, overutilization is proposed, with small-scale research that indicates high rates of the initiation of PPI therapy that cannot be supported by evidence-based justification [8]. The effects of making inappropriate prescriptions are complex such as amplified chances of adverse events, unjustified medical expenditures, and the possibility of medication interactions at the expense of patient safety.

The processes underlying the inappropriate use of PPI among hospitalized patients are multifactorial and multidimensional. The factors involved may include clinician practices, defensive medicine, perceived expectations of patients, and the continuance of outpatient prescriptions. Also, stress ulcer prophylaxis protocols in hospitals tend to promote the use of PPI in the intensive care units or in patients who seem to be at risk despite the absence of objective indicators of prophylaxis. This tendency can also spread to the cases of low-risk patients unwittingly, which will increase the inappropriate use rates even more. The key to informing interventions targeting the improvement of prescribing practice and patient safety, therefore, lies in understanding the prevalence and the underlying causes of the inappropriate prescription of PPI.

Considering all these, the current study sought to examine the level and factors of inappropriate prescribing of PPI in patients who are hospitalized. Our hypothesis was that a large percentage of inpatients are given PPI therapy without an indication that is supported by guidelines. To test this hypothesis, we compared two samples of the hospitalized patients, one of these samples was administrative data covering 6.5 million discharges in the U.S. university hospitals, to determine whether they used PPI in appropriate circumstances or as a result of appropriate diagnosis. When we studied the prescribing pattern and how well it complies with the accepted clinical guidelines, we were interested in determining the rate of inappropriate use as well as the factors which contribute to the inappropriate use. The given work offers a basis of specific interventions to maximize the use of PPI, decrease the number of adverse events which can be avoided, and ensure the use of evidence-based medication stewardship in hospitals.

Methodology

Study Design: This study was a retrospective observational cross-sectional study conducted to evaluate the rate and reasons for inappropriate Proton Pump Inhibitor (PPI) prescribing among hospitalized patients.

Study Area: The study was conducted in the Anugrah Narayan Magadh Medical College and Hospital, under the Department of Pharmacology, Gaya, Bihar, India.

Study Duration: The study was carried out over a period of 6 months from May 2025 to October 2025.

Sample Size: The total sample size included 1780 hospitalized patients admitted during the study period.

Study Population: The study population consisted of adult patients admitted to Medicine and allied departments of the hospital during the study duration. If patients had more than one admission during the study period, only data from the first admission were considered to avoid duplication.

Inclusion Criteria

- Patients aged 18–90 years
- Patients admitted to Medicine or allied clinical departments
- Patients who received at least one dose of a Proton Pump Inhibitor (omeprazole, pantoprazole, esomeprazole, rabeprazole, or lansoprazole) during hospitalization
- Patients with complete medical records available

Exclusion Criteria

- Patients below 18 years and above 90 years of age
- Pregnant women
- Prisoners
- Patients with incomplete or missing medical records
- Patients admitted for less than 24 hours

Data Collection: Data were collected retrospectively from inpatient medical records of patients

admitted during the six-month study period at the Department of Pharmacology, Anugrah Narayan Magadh Medical College and Hospital. Relevant information was obtained from case sheets, admission notes, discharge summaries, pharmacy dispensing records, laboratory reports, and endoscopy reports where available. The collected variables included demographic details (age and gender), admitting and discharge diagnoses, name of the prescribed Proton Pump Inhibitor (PPI), dose, route of administration, duration of therapy, and documented indication for PPI use. The appropriateness of PPI prescriptions was assessed based on established clinical guidelines and accepted indications such as gastroesophageal reflux disease, peptic ulcer disease, upper gastrointestinal bleeding, Helicobacter pylori eradication therapy, and stress ulcer prophylaxis in high-risk patients. Prescriptions without documented or guideline-supported indications were categorized as inappropriate.

Procedure: A list of hospitalized patients during the study period was obtained from the Medical Record Department. Patients who received at least one dose of a PPI during hospitalization were identified through pharmacy records. For patients with multiple admissions during the study period, only the first admission was considered for analysis to prevent duplication of data. Each identified case record was reviewed thoroughly to determine whether the PPI prescription had a valid clinical indication. Prescriptions were classified as appropriate or inappropriate based on predefined criteria. To ensure data accuracy, a random subset (approximately 5%) of cases categorized as inappropriate was re-evaluated in detail by reviewing clinical notes and investigation reports to confirm the absence of valid indications. All collected data were entered into a structured data collection form and subsequently transferred to statistical software for analysis.

Statistical Analysis: All collected data were entered into Microsoft Excel and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0. Continuous variables such as age were expressed as mean ± standard deviation (SD), while categorical variables such as gender, indication for PPI use, and appropriateness of prescription were presented as frequencies and percentages. The Student's t-test was used to compare continuous variables between groups, and the Chi-square test was applied to assess associations between categorical variables. Bonferroni correction was applied for multiple comparisons where necessary. A p-value of less than 0.05 was considered statistically significant, and for multiple categorical comparisons, a p-value of less than 0.01 was considered statistically significant."

Result

Table 1 details the valid indications for proton pump inhibitor (PPI) use among 820 patients. The most common indications were GERD (72 patients, 8.8%) and peptic ulcer disease (54, 6.6%), followed by gastritis/duodenitis (40, 4.9%), upper GI bleeding (32, 3.9%), and NSAID-induced ulcer prophylaxis in high-risk patients (34, 4.1%). Less frequent indications included H. pylori eradication therapy (18, 2.2%), Barrett's esophagus (10, 1.2%), and other documented acid-related disorders (20, 2.4%). Overall, only 280 patients (34.1%) had a documented valid indication for PPI therapy, highlighting substantial inappropriate use among the remaining 65.9% of PPI users.

Table 1: Valid Indications for Proton Pump Inhibitors (Among PPI Users, n = 820)

Indication	Number of Patients (n)	Percentage (%)
Gastroesophageal reflux disease (GERD)	72	8.8
Peptic ulcer disease	54	6.6
Upper GI bleeding	32	3.9
Gastritis/Duodenitis	40	4.9
H. pylori eradication therapy	18	2.2
NSAID-induced ulcer prophylaxis (high risk)	34	4.1
Barrett's esophagus	10	1.2
Others (documented acid-related disorders)	20	2.4
Total with valid indication	**280**	**34.10%**

Table 2 summarizes admission characteristics of the 1,780 patients in the study. PPIs were prescribed to 820 patients (46.1%), while 960 patients (53.9%) did not receive PPIs. The mean age of PPI users was 56 ± 14 years, slightly higher than non-users (52 ± 16 years). Gender distribution was similar, with 57.1% male and 42.9% female among PPI users, compared to 54.0% male and 46.0% female in non-users. ICU admissions were more common in the PPI group (30.0%) versus the non-PPI group (17.5%), whereas general ward admissions predominated among non-PPI patients (82.5%) compared to PPI users (70.0%), suggesting higher PPI use in more critically ill patients.

Table 2: Admission Characteristics of Study Population (N = 1780)		
Characteristic	**Received PPI (n = 820)**	**No PPI (n = 960)**
Number (%)	820 (46.1%)	960 (53.9%)
Age (mean ± SD)	56 ± 14	52 ± 16
Male (%)	468 (57.1%)	518 (54.0%)
Female (%)	352 (42.9%)	442 (46.0%)
ICU stay (%)	246 (30.0%)	168 (17.5%)
General ward only (%)	574 (70.0%)	792 (82.5%)

Table 3 summarizes PPI use among 820 patients (46.1% of the total population). Only 280 patients (34.1% of PPI users) had a valid indication, while the majority, 540 patients (65.9%), received PPIs without a valid reason. Subgroup analysis by location showed that in the ICU (n=246), 102 patients (41.5%) had a valid indication and 144 (58.5%) did not, whereas in the general ward (n=574), 178 patients (31.0%) had a valid indication and 396 (69.0%) did not. This highlights that inappropriate PPI use was more common in general wards than in ICUs.

Table 3: Patients Receiving PPIs With and Without Valid Indication		
Variable	**Number (%)**	
Total patients receiving PPIs	820 (46.1% of total)	
Patients with valid indication	280 (34.1% of PPI users)	
Patients without valid indication	540 (65.9% of PPI users)	
Subgroup Analysis		
Location of Stay	**With Valid Indication**	**Without Valid Indication**
ICU (n = 246)	102 (41.5%)	144 (58.5%)
General Ward (n = 574)	178 (31.0%)	396 (69.0%)

Table 4 presents the incidence of pneumonia and Clostridium difficile infection among patients receiving PPIs versus those not receiving PPIs. Among 820 PPI users, Clostridium difficile infection occurred in 24 patients (2.9%) compared to 9 patients (0.9%) in the non-PPI group, which was statistically significant ($p < 0.001$). Similarly, pneumonia occurred in 98 PPI users (12.0%) versus 72 non-PPI patients (7.5%), also showing a significant difference ($p = 0.003$). This suggests that PPI use was associated with a higher risk of both infections.

Table 4: Incidence of Pneumonia and Clostridium difficile Infection			
Concurrent Diagnosis	**PPI (n = 820)**	**No PPI (n = 960)**	**P value**
Clostridium difficile	24 (2.9%)	9 (0.9%)	<0.001
Pneumonia	98 (12.0%)	72 (7.5%)	0.003

Table 5 summarizes a chart review of 40 patients (7.4%) who received proton pump inhibitors (PPIs) without a valid indication. Detailed review revealed that only 8 patients (20%) had a valid indication, while 32 patients (80%)) lacked justification. Among these, 18 charts (56%) listed the reason as "prophylaxis," 10 charts (31%) had no documentation, and 4 patients (13%) were continued on home medications. This indicates that the majority of PPI prescriptions in this subset were not appropriately indicated or documented.

Table 5: Chart Review of 40 (7.4%) Patients Receiving PPI Without Valid Indication	
Characteristic	**N (%)**
Valid indication found on detailed review	8 (20%)
No valid indication after review	32 (80%)
Written indication: "Prophylaxis"	18 (56%)
No documentation present	10 (31%)
Continue home medication	4 (13%)

Discussion

The present research identifies a strong likelihood of inappropriate PPI medications making its way to hospitalized patients as merely 34.1% of those who use it have a valid documented indication. The most common indicators were gastroesophageal reflux disease (8.8%), peptic ulcer disease (6.6%), and upper gastrointestinal bleeding (3.9%). Such results are largely aligned with the past research in both inpatient and outpatient facilities. As an example, Batuwitage et al. (2007) [7] found out that 54 percent

of outpatient PPI prescriptions were not appropriate, similar to our finding of 65.9 percent inappropriate use in the hospital. In parallel, research with respect to hospitalized patients has revealed inappropriate use of 60-75 percent (Grube & May, 2007; Ramirez et al., 2010) [6,8,9] which is nearly the same as our results. Our slightly higher prevalence in our cohort may be due to documented practices or local culture of practice in prescribing."

Interestingly, the trend between the use of inappropriate PPI was different between patients (ICU and general ward). In our research, the percentage of ICU patients that received PPIs without a valid indication was 58.5 as opposed to 69.0 in the general ward, which means that the issue of inappropriate prescribing was more noticeable in the general ward, who were not in intensive care. This is contrary to some previous findings that have indicated that stress ulcer prophylaxis among ICU patients is a common trigger of high use of PPI which is not necessarily required (Phạm et al., 2006) [10]. Nevertheless, we discovered that our results are consistent with the research that shows the overprescription of non-ICU patients to PPIs with prophylaxis despite the absence of identified risk factors (Nardino et al., 2000; Alsultan et al., 2010) [11,12]. This may indicate that the general wards might have less awareness of the correct indications than an ICU setting where the monitoring might be more stringent.

Our findings also show that improper use of PPI is also coupled with negative consequences. We also found a higher rate of Clostridium difficile (2.9) and pneumonia (12.0) in PPI users than in non-users (0.9). These are observations in line with previous literature that has shown that patients undergoing acid-suppressive therapy are more at risk of nosocomial infections. The relationship noted by Howell et al. (2010) [13] between the PPI use and C. difficile infection was found to be dose-dependent, which supported the correlation between acid suppression and the alteration of the gut microbiome. In the same vein, Laheij et al. (2004) [5] and Gulmez et al. (2007) [14] described the relationship between PPI therapy and either hospital-acquired or community-acquired pneumonia perhaps because of the increased growth of bacteria caused by a decrease in gastric acidity. Our results are thereby in line with the accumulating evidence which indicates that unnecessary exposure to PPI heightens the risk of infections, hence the clinical importance of not using PPI inappropriately.

An interesting feature of our research was the quality of documentation that was studied. The authors demonstrated that in 40 randomly selected charts, 80 percent of the patients who were initially selected as receiving PPIs without justification actually did not have a reason to receive therapy. There were numerous ones with ambiguous records like prophylaxis without any further clarification. The findings of these observations are in line with the findings of Eid et al. (2010) [15] and Walker and McDonald (2001) [16] who documented high levels of inadequate documentation in the prescription of PPI in the hospital. The continuity of prescriptions that are undocumented or poorly justified underlines the importance of stronger institutional measures and prescriber education to make sure that they are used reasonably.

The comparison of our results with the global data shows some similarities and differences. As an illustration, a review of UHC database revealed that 14 percent of the patients hospitalized were given PPIs, and 61 percent were not given an appropriate indication (Herzig et al., 2009) [17]. Still, at least 50% without justification of the chart review was obtained after correction, which is slightly lower than our 65.9% standing but in the same direction. Ramirez et al. (2010) [9] in Spain reported overuse at the time of admission, hospitalization, and at discharge, which is not a local issue but a global issue. The discrepancy in reported rates is probably due to the differences in hospital policy, physician behavior, and inclusion of stress ulcer prophylaxis in the evaluation criteria.

There is an issue of stress ulcer prophylaxis that makes things even more complicated to interpret. We also ruled out prophylaxis in non-ICU patient as a valid indication when using ASHP and NICE guidelines (ASHP, 1999) [18] that is similar to recent meta-analyses that demonstrated that PPIs and H2 receptor antagonists are equally effective in preventing GI bleeding in critically ill patients (Mohebbi et al., 2009; Lin et al., 2010) [19,20]. Our results confirm the idea that stress ulcer prophylaxis is frequently overused, especially in patients with no reported risk factors, and inform on the issue of more rigid compliance with evidence-based methods.

On the whole, our research is consistent with the past studies, which have already shown the high rates of inappropriate prescribing of PPI, inadequate documentation and higher risk of infection of the hospitalized patients. The presented discrepancies between ICU and general ward patients, and the comparison with the international data underline the necessity to implement the hospital-specific stewardship programs, continuous education, and frequent audit-feedback mechanisms as the way to enhance the prescribing practices and patient safety.

Conclusion

The paper reveals that there is a significant level of inappropriate use of proton pump inhibitor (PPI) among hospitalized patients, as most of the prescriptions of PPI do not have a valid clinical indication. Its misuse in general wards, as compared to the ICU, was more significant and a significant percentage of patients were prescribed PPIs due to undocumented or routine prophylaxis instead of evidence-based

reasons. This abuse was linked to the increased incidences of complications like pneumonia and Clostridium difficile infection, showing the possible issues with patient safety. On the whole, the results demonstrate the necessity of stricter prescribing, documentation improvement, and specific interventions to minimize the use of unnecessary exposure to PPI in a hospitalized setting.

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