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Research Article

Assessment Of Proton Pump Inhibitor (PPI) Prescription Patterns In A Tertiary Care Hospital: A Prospective Analysis

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ABSTRACT

This study aimed to characterize PPI prescribing patterns, focusing on unapproved indications, excessive dosages, treatment duration, and number of PPIs dispensed per prescription. Analyzing data from 171 patients in a tertiary care hospital over six months, it found higher PPI utilization among males (63%). Pantoprazole was the most prescribed PPI (69.2%), followed by Rabeprazole (15%), Esomeprazole (7.6%), Omeprazole (4.6%), and Lansoprazole (3%). Most PPI usage occurred in the 30-49 age group (46.1%). The study observed 59.06% of prescriptions were for unapproved indications, with excessive dosages seen in 22% of cases, notably with Pantoprazole (77%). Inappropriateness was higher in the 18-60 age group, with 40% treated longer than recommended. PPIs were frequently co-prescribed with antibiotics (66.6%), often for unapproved indications per NHS guidelines. The study highlights PPIs as commonly overused drugs, particularly among males, reflecting a need to optimize their use.

INTRODUCTION

Proton-pump inhibitors (PPIs) significantly reduce stomach acid production by irreversibly inhibiting the stomach's proton pump, superseding H2-receptor antagonists and antacids in acid suppression efficacy.[1] Proton pump inhibitors (PPIs) are commonly used to treat various acid-related gastrointestinal disorders such as acid reflux (GERD), peptic ulcer disease (PUD), GI bleeding, and H. pylori infection. They work by reducing stomach acidity through action on gastric parietal cells responsible for acid secretion. PPIs are favored for their high efficacy, good tolerance, safety profile, and affordability, both in original and generic forms, making them widely adopted by primary care providers and gastroenterologists

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worldwide. [2] Proton pump inhibitors (PPIs), highly effective for upper gastrointestinal disorders, are widely prescribed, but often without clear indication, with estimates suggesting 25-70% lack appropriate rationale, highlighting potential overuse. [4] In the United States (US) alone, PPIs account for >$10 billion in healthcare costs and the global costs exceed $25 billion/year.[5] Clinicians may prescribe medications based on their clinical judgment despite narrow FDA approval, as with proton pump inhibitors (PPIs) effectively reducing the incidence of low-dose aspirin-associated GI ulcers and bleeding. [6] However, concerns about PPI–clopidogrel interaction, overprescribing of PPIs and side effects of PPIs, have increased in recent years.[7] The class of proton-pump inhibitor medications is on the World Health Organization's list of Essential Medicines.[8] The effectiveness of PPIs has led to overutilization in multiple treatment arenas, exposing patients to an increasing number of potential risks.[9][10] Assessing and analyzing PPI utilization can aid clinicians in making informed decisions regarding tapering or discontinuing PPIs safely. Consulting tertiary care professionals during the development, review, and endorsement of evidence-based guidelines can ensure that decisions are based on the best available evidence.[11]

OBJECTIVES

- To assess the PPI utilization among patients in a tertiary care hospital
- To characterize PPI prescribing pattern by unapproved Indication, Excessive dosages, Treatment duration of PPI, Number of PPI dispensed per prescription.

METHODOLOGY

Study Design:

A Prospective observational study

Study Population:

All Individual aged ≥18 years with at least one dispensing PPIs were identified as PPI users of study site hospital

Study site:

Srinivas Institute of Medical Science & Research Centre, Mukka, Dakshina Kannada

Study Duration:

6 months (January 2024 - June 2024)

Sample Size Obtained

:1713

Inclusion criteria:

Individuals aged 18 years or above and prescribed with oral PPI

Exclusion criteria:

Patients with Parenteral PPI

Source Of Data Collection:

Patient and medical records were utilized to collect data, identifying individuals with at least one PPI dispensing as PPI users. The first dispensing date for PPIs served as the index date, with new users defined as those without any PPI dispensing in the year prior. Exclusions were made for patients with missing medical details, unknown date of birth or gender, and those changing prescribed PPIs within a calendar year.

Materials used:

Data collected from all medical wards were analyzed using appropriate statistical tests. Descriptive statistics summarized demographic and clinical characteristics, while categorical variables were presented as frequencies and percentages. Chi-square or Student's t-tests were used as needed. Paired sample t-tests compared age groups and PPI users, while independent sample t-tests assessed the association between PPI users and age group, with $p < 0.05$ considered significant.

RESULTS

1. Demographic Characteristics

The study included 171 participants meeting inclusion criteria, with a mean age of 45 years and a male-to-female ratio of 1.375. Among 425 medical patients meeting criteria, 102 were excluded. Of the remaining 171 patients assessed for PPI use, 59 were new users, with 52.5% men

and 47.45% women. Most participants (78.94%) were aged 18-60 years, with 54.07% men and 45.93% women. In the over-60 age group, 63.88% were men and 36.3% women. PPI utilization was higher in male patients (63%), with most users from gastroenterology (35%) and general medicine (30%) departments, and outpatient settings (20%).

Table 1 Demographic Details

Category		Total (n)
Age group	18-29	26
	30-49	84
	50-59	25
	>60	36
Gender	Male	99
	Female	72
Medical Patients during the audit period		425
Patients excluded as per the exclusion criteria (n)		107
Patients assessed (n)		171
Unclear from the records		147 (34.5%)

2. PPI USERS

According to standard reference, 65.49% of patients were categorized as old users, having received PPIs within the current year, while 34.51% were new users, having not received any PPIs in the previous year (Table 2). This categorization provides insights into PPI utilization patterns, aiding in the assessment of prevalence and comparison of characteristics and demographics between old and new users. It also allows for investigation into factors influencing PPI usage and reasons behind new users initiating PPI therapy, serving as a foundational resource for enhancing understanding and potentially optimizing PPI utilization in a tertiary care hospital setting.

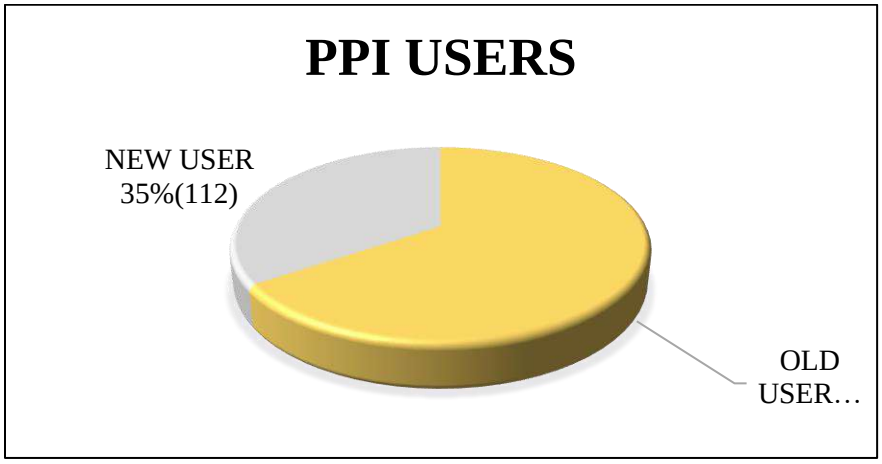

Figure 1: PPI users

3. AGE, GENDER WISE UTILIZATION OF PPI

The study categorized PPI utilization by age: 18-29 years (26), 30-49 years (84), 50-59 years (25), and >60 years (36). Middle-aged patients showed higher PPI utilization (49.12%) compared to the elderly (>60 years, 21.05%), possibly due to increased disease prevalence. Prolonged PPI use was more prevalent in the elderly (75%). This data provides insights into age and gender disparities in PPI usage, facilitating tailored interventions for specific demographics based on comorbidity rates and gender-specific variations.

Table 2: Age, gender wise Utilization of PPI

Age	No. of Subjects	No. of Comorbidities	No of Females	No of Male	New Users	Age
		N	%			
18-29	26	9	34.61	11	15	17
30-49	84	38	45.2	39	45	22
50-59	25	9	36	9	16	9
>60	36	11	30.5	13	23	11

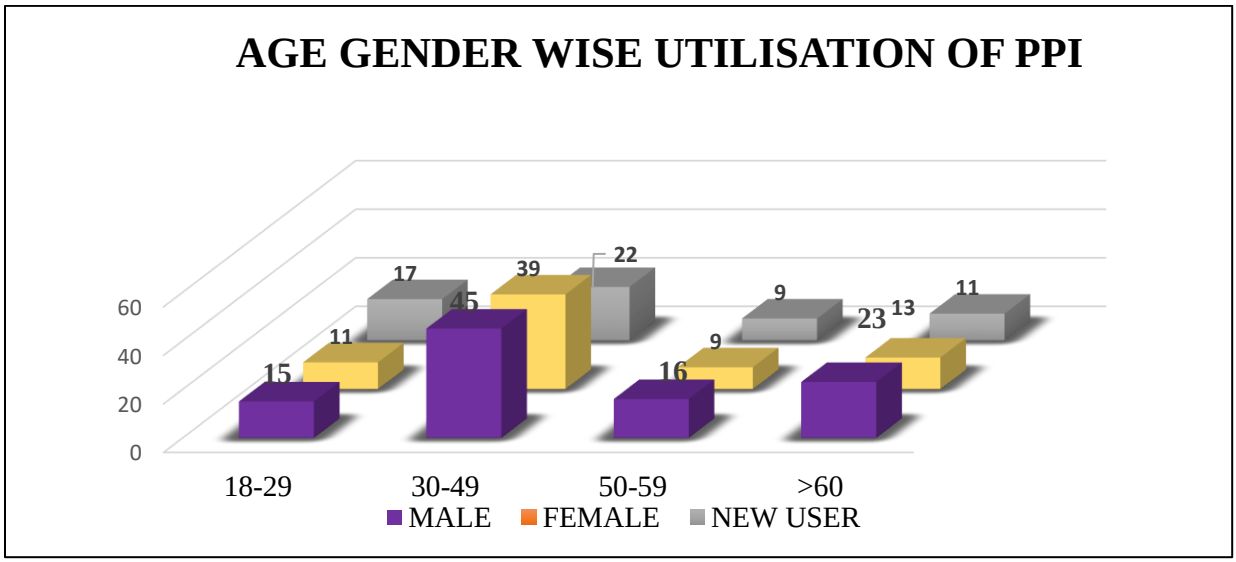

Figure 2: Age, gender wise Utilization of PPI

4. CHARACTERISTICS OF PROTON PUMP INHIBITOR (PPI) THERAPY

In the study, Pantoprazole was the most prescribed PPI, accounting for 68.42% of total prescriptions (42.6% male, 57.3% female), primarily in the 18-60 age group, followed by Rabeprazole (15.2%) (53.8% male, 46.15% female), Esomeprazole (8.18%) (57.145% male), Omeprazole (7.01%) (58.33% male), and Lansoprazole (1%) (100% male). PPI utilization was predominantly in the 18-60 age group (78%) compared to over 60 (22%). This data aids in understanding diverse PPI utilization in a tertiary care hospital, assessing preferred medications, exploring age and gender-related prescription disparities, identifying trends among new users, and customizing therapy guidelines based on patient demographics, ultimately guiding clinical decisions and enhancing PPI usage.

Table 3: Characteristics of proton pump inhibitor (PPI) therapy

PPI	Overall (n=171) n (%)	18-60years (n=135) n (%)			60 years (n=36) n (%)			New user	Males	Females
Characteristics of PPI therapy										
Pantoprazole	117(68.42)	M	F	Total	M	F	Total	42	24	18
		57	35	92(78.63)	16	9	25(21.37)			
Rabeprazole	26(15.2)	8	11	19(73.06)	6	1	7(26.94)	9	5	4
Esomeprazole	14(8.18)	6	7	13(92.85)	1	0	1(7.15)	6	2	4
Omeprazole	12(7.01)	5	5	10(83.33)	0	2	2(16.67)	2	0	2

Lansoprazole	2(1.16)	0	1	1(50)	0	1	1(50)	0	0	0

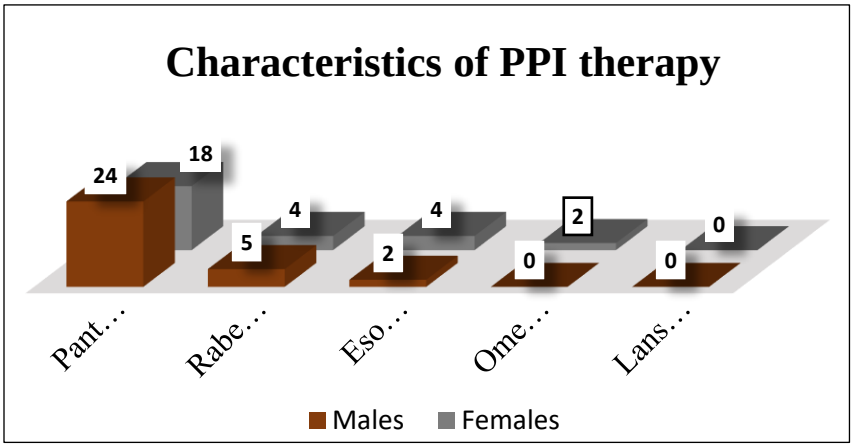

Figure3: Characteristics of PPI therapy based on gender

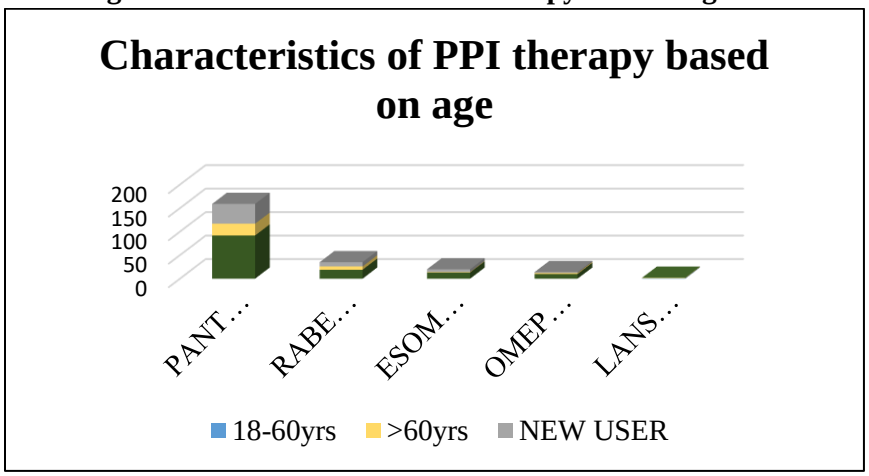

Figure 4: Characteristics of PPI therapy based on age

5. PRESCRIBED DOSES

The study found that 22.22% of patients took higher doses and 9% took lower doses than the standard, with Pantoprazole having the highest rates of both high (16.95%) and low (2.9%) dose consumption among PPIs. Understanding dosing variations and medication record inconsistencies is crucial for optimizing PPI therapy. Accurate dosing is essential for effective management and minimizing side effects. This data highlights dosing patterns, deviations from standard doses, differences among PPI types, and variations between inpatient and outpatient settings, helping healthcare professionals refine prescriptions and improve patient care.

Table 4: Prescribed Doses found in Patient Medical Records and interview

PPI	High dose n (%)
Pantoprazole	35(29.2)
Rabeprazole	5(19.84)
Esomeprazole	4(28.58)
Omeprazole	1(8.34)
Lansoprazole	0(0)

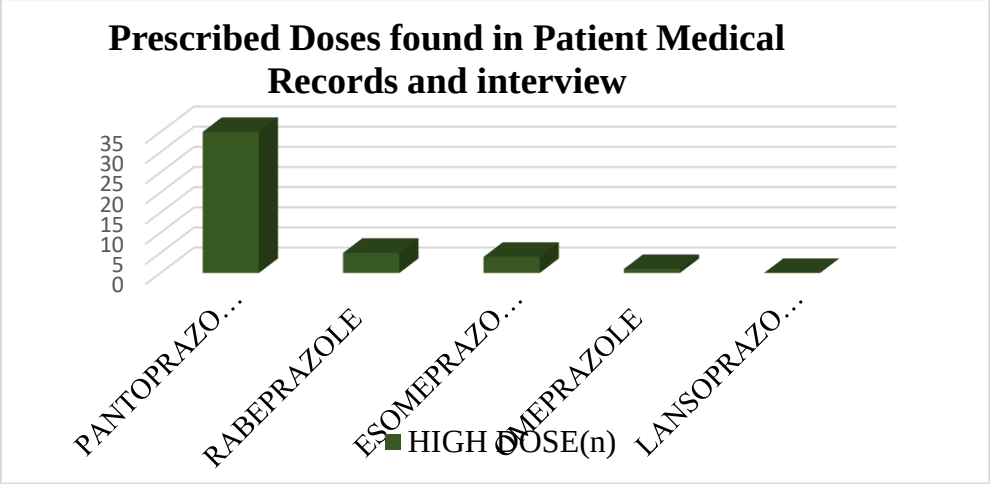

Figure 5: Prescribed Doses found in Patient Medical Records and interview

6. TREATMENT DURATION OF PPIS

The study found that 40% of individuals aged 18-60 years received PPI treatment for longer than recommended by standard guidelines, raising concerns about appropriateness. This data is significant as it sheds light on the duration of PPI treatment and deviations from guidelines, prompting further examination of PPI usage practices in this age group.

Table 5: Treatment Duration of PPIs

Treatment duration	Overall (n=171) n (%)		18–60years (n=135) n (%)	› 60 years (n=36) n (%)
0-1 month	1-7 days	58(33.9)	56(41.48)	2(5.55)
	2-4 weeks	24(14.03)	20(14.81)	4(11.11)
1–2 months	59(34.50)		59(34.50)	45(33.33)
2–6 months	28(16.37)		28(16.37)	9(6.66)
> 6 months	2(1.16)		2(1.16)	0(0)

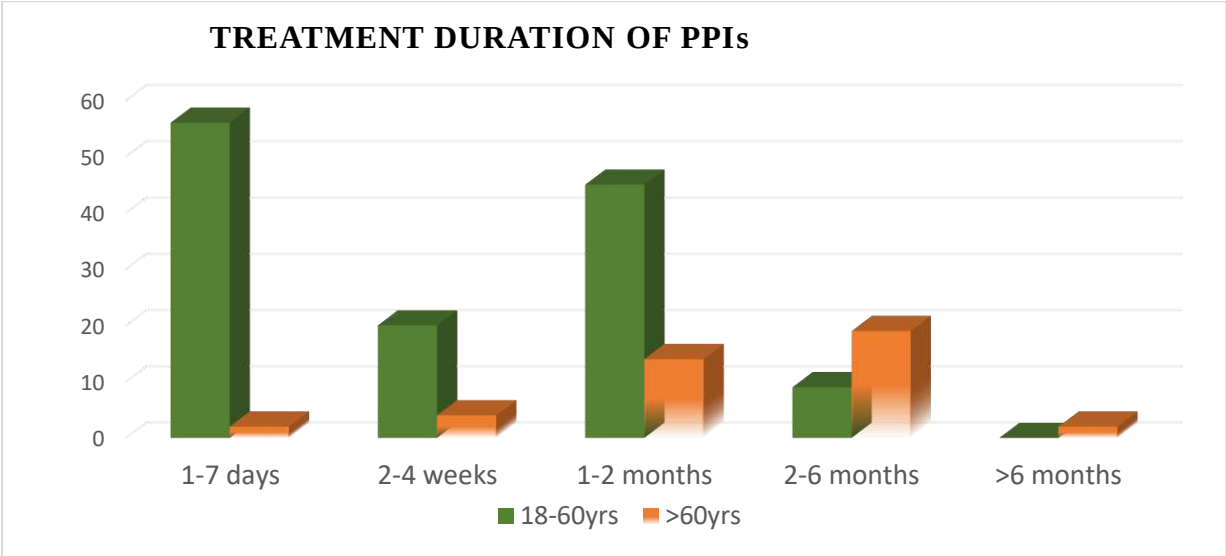

Figure 6: Treatment Duration of PPIs

7. NUMBER OF PPI DISPENSED PER PRESCRIPTION

The study analyzed the number of PPIs dispensed per prescription, categorized by age into 18-60 years and over 60 years. Among patients aged 18-60, 84.44% were prescribed a single PPI, with 21% receiving double. In patients over 60, the majority received a double dose (77.77%), with 15.5% receiving a single dose. Understanding these patterns is crucial for assessing PPI therapy intensity and identifying potential overuse or underuse, while also allowing analysis of gender and age-related differences in prescribing practices. These insights aid in optimizing PPI therapy, ensuring appropriate use, and minimizing unnecessary medication.

Table 6: Number of PPI Dispensed per prescription

Number of PPI Dispensed	Overall (N=171) n (%)	18–60years (N=135) n (%)	>60years (N=36) n (%)	New user n
Single	122(71.3)	114(84.44)	8(22.22)	51
Double	49(28.6)	21(15.5)	28(77.77)	8

8. APPROPRIATENESS OF PPI PRESCRIPTION

PPI Prescription for Approved Indication

Overall, PPIs are inappropriately prescribed in 57.3%. In order to reveal the main categories of inappropriate drug use, PPI appropriateness was further evaluated by the approved indications, the duration of therapy for different diseases and prophylactic use of PPIs, respectively. In detail, the rate of appropriateness according to the approved indications was 34%. In contrast, a high rate of appropriate prescriptions was observed for the duration (PUD: 60%, GI bleeding: 33.3%, GERD: 30%).

PPI Prescription as Co-prescription

The study found that among new PPI users, those with co-prescribed NSAIDs and risk factors had a lower proportion (26.6%) compared to those with Glucocorticosteroids (37.5%). The proportion for Antiplatelet co-prescription was 50% (table 9). These findings are important for evaluating the appropriateness of PPI prescriptions alongside other medications, ensuring adherence to guidelines for patient safety and optimal outcomes. This data helps healthcare professionals make informed decisions regarding PPI co-prescription, assess adherence to guidelines, and optimize prescriptions based on specific diagnoses, duration, and dosage.

Table 7: Appropriateness of PPI prescription

Category (Total Cases:171)	Appropriate PPI Prescription	
	Yes 73(42.6%)	No 98(57.3%)
Approved Indication	32 (34.6%)	38(65.3%)
PUD (26) H. Pylori Eradication (18) GERD (15) GI Bleeding (11)	12 8 8 4	14 10 7 7
Unapproved Indication (Co-Prescription with the following)	41(40.59%)	60(59.40%)

Antibiotics (42)	19	23
Gluco-corticosteroids (26)	10	16
Dual antiplatelet Therapy (18)	8	10
NSAIDS (15)	4	11

DISCUSSION

PPIs are among the most frequently prescribed drugs worldwide, and their overuse has been on the rise in recent years. 12]The current study provides valuable insights into the utilization patterns of PPI users. It was observed that a majority of the patients who were long-term users of PPIs belonged to the age group of 30-49 years,this observation aligns with the findings ofLiu Y et al., that majority of the patients were long term users of PPIs belonged to the age group of 18-65yrs.[1] Interestingly, the present study revealed a high prevalence of PPI utilization among male patients, particularly those in middle age. This finding contradicts the results of the study by Hoteit M et al., where utilization of PPI was observed more in Females.[9] The study found that Pantoprazole had the highest prescription rate among all PPIs, primarily prescribed to patients aged 18-60. Rabeprazole was the next most prescribed, followed by Esomeprazole, Omeprazole, and Lansoprazole. The majority of PPI prescriptions were for the 18-60 age group, with fewer prescriptions observed in the >60 age group due to a smaller percentage of participants. In the study, Pantoprazole was commonly prescribed, especially in individuals aged >65 years. A small percentage of PPI users were on prolonged therapy (over 6 months), mostly among those aged 65 years or older, consistent with Nishtala PS et al.'s study in New Zealand.[13] The study revealed that a significant majority of PPI prescriptions were inappropriate. Prescriptions for approved indications were limited, with H. pylori eradication prescriptions being a smaller portion. Prescriptions related to gastric diagnoses were moderate, resembling the findings of Jie Ying's survey in 45 Chinese hospitals.[14]Most PPI users were found to be using them excessively, with a higher proportion using them beyond recommended indications. Upon examination of the excessive utilization of Proton Pump Inhibitors (PPIs) in the study, it became evident that two key factors were responsible for this overuse: high-dosage regimens and extended durations of usage. Among those individuals who engaged in the excessive use of PPIs, a significant portion extended their treatment beyond the recommended duration, surpassing established clinical guidelines. The remaining subset of patients fell within the high-dosage therapy category, aligning closely with findings reported in a similar study conducted by Mayssaa H et al., which demonstrated that a significant proportion of the population exceeded the recommended treatment duration as stipulated by the NICE (National Institute for Health and Care Excellence) guidelines.[9] Pantoprazole exhibited the highest incidence of excessive use among all PPIs, with overutilization more common in patients with co-prescriptions compared to those prescribed for clinical diagnostics alone, consistent with previous research. Long-term, high-dose PPI regimens may lead to complications including hypomagnesemia, increased risk of osteoporotic fractures, and cardiovascular diseases. A "Step Down Therapy" approach is recommended after symptom alleviation, involving gradual reduction of both duration and dosage of PPI use through periodic reassessment.. [15] Present study, found that high-dose therapy was most frequently prescribed compared with standard and low-dose therapy (3.6 %), which was similar to the findings of the result Hendrix I et al

in Australia in 2017. Study also found small portion of PPI users were using long-term, and undoubtedly, majority of them could have been brought down to withdraw from this therapy.[16] Despite numerous guidelines and extensive published reports highlighting the importance of appropriate use of PPIs and the potential disadvantages of inappropriate usage, the inappropriate prescribing of PPIs has persisted in clinical practice. For instance, Giannini et al.,[17]reported that PPIs were inappropriately prescribed for approximately high proportion of outpatients, and an even higher rate of inappropriate PPI use was observed in patients by the findings Thomas Y et al.,[18]These observations raise growing concerns regarding both the economic costs and safety implications, particularly when considering long-term usage. The study revealed PPIs were frequently co-prescribed with antibiotics prophylactically, despite minimal risk factors necessitating gastroprotective treatment. Co-prescription with corticosteroids was less common than in previous research. Notably, many patients used PPIs to prevent NSAID-related ulcers without high-risk factors, and Omeprazole was commonly prescribed with antiplatelets, potentially compromising clopidogrel's efficacy due to CYP2C19 metabolism. 19]

CONCLUSION:

The study identified widespread issues with PPI use, such as unapproved indications, excessive dosages, prolonged treatments, and inappropriate co-prescription with antibiotics, signaling significant overuse and frequent inappropriate prescriptions. To address these concerns, efforts should focus on limiting PPI treatments to appropriate indications, educating on proper usage, and regularly assessing risks and benefits to ensure rational use. Additionally, healthcare practitioners should monitor and re-evaluate PPI therapy regularly.

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