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Original Article

Drug Utilization Patterns and Pharmacoeconomic Evaluation in Patients Undergoing Abdominal Surgery at a Tertiary Care Hospital

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ABSTRACT

Background: This study investigates the patterns of medication usage and evaluates the pharmacoeconomic implications of drugs administered during abdominal surgeries in a tertiary care hospital setting. Particular emphasis is placed on two primary therapeutic categories: analgesics and Proton Pump Inhibitors (PPIs). Understanding these patterns aids in optimizing pharmacological decisions and curbing unnecessary healthcare expenditures. **Objectives:** To assess drug utilization trends and conduct a pharmacoeconomic evaluation among patients undergoing abdominal surgeries. **Materials and Methods:** A cross-sectional study was conducted on 110 patients receiving perioperative care. Data were extracted from inpatient case records to analyze demographics, prescribing patterns, dosage regimens, duration of therapy, and comparative drug costs. A Cost-Minimization Analysis (CMA) was utilized to evaluate price variations between hospital-supplied drugs and other commercially available brands. **Results:** Diclofenac (48.18%) and tramadol (47.27%) were the most prescribed analgesics, while pantoprazole (46.36%) was the leading PPI. Substantial price differences were observed, particularly for Inj. Paracetamol 1 g (236.77% cost variation). These discrepancies suggest significant opportunities for reducing costs through rational prescribing and promoting generic alternatives. **Conclusion:** Rational and cost-conscious drug prescribing is essential for improving patient outcomes and minimizing financial burden. Encouraging the use of generics, enforcing pricing transparency, and implementing evidence-based prescription protocols can significantly enhance affordability and care quality in perioperative settings.

Keywords: Perioperative Pharmacotherapy, Cost Variation Analysis, Generic Substitution, Analgesic Utilization, Proton Pump Inhibitors, Abdominal Surgery Economics.

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INTRODUCTION

Drug utilization research, as defined by the World Health Organization (WHO), involves the systematic study of the marketing, distribution, prescription, and consumption of medicines within a given population. It aims to assess the medical, social, and economic implications of drug use. Central to this discipline is the promotion of rational drug use, ensuring that medications are prescribed appropriately, administered correctly, and used in a manner that optimizes therapeutic outcomes while minimizing harm and cost. Drug utilization studies are essential tools for identifying patterns of inappropriate prescribing, enhancing the quality of patient care, and informing policy and clinical guidelines.[1]

The collaboration between WHO and the International Network for the Rational Use of Drugs (INRUD) has resulted in the development of standard indicators to evaluate and monitor rational medicine use.[2] Despite these global efforts, irrational prescribing remains a pervasive issue-manifesting as overuse, underuse, or misuse of medicines, often driven by lack of awareness, patient demand, or institutional constraints. Such practices not only compromise clinical outcomes but also escalate treatment costs, impose financial burdens on patients, and strain healthcare systems. A rational prescribing approach encompasses accurate diagnosis, selection of the most effective and safe medications, appropriate dosage, proper dispensing, and adherence to the prescribed regimen.[1]

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Pharmacoeconomics, a subfield of health economics, complements drug utilization studies by analysing the economic efficiency of different pharmaceutical interventions. It evaluates the cost-effectiveness, cost-utility, cost-benefit, and cost-minimization of medications and treatment regimens, helping healthcare providers and policymakers make informed decisions. In an era of rapidly increasing healthcare expenditures and constrained budgets, pharmacoeconomic assessments are essential for maximizing health outcomes relative to resource use. They also support the prioritization of treatments, especially in settings where affordability and accessibility are critical concerns.[3]

The relevance of pharmacoeconomic analysis is particularly pronounced in surgical care, where perioperative pharmacotherapy plays a pivotal role in recovery, complication prevention, and overall patient satisfaction. Abdominal surgeries, ranging from appendectomies and hernia repairs to complex procedures involving gastrointestinal malignancies, are among the most commonly performed worldwide. These interventions often necessitate a multidrug approach-including analgesics for pain control, Proton Pump Inhibitors (PPIs) to mitigate gastrointestinal side effects, antibiotics for infection prevention, and anaesthetics for procedural sedation. Given this therapeutic complexity, optimizing drug selection based on clinical efficacy and economic impact becomes imperative.[4,5]

While numerous studies have explored drug usage in general medical settings, there is a paucity of data focusing on the perioperative phase of abdominal surgeries, particularly in resource-limited healthcare systems. Such analyses are crucial for understanding prevailing prescription patterns, identifying high-cost medications with equally effective lower-cost alternatives, and proposing interventions to enhance cost-efficiency without compromising patient safety or clinical outcomes. This study was designed to address this research gap by evaluating the prescribing trends and pharmacoeconomic aspects of analgesics and PPIs among patients undergoing abdominal surgery at a tertiary care hospital.

Through this approach, the study seeks to generate actionable insights that can support evidence-based prescribing, promote the use of generics where appropriate, and influence policy decisions regarding hospital formularies and procurement strategies. Ultimately, the findings are expected to contribute to improved clinical governance, reduced treatment costs, and more sustainable healthcare delivery in surgical departments.

MATERIALS AND METHODS

Study Design and Setting

This study employed a cross-sectional observational design and was conducted in the Department of Surgery at JSS Hospital, Mysuru-a tertiary care teaching hospital. The research was carried out over a period of ten months, from February to November 2024.

Sample Size and Population

The sample size was calculated based on the findings of a prior study by Patil A *et al.*, where 93.54% of patients were administered ondansetron 4 mg as a pre-anaesthetic medication.[6] Using the sample size calculation formula:

$$n=(z\times\sigma/E)^2$$

Where:n=sample size.

z=The z-score corresponding to the desired confidence level.

σ=The population standard deviation.

E=The margin of error.

With a 95% confidence interval and a 5% allowable error, the required sample size was determined to be 92. To accommodate potential dropouts and enhance robustness, the final sample size was adjusted to 110 patients.

Inclusion Criteria

- Patients aged between 18 and 65 years,
- Undergoing elective or emergency abdominal surgeries,
- Willing and able to provide informed consent,
- Receiving drug therapy during the perioperative period (Pre-, Intra-, and Post-Operative),
- Patients with comorbid conditions such as diabetes or hypertension were included.

Exclusion Criteria

- Patients below 18 or above 65 years of age,
- Undergoing non-abdominal surgical procedures,
- Patients admitted to the Intensive Care Unit (ICU).

Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee of Medical College, Mysuru. All participants provided written informed consent prior to inclusion in the study.

Data Collection Procedure

Data were collected prospectively from the case sheets of inpatients admitted to surgical wards. The data extracted included demographic information (age, gender), clinical details (diagnosis, comorbidities), and comprehensive therapeutic information (drug name, dosage, route, frequency, duration of therapy). Cost data were obtained for both hospital-provided and commonly prescribed branded alternatives.

Drug Categories Assessed

The analysis focused on two major therapeutic classes:

1. **Analgesics**-Including injectable and oral formulations used for pain management.
2. **Proton Pump Inhibitors (PPIs)**-Administered to prevent or manage gastrointestinal complications associated with analgesic use.

Pharmacoeconomic Analysis

The market prices were taken from JSS Pharmacy, JSS Hospital, Mysuru. The prices reflect the MRP, and the drugs under study had no such discounted rates or other metrics. A Cost-Minimization Analysis (CMA) was used to compare the cost differences between the brands provided by the hospital and the most commonly used commercial alternatives. This method is appropriate when comparing therapeutically equivalent drugs. The analysis employed the following formulas.

Formula:

$$\text{Cost Difference} = (\text{Maximum Cost} - \text{Minimum Cost})$$

$$\text{Cost Ratio} = \text{Maximum Cost} / \text{Minimum Cost}$$

$$\%\ \text{Cost Variation} = \frac{\text{Maximum Cost} - \text{Minimum Cost}}{\text{Minimum Cost}}$$

Cost ratios exceeding 2 and percentage variations over 100% were considered significant indicators of economic disparity.[7]

Statistical Analysis

"Chi-square test, Mann-Whitney U test, independent samples *t*-test, and Kruskal-Wallis's test was used to assess associations and group differences. A *p*-value <0.05 was considered statistically significant. SPSS version 30.0 was used for all inferential analyses."

Data were compiled using Microsoft Excel 2021 and statistically analyzed with SPSS version 30.0. Descriptive statistics were used to summarize patient demographics, drug utilization patterns, and pharmacoeconomic outcomes.

RESULTS

Sociodemographic Profile

Out of the 110 patients included in the study, 58.2% were female and 41.8% were male. The mean age of the study population was 46.47 years with a standard deviation of ±12.69 years. For analysis, the age distribution was categorized into five groups: 6.4% were aged 18-25 years, 17.3% were 26-35 years, 20.9% were 36-45 years, 21.8% were 46-55 years, and 33.6% were between 56-65 years.

Distribution of Cases According to Various Incidence

Among the 110 patients who underwent abdominal surgery, cholecystitis was the most common indication (42.7%). Umbilical hernia and inguinal hernia each accounted for 10% of the surgeries. Less frequent indications (0.9% each) included acute appendicitis with bilateral ovarian cyst, pelvic tumor, cancer of the duodenum, gallbladder carcinoma, adenocarcinoma of the caecum, umbilical sinus with abscess, and various combinations of cholelithiasis with other conditions (Figure 1).

Comorbidities

Regarding comorbidities, 40% of patients had none. Among those with chronic conditions, 15.4% had diabetes mellitus, 19.1% had hypertension, and 25.5% had both diabetes and hypertension.

Type of Surgery and Anaesthesia Administered

Laparoscopic procedures were more common (56.4%) compared to open surgeries (43.6%). Regarding anesthesia, 79.1% of patients received general anesthesia, 20% spinal anesthesia, and 0.9% a combined spinal-epidural approach.

Drug Utilization Analysis

The drug utilization analysis focused on two therapeutic subgroups used in the perioperative period: Proton Pump Inhibitors (PPIs) and analgesics.

Analgesics: The most frequently used injectable analgesics were Inj. Diclofenac (48.18%) and Inj. Tramadol (47.27%). Oral combinations like Tab. Tramadol+Paracetamol were also used for postoperative pain management (Table 1).

Proton Pump Inhibitors: Among PPIs, Inj. Pantoprazole (46.36%) was the most prescribed, followed by Tab. Rabeprazole (31.82%). Other PPIs like Esomeprazole and Lansoprazole were used less frequently (Table 2).

Inferential Analysis

Gender vs. Type of Surgery

A Chi-square test was performed to evaluate the association between patient gender and the type of surgery performed (laparoscopic vs. open). The result was not statistically significant (p=0.28), suggesting that the choice of surgical approach was independent of patient gender.

Comorbidity Status vs. PPI Usage

The association between the presence of comorbid conditions (diabetes and/or hypertension) and the use of PPIs was analyzed. The use of PPIs was significantly higher among patients with comorbidities compared to those without (χ^2, p=0.03). This may reflect greater physician caution to prevent gastrointestinal complications in patients with systemic illness.

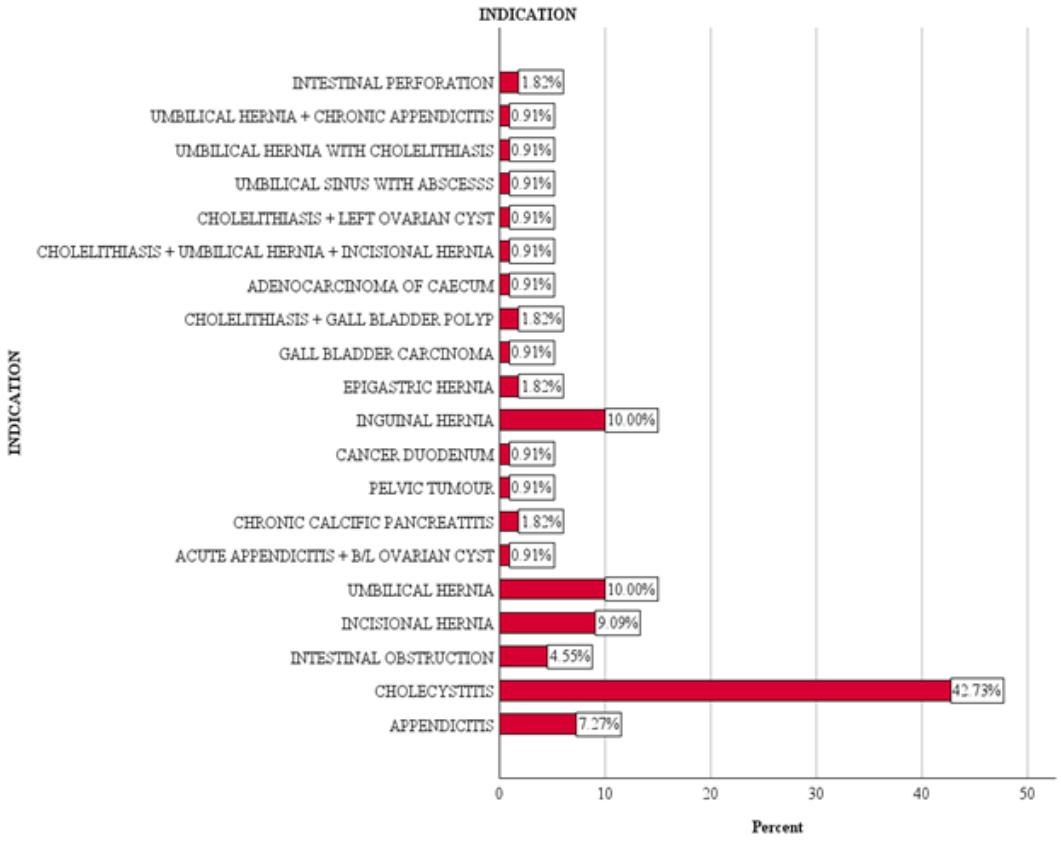

Figure 1: Distribution of cases according to various incidence.

Age Group vs. Choice of Analgesic

A Kruskal-Wallis's test was used to determine whether age groups differed in their choice of perioperative analgesics. No statistically significant difference was found across age groups in terms of the analgesic prescribed (p=0.08), suggesting age was not a determining factor in analgesic selection.

Surgical Approach vs. Drug Cost

An independent samples t-test was used to compare the mean total drug cost between patients undergoing laparoscopic and open surgeries. No statistically significant difference was found (p=0.14), although a trend toward lower mean cost in laparoscopic cases was observed, possibly due to shorter hospital stays.

Comorbidity vs. Total Drug Cost

The Mann-Whitney U test showed that patients with comorbidities had significantly higher total drug costs compared to those without comorbidities (p=0.01), likely due to the need for additional medications to manage underlying conditions and prevent complications.

Pharmacoeconomic Analysis

Analgesics

The highest price variation was observed for Inj. Paracetamol 1g, with a cost difference of ₹367 compared to an alternative brand.

Table 1: Distribution of Analgesics among patients undergoing abdominal surgery.

Drug	Quantity	Percentage
Inj. Diclofenac 75 mg	53	48.18
Inj. Paracetamol 1 g	33	30.00
Inj Tramadol 100 mg	52	47.27
Inj. Tramadol 50 mg	12	10.91
Tab. Aceclofenac+Paracetamol+Serratiopeptidase	17	15.45
Tab. Tramadol+Paracetamol	18	16.36
Tab. Aceclofenac+Paracetamol 425 mg	9	8.18
Tab. Paracetamol 650 mg	14	12.73
Tab. Trypsin+Bromelain+Rutoside+Diclofenac	13	11.82

Cost differences for Inj. Diclofenac (₹3.43-₹22.75) and Tab. Tramadol+Paracetamol (₹15.28-₹17.43) also indicated variability across brands (Figure 2).

PPIs

For PPIs, Inj. Esomeprazole 40 mg showed a cost difference of ₹65.1 compared to one alternative and ₹3.4 with another. Tab. Rabeprazole 40 mg showed cost differences of ₹19.99 and ₹3.59

against different brands. Inj. Pantoprazole had consistent pricing with no observed variation (Figure 3).

Cost Variation Analysis

Drugs were evaluated for both cost ratio and percentage cost variation. A cost ratio above 2 and cost variation exceeding 100% were flagged as significant.[7] Notable examples include Inj. Paracetamol 1 g with 236.77% cost variation, Inj. Tramadol 50 mg with 163.31%, and Tab. Aceclofenac+Paracetamol with 154.93%. Conversely, minimal variation was observed in basic formulations such as Tab. Paracetamol 650 mg (Table 3).

Tab. Pantoprazole 40 mg showed a very low-cost fluctuation of 17.55%, whereas Tab. Esomeprazole 40 mg showed greater variances of 77.94% and 92.86% respectively. These significant price differences for rabeprazole and esomeprazole, underscore the financial obstacles patients encounter when trying to obtain these necessary drugs (Table 4).

These findings emphasize the extent of price disparities between different brands and highlight the need for cost-effective prescribing strategies.

DISCUSSION

This cross-sectional study aimed to evaluate the drug utilization patterns and pharmacoeconomic implications of perioperative medications-specifically analgesics and Proton Pump Inhibitors (PPIs)-in patients undergoing abdominal surgeries at a tertiary care hospital. The findings provide valuable insights into current prescribing practices, the economic burden of drug therapy, and opportunities for improving cost-efficiency without compromising patient care.

Table 2: Distribution of Proton-pump Inhibitors among patients undergoing abdominal.

Drug	Quantity	Percentage
Inj. Pantoprazole 40 mg	51	46.36
Inj. Esomeprazole 40 mg	10	9.09
Tab. Pantoprazole 40 mg	17	15.45
Tab. Rabeprazole 40 mg	35	31.82
Tab. Esomeprazole 40 mg	10	9.09

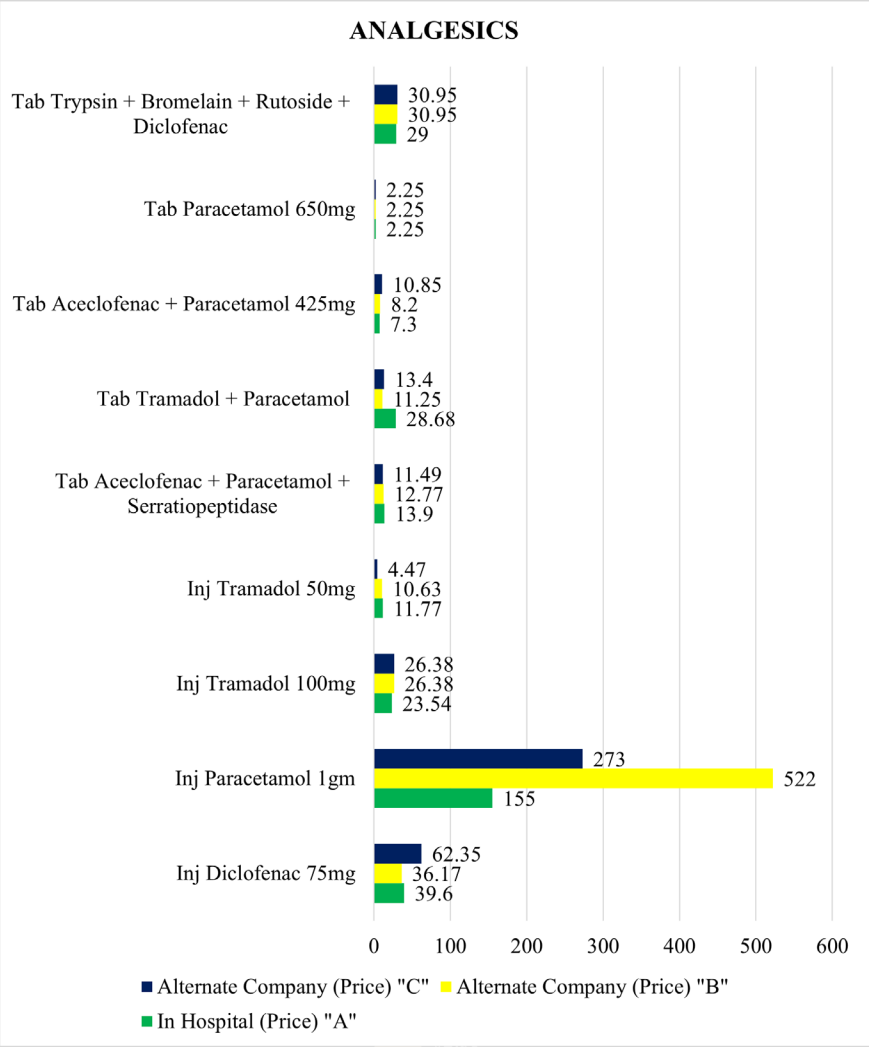

Figure 2: Cost Minimisation analysis-Analgesics.

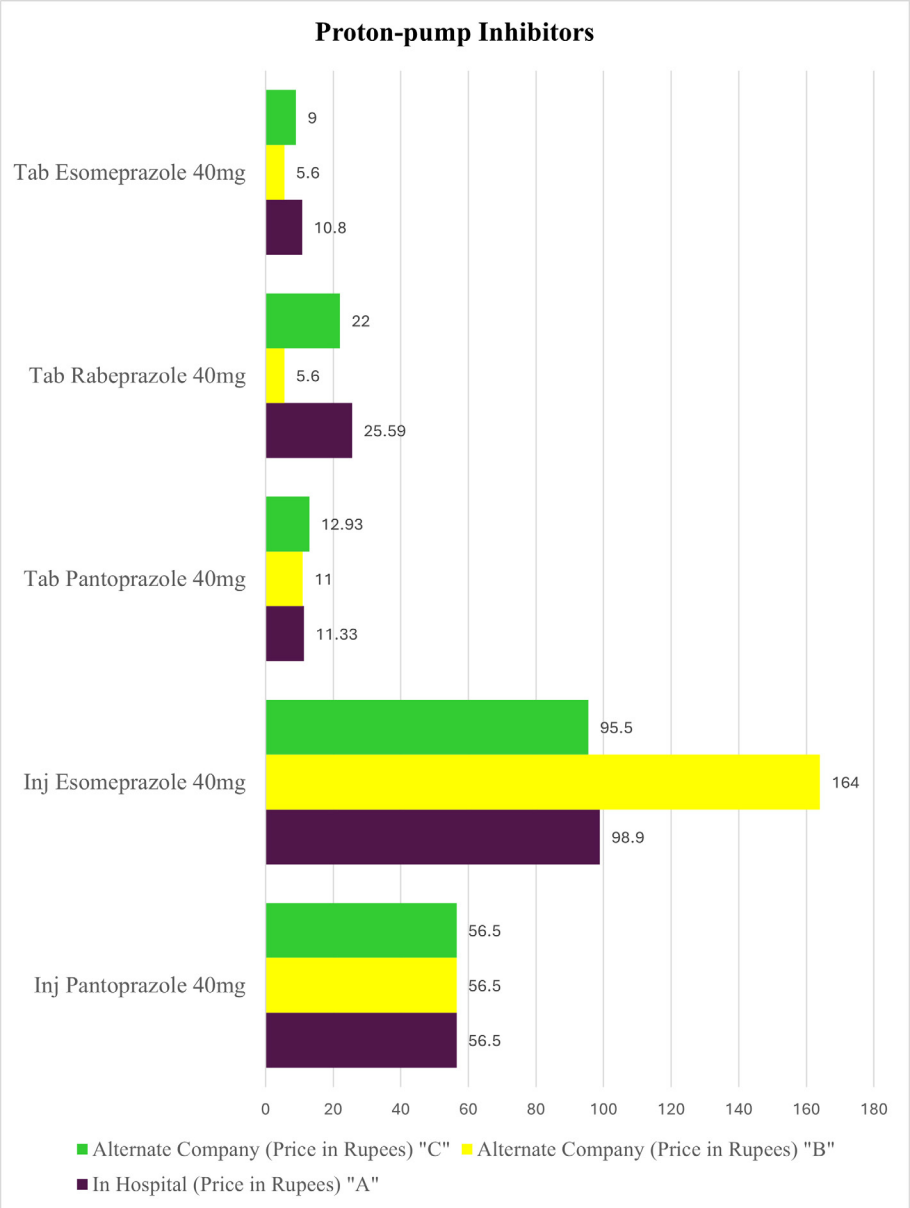

Figure 3: Cost Minimisation analysis-Proton-pump Inhibitors.

The demographic profile revealed that 58.2% of the study population were female, with the highest proportion (33.6%) falling within the 56-65-year age group. These demographics mirror established epidemiological patterns, where abdominal pathologies like cholecystitis are more prevalent among older female populations. Cholecystitis (42.7%) emerged as the most common surgical indication, reflecting the disease burden associated with gallbladder disorders. Hernia repairs were the next most common, affirming the clinical relevance of this surgical domain in general practice. From a clinical perspective, the high prevalence of comorbidities-such as diabetes mellitus and hypertension-demands tailored perioperative drug regimens to mitigate risks such as postoperative infections, delayed healing, and cardiovascular events. These findings underscore the necessity for integrating comorbidity profiles into treatment protocols and individualized pharmacotherapy.[8]

Surgical trends observed in the study, such as the higher frequency of laparoscopic over open procedures (56.4% vs. 43.6%), are in line with global advances in minimally invasive surgical techniques. Laparoscopy is associated with shorter recovery time, fewer postoperative complications, and reduced hospital stays, all of which contribute to better patient outcomes and potentially lower healthcare costs. General anesthesia was used in the majority of cases (79.1%), consistent with its widespread use in abdominal surgeries requiring prolonged or complex procedures. In terms of pharmacological management, diclofenac and tramadol were nearly equally prescribed for postoperative analgesia. This aligns with the therapeutic profiles of both drugs: diclofenac offers potent anti-inflammatory effects, whereas tramadol provides moderate opioid analgesia with a relatively favourable side-effect profile. Their widespread use points to an established standard in managing postoperative pain, although the near-parity in their

prescription rates may also indicate inconsistencies in prescriber preferences or hospital guidelines.[9]

Proton pump inhibitors, particularly pantoprazole, were the most frequently prescribed agents for gastric protection. This is not surprising, as pantoprazole is often favoured for its efficacy, tolerability, and lower risk of drug-drug interactions. However, overuse of PPIs has been documented in various studies, raising concerns regarding unnecessary expenditure and potential adverse effects such as nutrient malabsorption and increased risk of infections.[10] The pharmacoeconomic analysis highlighted significant price variation among brands, with drugs like Inj. Paracetamol 1 g showing a cost variation of over 236%. Such disparities are alarming in a healthcare system where a significant proportion of expenses are borne out-of-pocket by patients. Inj. Tramadol (163.31%) and Tab. Aceclofenac+Paracetamol (154.93%) also displayed considerable cost variability. These Figures emphasize the urgent need for prescriber awareness regarding brand costs and for institutional procurement policies that prioritize cost-effective options.

Interestingly, some PPIs like Inj. Pantoprazole displayed no variation, suggesting either a standardized procurement policy or lower brand competition. Conversely, oral PPI formulations such as esomeprazole and rabeprazole showed notable price differences, highlighting areas where intervention could improve affordability.

Globally, drug price regulation policies have had mixed results. Studies in India have shown that the Drug Price Control Order (DPCO) has limited success in standardizing prices across therapeutic classes, largely due to loopholes and weak enforcement mechanisms. Similar issues are reflected in the present findings, further substantiating the case for stronger price monitoring and generic substitution policies. Hospital-based initiatives-such as formulary restrictions, educational programs for prescribers, and real-time cost dashboards-could support more rational prescribing. Furthermore, pharmacist-led interventions, such as medication audits and therapeutic substitution protocols, could significantly reduce unnecessary variations and enhance the quality of care.[11-13]

This study also reinforces the role of pharmacoeconomic assessments as part of routine hospital practice. By continuously evaluating prescribing trends and their financial implications, healthcare institutions can ensure optimal use of resources, improved accessibility for patients, and alignment with national healthcare goals. Implementing structured drug utilization reviews and including pharmacoeconomics in clinical training for healthcare professionals would help institutionalize these practices. Despite its strengths, this study is limited by its single-center design and the focus on only two drug categories. Expanding the scope to include other essential drug classes-such as antibiotics, antiemetics, and anticoagulants-could provide

Table 3: Comparison of maximum cost of analgesics with their minimum cost as per the data collected.

Sl. No.	Drugs	Maximum cost	Minimum Cost	Cost Difference	Cost Ratio	% Cost Variation
1	Inj. Diclofenac 75 mg	62.35	36.17	26.18	1.72	72.38
2	Inj. Paracetamol 1 g	522	155	367	3.37	236.77
3	Inj. Tramadol 100 mg	26.38	23.54	2.84	1.12	12.06
4	Inj. Tramadol 50 mg	11.77	4.47	7.3	2.63	163.31
5	Tab. Aceclofenac+Paracetamol+Serratio peptidase	13.9	11.49	2.41	1.21	20.97
6	Tab. Tramadol+Paracetamol	28.68	11.25	17.43	2.55	154.93
7	Tab. Aceclofenac+Paracetamol 425 mg	10.85	7.3	3.55	1.49	48.63
8	Tab. Paracetamol 650 mg	2.25	2.25	0	1.00	0.00
9	Tab. Trypsin+Bromelain+Rutoside+Diclofenac	30.95	29	1.95	1.07	6.72

Table 4: Comparison of maximum cost of PPIs with their minimum cost as per the data collected surgery.

Sl. No.	Drugs	Maximum cost	Minimum Cost	Cost Difference	Cost Ratio	% Cost Variation
1	Inj. Pantoprazole 40 mg	56.5	56.5	0	1.00	0.00
2	Inj. Esomeprazole 40 mg	164	95.5	68.5	1.72	71.73
3	Tab. Pantoprazole 40 mg	12.93	11	1.93	1.18	17.55
4	Tab. Rabeprazole 40 mg	25.59	5.6	19.99	4.57	356.96
5	Tab. Esomeprazole 40 mg	10.8	5.6	5.2	1.93	92.86

a more comprehensive understanding of perioperative pharmacoeconomics. Additionally, multicentre studies would improve generalizability and support the development of broader, evidence-based prescribing frameworks.

In conclusion, this study presents a strong case for integrating pharmacoeconomic strategies into routine perioperative care. By combining clinical efficacy with economic prudence, healthcare systems can move toward more sustainable and equitable care delivery, particularly in resource-constrained environments.

CONCLUSION

This study provides a detailed evaluation of drug utilization patterns and pharmacoeconomic outcomes among patients undergoing abdominal surgeries, with a specific focus on analgesics and Proton Pump Inhibitors (PPIs). The findings highlight critical insights into prescribing practices, therapeutic preferences, and significant cost disparities among different drug brands. Diclofenac and tramadol emerged as the primary analgesics administered perioperatively, while pantoprazole was the most commonly prescribed PPI. Although these choices are clinically appropriate, the observed variations in brand pricing point to an urgent need for greater prescriber awareness and institutional oversight to ensure cost-effective prescribing. The significant price differences identified, especially for injectable analgesics and PPIs, underscore the potential for substantial healthcare savings through rational prescription strategies and the promotion of generic alternatives.

By integrating pharmacoeconomic assessments into clinical decision-making, healthcare providers can improve patient access to essential medications and reduce financial burdens without compromising therapeutic efficacy. Furthermore, hospital policies supporting generic substitution, evidence-based guidelines, and regular drug utilization audits can foster a more sustainable approach to perioperative care. Although limited by its single-center scope and focus on two drug classes, this study lays the groundwork for broader investigations that include additional therapeutic categories and multiple institutions. Future research should explore long-term patient outcomes, the impact of educational interventions on prescriber behavior, and the effectiveness of policy measures like pricing regulations.

Ultimately, this study reinforces the value of pharmacoeconomics in guiding rational drug use and enhancing the efficiency of surgical healthcare delivery. Through continued assessment and adaptation, the healthcare system can achieve a more balanced, affordable, and patient-centered model of care.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICAL CLEARANCE STATEMENT

JSS/MC/PG/2034/2023-24.

AUTHOR CONTRIBUTION

Study conception and design: Raghavendra Konnur, Jayanthi MK, Pankaja SS; Data collection: Raghavendra Konnur; Analysis and interpretation of results: Raghavendra Konnur, Jayanthi MK, Pankaja SS, Saddique Choudhury; Draft manuscript: Raghavendra Konnur, Jayanthi MK, Saddique Choudhury.

SUMMARY

This study involved 110 patients undergoing abdominal surgery, with 58.2% females and 41.8% males, aged between 18 and 65 years. The majority (33.6%) belonged to the 56-65-year age group. Among these patients, 42.7% underwent surgery for cholecystitis. Comorbidity analysis showed that 40% had no associated illnesses, while 15.4% had diabetes mellitus, 19.1% had hypertension, and 25.5% suffered from both conditions.

Surgical approaches included laparoscopic (56.4%) and open procedures (43.6%). General anaesthesia was the predominant choice (79.1%), followed by spinal anaesthesia (20%), and a combination of spinal and epidural anaesthesia in 0.9% of cases.

In terms of postoperative pain management, Inj. Diclofenac (48.18%) was slightly preferred over Inj. Tramadol (47.27%). Among Proton Pump Inhibitors (PPIs), Inj. Pantoprazole was the most frequently prescribed (46.36%), raising concerns about potential overuse.

The study underscores the importance of evidence-based pharmacotherapy to enhance patient outcomes and reduce healthcare costs. It highlights the need for rational drug selection and the minimization of unnecessary prescriptions in perioperative care.

Pharmacoeconomic evaluations revealed significant variability in drug prices across manufacturers and between branded and generic versions. These findings point to the potential for cost optimization through rational prescribing, adoption of cost-effective generics, and robust pricing policies. Such strategies are essential to improving both affordability and accessibility in healthcare.

Overall, the study calls for continuous pharmacoeconomic assessments to guide clinicians, policymakers, and stakeholders in making informed decisions that balance treatment quality with economic sustainability.

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