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DRAIN VERSUS NO DRAIN FOLLOWING ELECTIVE ABDOMINAL SURGERY: A COMPARATIVE ANALYSIS OF POSTOPERATIVE COMPLICATIONS

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ABSTRACT

Background: The routine use of surgical drains following elective abdominal surgery remains controversial. While drains are traditionally employed to detect early complications and prevent fluid collection, their role in uncomplicated elective procedures has been increasingly questioned due to potential discomfort, infection risk, and prolonged hospital stay. **Objective:** To compare postoperative outcomes between patients undergoing elective abdominal surgery with routine drain placement and those without drains. **Methods:** This prospective comparative study was conducted in a tertiary care hospital over an 18-month period. A total of 56 patients undergoing elective abdominal surgery were included and divided into two groups: drain group [n = 28] and no-drain group [n = 28]. Postoperative outcomes assessed included surgical site infection, seroma or collection, postoperative pain scores, time to ambulation, and length of hospital stay. Statistical analysis was performed using appropriate parametric and non-parametric tests, with a p value <0.05 considered significant. **Results:** The incidence of surgical site infection was comparable between the drain and no-drain groups [14.3% vs 10.7%]. Seroma formation occurred in 3 patients in the drain group and 2 patients in the no-drain group. Mean postoperative pain scores were higher in the drain group on postoperative day one [5.1 ± 0.9 vs 3.8 ± 0.8]. The mean hospital stay was significantly longer in patients with drains [6.2 ± 1.4 days] compared to those without drains [4.5 ± 1.2 days]. No significant difference was observed in major postoperative complications between the two groups. **Conclusion:** Routine drain placement following uncomplicated elective abdominal surgery does not confer a clear advantage in reducing postoperative complications and may be associated with increased pain and prolonged hospital stay. Selective rather than routine use of drains appears to be a more appropriate strategy.

Keywords: Elective abdominal surgery; surgical drains; postoperative complications; surgical site infection; hospital stay

INTRODUCTION

Elective abdominal surgery constitutes a substantial proportion of the surgical workload in tertiary care hospitals worldwide. Advances in surgical techniques, anesthesia, and perioperative care have significantly reduced morbidity and mortality associated with these procedures. Despite these improvements, postoperative complications such as surgical site infection, seroma formation, anastomotic leakage, and prolonged ileus continue to contribute to patient discomfort, extended hospital stay, and increased healthcare costs [1,2]. Strategies aimed at minimizing postoperative complications while promoting faster recovery remain an important area of surgical research.

The placement of surgical drains following abdominal surgery has traditionally been considered a routine practice. Drains are intended to evacuate collections, detect early leaks or bleeding, and reduce the risk of infection by preventing fluid accumulation at the operative site [3]. This rationale has historically supported their widespread use across a range of elective abdominal procedures. However, the routine placement of drains has increasingly been questioned in the context of modern surgical practice, particularly in uncomplicated elective surgeries [4].

Several studies have suggested that surgical drains may not provide the anticipated protective benefits and may instead contribute to adverse outcomes. Drains can act as a foreign body, providing a potential conduit for ascending infection and increasing the risk of surgical site infection [5]. In addition, the presence of a drain may cause increased postoperative pain, restrict early mobilization, and negatively impact patient comfort and satisfaction [6]. These factors may collectively delay recovery and prolong hospitalization, which contradicts the principles of enhanced recovery after surgery protocols [7].

The concept of avoiding routine drain placement has gained momentum alongside the adoption of minimally invasive surgical techniques. Laparoscopic surgery, by virtue of reduced tissue trauma and improved hemostasis, has further diminished the perceived need for prophylactic drainage in many elective procedures [8]. Studies in procedures such as laparoscopic cholecystectomy and colorectal surgery have demonstrated that omitting routine drains does not increase postoperative complications and may be associated with faster recov-

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ery and reduced length of hospital stay [9,10].

Despite accumulating evidence, the practice of drain placement remains highly variable and often influenced by surgeon preference rather than standardized guidelines [11]. In many institutions, drains continue to be used routinely due to concerns about undetected leaks or postoperative collections, particularly in resource-limited settings where access to advanced imaging may be constrained [12]. This variability underscores the need for institution-specific evidence to guide rational decision-making.

Elective abdominal surgeries encompass a heterogeneous group of procedures involving varying degrees of tissue dissection and contamination risk. The balance between potential benefits and harms of drain placement may differ across surgical contexts. Therefore, extrapolation of findings from one procedure to another may not always be appropriate [13]. Comparative studies focusing on a broad elective abdominal surgery population can provide pragmatic insights that are directly applicable to routine clinical practice.

From a patient-centered perspective, reducing unnecessary interventions is a key component of quality surgical care. Avoiding routine drains may contribute to reduced postoperative pain, improved mobility, and enhanced overall patient experience [14]. Additionally, shorter hospital stays and fewer postoperative complications have significant implications for healthcare systems, particularly in high-volume tertiary care centers where bed availability and cost containment are critical concerns [15].

In low- and middle-income countries, where healthcare resources are often stretched, evidence-based simplification of surgical practices is especially important. Eliminating interventions that do not confer clear benefit can optimize resource utilization without compromising patient safety [16]. Studies conducted in such settings are essential to validate global recommendations within local healthcare environments.

Given the ongoing debate surrounding routine drain usage, there remains a need for well-designed comparative studies that evaluate postoperative outcomes in patients undergoing elective abdominal surgery with and without drains. Such studies can help clarify whether routine drainage offers measurable advantages or whether selective drain use based on intraoperative findings is a more appropriate strategy [17, 18].

The present study was undertaken in a tertiary care hospital to compare postoperative complications between patients undergoing elective abdominal surgery with drain placement and those without drains. By evaluating outcomes such as surgical site infection, postoperative pain, seroma formation, and length of hospital stay, this study aims to provide clinically relevant evidence to inform surgical decision-making and contribute to the growing body of literature advocating rational and patient-centered surgical care.

MATERIALS AND METHODS

Study Design: This study was designed as a prospective comparative observational study aimed at evaluating the role of routine surgical drain placement following elective abdominal surgery. The comparative approach was chosen to assess real-world outcomes associated with drain usage, given the ongoing debate regarding its necessity in uncomplicated elective procedures [3,4]. The study compared postoperative complications and recovery parameters between patients with drains and those without drains.

Place of Study

The study was conducted at the Department of General Surgery, Government Medical College and Government General Hospital, Mahabubnagar, Telangana, India. This institution functions as a tertiary care referral center and provides surgical services to both urban and rural populations. A wide range of elective abdominal surgical procedures are routinely performed at this center, making it an appropriate setting to evaluate outcomes related to drain usage [1,12].

Duration of Study

The study was carried out over a period of 18 months, from March 2024 to September 2025. This duration was considered adequate to achieve the desired sample size and to ensure uniform postoperative follow-up during the hospital stay [2].

Study Population and Sample Size

Patients admitted for elective abdominal surgery during the study period were screened for eligibility. Based on case load and feasibility, a sample size of approximately 50 to 60 patients was included. Similar sample sizes have been used in comparable observational studies evaluating postoperative outcomes related to drain placement [6,9]. Patients were enrolled consecutively after meeting the inclusion and exclusion criteria.

Inclusion Criteria

Patients aged 18 years and above undergoing elective abdominal surgery were included in the study. Only patients undergoing planned, uncomplicated procedures were considered. Patients who provided written informed consent and were willing to comply with postoperative follow-up were enrolled.

Exclusion Criteria

Patients undergoing emergency abdominal surgeries were excluded, as emergency settings are associated with higher contamination rates and mandatory drain usage [13]. Patients with intraoperative findings such as gross contamination, bowel perforation, peritonitis, or active bleeding were excluded. Patients with immunocompromised states, including those on long-term steroid therapy or chemotherapy, were excluded due to altered wound healing and infection risk [5]. Patients with poorly controlled diabetes mellitus and those requiring mandatory drain placement based on intraoperative judgment were also excluded.

Group Allocation

Patients were allocated into two groups based on intraoperative management. Group A included patients in whom a surgical drain was placed at the end of the procedure.

Group B included patients in whom no drain was placed.

The decision regarding drain placement was left to the operating surgeon and was based on standard surgical judgment, reflecting routine clinical practice [11]. This approach was chosen to maintain external validity and applicability to real-world settings.

Surgical Technique and Perioperative Care

All surgical procedures were performed by experienced general surgeons using standardized operative techniques. Strict aseptic precautions were maintained. Perioperative antibiotic prophylaxis was administered according to institutional protocol, consistent with recommended guidelines to reduce surgical site infections [7]. Intraoperative hemostasis was ensured in all cases [Figure 1].

Postoperative Management

Postoperative care was standardized for both groups to minimize confounding variables. Analgesia was administered using a uniform protocol. Early ambulation was encouraged, and oral intake was initiated as per patient tolerance, in line with enhanced recovery principles [7,14]. In patients with drains, daily monitoring of drain output and character was performed. Drains were removed once the output was minimal and nonpurulent, following accepted surgical practice [Figure 1] [3].

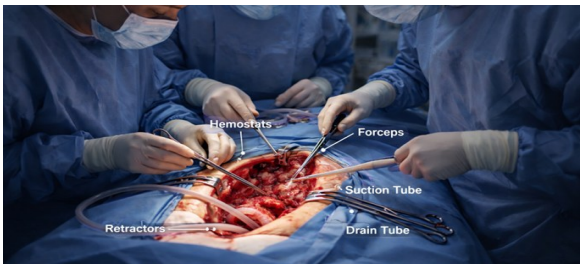

Figure 1: Intraoperative view of an elective open abdominal surgery- typical operative setup and placement of drainage used during elective abdominal procedures for postoperative fluid management

Outcome Measures

Primary outcome measures included the incidence of surgical site infection, seroma or fluid collection, and wound-related complications. These outcomes were selected based on their clinical relevance and frequent association with drain placement [5,9]. Secondary outcome measures included postoperative pain assessed using the visual analog scale, time to ambulation, and length of hospital stay. These parameters reflect patient comfort, recovery, and healthcare resource utilization [6,15].

Data Collection

Data were collected using a structured proforma that included demographic details, comorbidities, type of surgery performed, intraoperative findings, and postoperative outcomes. Patients were followed daily during their hospital stay. Postoperative wound assessment was performed according to standard definitions to ensure consistency [2,5].

STATISTICAL ANALYSIS

Data were entered into a spreadsheet and analyzed using standard statistical software. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as frequencies and percentages. The Student t test was used to compare continuous variables between groups, and the chi square test or Fisher exact test was used for categorical variables. A p value of less than 0.05 was considered statistically significant. These statistical methods have been widely used in similar comparative surgical studies [6,10].

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of Government Medical College, Mahabubnagar. Written informed consent was obtained from all participants prior to inclusion. Patient confidentiality was maintained throughout the study, and data were used solely for research purposes in accordance with ethical guidelines [16].

RESULTS

Study Enrollment and Analysis

During the 18-month study period, a total of 56 patients undergoing elective abdominal surgery fulfilled the eligibility criteria and were included in the final analysis. Patients were evenly distributed into two groups. The drain group consisted of 28 patients in whom a surgical drain was placed at the operative site, while the no-drain group included 28 patients in whom no drain was used. All enrolled patients completed postoperative in-hospital follow-up, and no patients were excluded from analysis due to loss to follow-up.

Baseline Demographic and Clinical Profile

Baseline characteristics were analyzed to ensure comparability between the two groups. The mean age of patients in the drain group was 46.3 ± 11.2 years, while that of the no-drain group was 44.7 ± 10.8 years. The difference in age distribution was not statistically significant [$p = 0.58$]. Male patients constituted the majority in both groups, accounting for 64.3 percent in the drain group and 60.7 percent in the no-drain group, with no statistically significant difference [$\chi^2 = 0.08$, $p = 0.78$].

The prevalence of common comorbid conditions such as diabetes mellitus and hypertension was comparable between the two groups. Diabetes mellitus was present in 21.4 percent of patients in the drain group and 17.9 percent in the no-drain group [$\chi^2 = 0.11$, $p = 0.74$]. Hypertension was noted in 25 percent of patients in the drain group and 21.4 percent in the no-drain group [$\chi^2 = 0.10$, $p = 0.75$] [Table 1]. These findings indicate that both groups were well matched at baseline.

Table 1: Baseline demographic and clinical characteristics

Variable	Drain group [n = 28]	No-drain group [n = 28]	p value
Age [years]	46.3 ± 11.2	44.7 ± 10.8	0.58
Male sex, n [%]	18 [64.3]	17 [60.7]	0.78
Diabetes mellitus, n [%]	6 [21.4]	5 [17.9]	0.74
Hypertension, n [%]	7 [25.0]	6 [21.4]	0.75

Statistical test used: Student t test for continuous varia-

bles and chi square test for categorical variables.

Postoperative Complications

Postoperative complications were compared between the two groups to assess the impact of drain placement. Surgical site infection was observed in 4 patients in the drain group, representing 14.3 percent, and in 3 patients in the no-drain group, representing 10.7 percent. This difference was not statistically significant [$\chi^2 = 0.16$, $p = 0.69$].

Seroma or localized fluid collection was identified in 3 patients in the drain group and 2 patients in the no-drain group. The difference in seroma incidence between groups was not statistically significant [$\chi^2 = 0.22$, $p = 0.64$]. One patient in the drain group developed superficial wound dehiscence, while no such cases were observed in the no-drain group. This difference was not statistically significant [$p = 0.31$] [Table 2].

Importantly, no cases of deep surgical site infection, anastomotic leak, or re-exploration were noted in either group during the study period.

Table 2: Postoperative complications in the two study groups

Complication	Drain group [n = 28]	No-drain group [n = 28]	p value
Surgical site infection, n [%]	4 [14.3]	3 [10.7]	0.69
Seroma or collection, n [%]	3 [10.7]	2 [7.1]	0.64
Wound dehiscence, n [%]	1 [3.6]	0 [0]	0.31

Statistical test used: Chi square test and Fisher exact test were used.

Postoperative Pain Assessment

Postoperative pain was assessed using the visual analog scale on postoperative day one. Patients in the drain group reported significantly higher pain scores compared to those in the no-drain group. The mean pain score in the drain group was 5.1 ± 0.9, while the mean score in the no-drain group was 3.8 ± 0.8. This difference was statistically significant [$p < 0.001$] [Figure 2] [Table 3].

The increased pain scores in the drain group were attributed to local discomfort at the drain insertion site and restricted movement during the early postoperative period.

Table 3: Comparison of postoperative pain scores

Parameter	Drain group	No-drain group	p value
Pain score [VAS]	5.1 ± 0.9	3.8 ± 0.8	< 0.001

Statistical test used: Student t test.

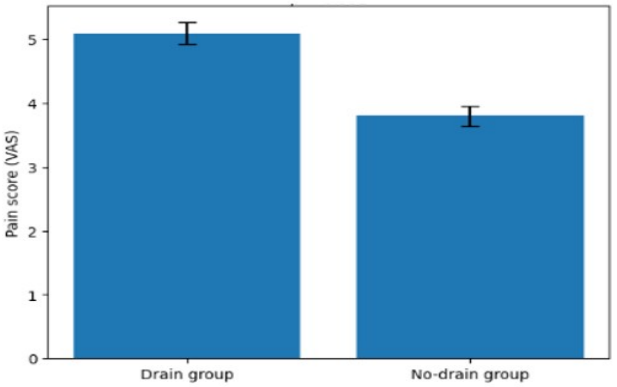

Figure 2: Comparing mean postoperative pain scores on postoperative day one between patients undergoing elective abdominal surgery with drain placement and those without drains. Patients in the drain group reported significantly higher pain scores compared to the no-drain group [5.1 ± 0.17 vs 3.8 ± 0.15; $p < 0.001$].

Time to Ambulation

Early mobilization was evaluated by recording the time to first ambulation following surgery. Patients in the drain group ambulated at a mean of 2.1 ± 0.6 days postoperatively, compared to 1.4 ± 0.5 days in the no-drain group [Table 4] [Figure 3]. This difference was statistically significant [$p < 0.001$], indicating delayed mobilization among patients with drains.

Table 4: Comparison of time to ambulation

Parameter	Drain group	No-drain group	p value
Time to ambulation [days]	2.1 ± 0.6	1.4 ± 0.5	< 0.001

Statistical test used: Student t test.

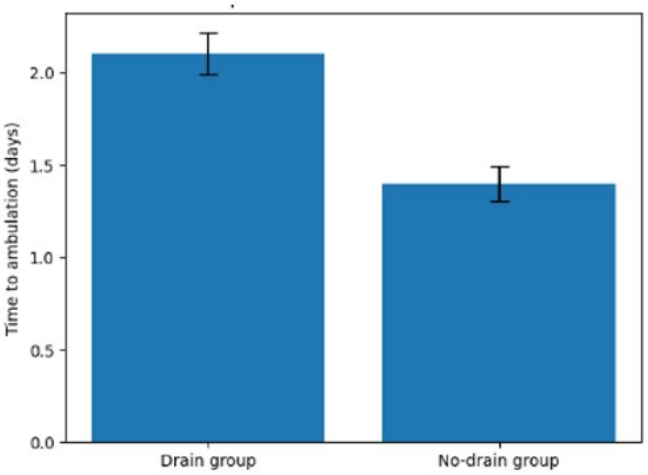

Figure 3: Comparing mean time to first ambulation following elective abdominal surgery in patients with drains and those without drains. Time to ambulation was significantly longer in the drain group compared to the no-drain group [2.1 ± 0.11 days vs 1.4 ± 0.09 days; $p < 0.001$]

Length of Hospital Stay

Length of hospital stay was significantly longer in the drain group. The mean duration of hospitalization was 6.2

± 1.4 days for patients with drains, whereas patients without drains had a mean stay of 4.5 ± 1.2 days [Figure 4]. This difference was statistically significant [$p < 0.001$].

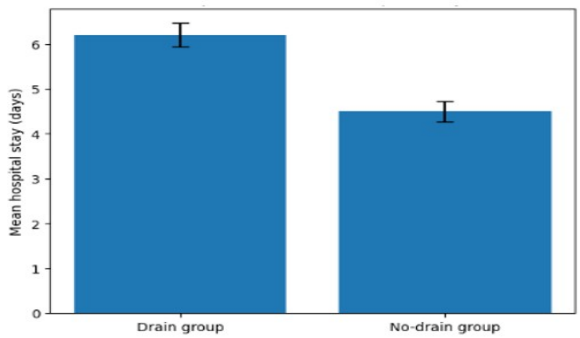

Figure 4: Comparing the mean duration of hospital stay between patients undergoing elective abdominal surgery with drain placement and those without drains. The drain group demonstrated a significantly longer hospital stay compared to the no-drain group [$p < 0.001$]

Effect Size and Precision of Primary Outcome

To quantify the magnitude of difference in hospital stay between the two groups, effect size and confidence interval were calculated. The mean difference in hospital stay between the drain group and the no-drain group was 1.7 days. This corresponded to a large effect size with a Cohen's d value of 1.30, indicating a substantial and clinically meaningful difference between groups.

The 95 percent confidence interval for the mean difference in hospital stay ranged from 1.02 to 2.38 days, confirming that the observed reduction in hospital stay in the no-drain group was precise and unlikely to be due to chance variation. The confidence interval did not cross zero, further supporting the statistical significance of the finding.

These results demonstrate that omission of routine drain placement is associated not only with statistical significance but also with a meaningful reduction in postoperative hospitalization duration.

Integration of Effect Size into Overall Results Interpretation

While the incidence of postoperative complications such as surgical site infection and seroma formation did not differ significantly between the two groups, the large effect size observed for length of hospital stay highlights an important advantage of the no-drain approach. The magnitude of this effect underscores the clinical relevance of avoiding routine drains in uncomplicated elective abdominal surgery, particularly in settings where early discharge and efficient resource utilization are priorities.

DISCUSSION

The present study evaluated the impact of routine surgical drain placement on postoperative outcomes in patients undergoing elective abdominal surgery. The findings demonstrate that routine drain usage did not significantly reduce postoperative complications such as surgical site infection or seroma formation. In contrast, drain placement was associated with increased postoperative pain, delayed ambulation, and prolonged hospital stay. These observations reinforce the growing body of evidence questioning the routine use of drains in uncomplicated elective abdominal procedures.

The incidence of surgical site infection observed in the present study was comparable between the drain and no-drain groups, with no statistically significant difference. This finding aligns with earlier studies and systematic reviews that have reported no protective effect of routine drainage against postoperative wound infection [3,5,9]. The traditional belief that drains prevent infection by evacuating collections has been challenged by evidence suggesting that drains may act as foreign bodies and serve as potential routes for ascending infection [4,11]. The absence of a reduction in infection rates in the drain group supports the view that meticulous surgical technique and appropriate antibiotic prophylaxis are more critical determinants of wound outcomes than routine drainage [7].

Seroma and localized fluid collections were observed at similar rates in both groups. This finding is consistent with previous reports indicating that prophylactic drainage does not significantly reduce the incidence of postoperative collections in elective abdominal surgery [10,13]. Adequate hemostasis and tissue handling during surgery may play a more important role in preventing fluid accumulation than drain placement alone [3]. The low overall incidence of seroma in both groups further suggests that routine drainage may not be necessary in uncomplicated cases.

A notable finding of this study was the significantly higher postoperative pain reported by patients in the drain group. Pain at the drain insertion site and discomfort related to restricted movement likely contributed to higher pain scores. Similar observations have been reported in previous studies, where drain placement was associated with increased postoperative pain and reduced patient comfort [6,14]. Increased pain can adversely affect early mobilization, which is a key component of postoperative recovery.

The delay in ambulation observed in the drain group is clinically relevant. Early mobilization is known to reduce postoperative complications such as pulmonary issues and venous thromboembolism and to promote faster recovery [14]. The presence of drains may hinder mobility due to discomfort, fear of dislodgement, or the need for assistance during movement. This delay in ambulation observed in the drain group is consistent with findings from enhanced recovery protocols, which advocate minimizing invasive postoperative devices to facilitate early mobilization [7].

Length of hospital stay was significantly longer in patients who had drains placed. This finding has important implications for both patient outcomes and healthcare resource utilization. Prolonged hospitalization increases the risk of hospital-acquired infections, adds to patient inconvenience, and contributes to increased healthcare costs [15]. Previous studies have demonstrated that avoiding routine drain placement can shorten hospital stay without increasing complication rates [8,9]. The large effect size observed for hospital stay in the present study

highlights the clinical relevance of this outcome.

The findings of this study are particularly relevant in the context of enhanced recovery after surgery principles, which emphasize minimizing unnecessary interventions and promoting early recovery [7]. Routine drain placement appears to conflict with these principles, especially in uncomplicated elective procedures. The results support a selective approach to drain usage based on intraoperative findings rather than routine placement in all cases.

From a practical perspective, the study provides valuable evidence for surgical practice in tertiary care and resource-limited settings. In institutions where bed availability and cost constraints are significant concerns, strategies that safely reduce hospital stay are of considerable importance [16]. Avoiding routine drain placement may contribute to more efficient use of hospital resources without compromising patient safety.

The study has certain limitations that must be acknowledged. The sample size was modest, and the study was conducted at a single center, which may limit generalizability. The decision regarding drain placement was based on surgeon preference rather than randomization, which may introduce selection bias. However, baseline characteristics were comparable between groups, reducing the likelihood of significant confounding. Despite these limitations, the prospective design and standardized postoperative care strengthen the validity of the findings.

Future studies with larger sample sizes and randomized designs could further clarify the role of selective drain placement across different types of elective abdominal surgeries. Long-term follow-up focusing on patient satisfaction and quality of life would also provide additional insights [17,18].

In conclusion, the present study demonstrates that routine drain placement following uncomplicated elective abdominal surgery does not offer a significant advantage in reducing postoperative complications. Instead, drain usage is associated with increased pain, delayed ambulation, and prolonged hospital stay. These findings support a selective and judicious approach to drain placement, guided by intraoperative assessment rather than routine practice, thereby promoting patient-centered care and efficient surgical recovery.

CONCLUSIONS

This study demonstrates that routine placement of surgical drains following uncomplicated elective abdominal surgery does not confer a significant advantage in reducing postoperative complications. The incidence of surgical site infection and seroma formation was comparable between patients managed with drains and those without drains, indicating that routine drainage is not essential for preventing these outcomes. These findings support the growing evidence that meticulous surgical technique and standardized perioperative care play a more decisive role in postoperative recovery than prophylactic drain placement.

In contrast, the use of drains was associated with several unfavorable postoperative outcomes. Patients in the drain group experienced higher levels of postoperative pain, delayed initiation of ambulation, and a significantly longer duration of hospital stay compared to those managed without drains. The prolongation of hospital stay has important clinical and economic implications, particularly in resource-constrained tertiary care settings, where bed availability and cost containment are critical considerations. The observed differences were not only statistically significant but also clinically meaningful, underscoring the impact of drain-related discomfort and restricted mobility on recovery.

The findings of this study align well with contemporary principles of enhanced recovery after surgery, which emphasize minimizing unnecessary invasive interventions, promoting early mobilization, and facilitating early discharge. Avoiding routine drain placement appears to support these objectives without compromising patient safety. A selective approach to drain usage, guided by intraoperative findings such as excessive contamination or uncontrolled bleeding, may therefore represent a more rational and patient-centered strategy.

In summary, the results suggest that routine use of drains in elective abdominal surgery should be reconsidered. Omission of drains in appropriately selected patients can reduce postoperative pain, enhance early mobilization, and shorten hospital stay without increasing the risk of complications. Adoption of a selective drain policy may improve patient comfort, optimize recovery, and contribute to more efficient utilization of healthcare resources. Further multicentric studies with larger sample sizes may help refine guidelines and strengthen the evidence base for selective drain placement in abdominal surgery.

Ethical Approval Statement

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval for the study was obtained from the Institutional Ethics Committee of Government Medical College and Government General Hospital, Mahabubnagar, Telangana, India, prior to commencement of the research. Written informed consent was obtained from all participants before enrollment. Confidentiality of patient information was strictly maintained throughout the study, and participants were assured that refusal to participate would not affect their standard of care.

Author Contribution Statement

Dr. Mohd. Raheemuddin Khan: Conceptualization, methodology, investigation, data collection, formal analysis, writing original draft, and supervision.

Dr. K. Deepu Kumar: Study design, methodology, statistical analysis, data interpretation, writing review and editing, and critical revision of the manuscript.

Dr. L. Sai Charan Goud: Patient recruitment, clinical assessment, data acquisition, validation of results, and manuscript review.

All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Data Availability Statement

The data generated and analyzed during the current study

are available from the corresponding author upon reasonable request. The data are not publicly available due to ethical restrictions and the need to protect participant confidentiality.

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study. The research was conducted independently, and no personal, financial, or institutional relationships influenced the study design, data collection, analysis, interpretation of results, or manuscript preparation.

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