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Comparison of Drain Versus No Drains in Abdominal Surgery- Impact on Morbidity and Recovery

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KEYWORDS

Abdominal surgery, postoperative morbidity, surgical drains.

ABSTRACT:

Background: The role of prophylactic drains in abdominal surgery remains controversial, with conflicting evidence regarding their benefit in preventing postoperative complications. Modern surgical philosophies, particularly Enhanced Recovery After Surgery (ERAS) pathways, advocate minimal use of drains to enhance patient comfort and reduce hospital stay. This study aimed to compare postoperative morbidity, recovery, and cost outcomes between patients undergoing abdominal surgery with and without drain placement.

Methods: A prospective comparative observational study was conducted on 120 patients undergoing elective or emergency abdominal surgeries at a tertiary-care center. Patients were divided into two groups-Drain group (n = 60) and No-drain group (n = 60)-based on intraoperative decision. Postoperative parameters including surgical site infection (SSI), intra-abdominal collection, pain scores, time to ambulation, oral intake, bowel activity, length of hospital stay, and direct treatment costs were recorded and statistically analyzed using chi-square and Welch t-tests.

Results: Composite morbidity within 30 days was 36.7 % in the drain group and 23.3 % in the no-drain group ($p = 0.084$). Rates of SSI (31.7 % vs 18.3 %) and intra-abdominal collections (13.3 % vs 10.0 %) did not differ significantly. However, the no-drain group exhibited significantly lower postoperative pain (VAS at 24 h = 4.9 ± 1.1 vs 5.8 ± 1.2; $p < 0.001$), earlier ambulation (18.9 ± 5.9 h vs 22.7 ± 6.8 h; $p = 0.001$), shorter hospital stay (5.1 ± 1.8 days vs 6.2 ± 2.1 days; $p = 0.002$), higher comfort and quality-of-recovery scores, and lower mean hospital cost (₹ 33,140 ± 8,900 vs ₹ 38,720 ± 9,800; $p = 0.0009$).

Conclusion: Routine drain placement after abdominal surgery offers no significant reduction in postoperative complications and may delay recovery. Omission of drains facilitates early mobilization, improved comfort, shorter hospitalization, and cost savings without increasing morbidity. Selective use of drains based on intraoperative findings is recommended over a universal approach.

INTRODUCTION

The use of surgical drains in abdominal surgery has been a long-standing and contentious issue in operative practice. Drains are traditionally placed to prevent accumulation of fluid, blood, bile, pus, or serum within the peritoneal cavity, which may otherwise predispose to infection or delayed healing. Their use has been deeply ingrained in surgical routines since the late 19th century, when the practice emerged to prevent postoperative complications such as abscess formation and peritonitis. However, with advancements in surgical techniques, meticulous hemostasis, and improved perioperative care, the necessity of routine drainage in abdominal procedures has come under increasing scrutiny. The debate now centers on whether drains actually reduce

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morbidity or conversely increase postoperative complications and discomfort, thereby delaying recovery.[1]

The fundamental purpose of a drain is to remove unwanted collections from surgical sites and to allow early detection of postoperative hemorrhage or leakage. Drains are generally categorized as open (such as Penrose drains) or closed (such as suction drains like Jackson-Pratt or Redon systems). In abdominal surgeries, closed suction drains are commonly used to evacuate serous or hemorrhagic collections following procedures such as cholecystectomy, appendectomy, colorectal resections, and laparotomies for malignancy or perforation. However, numerous randomized trials and meta-analyses have shown inconsistent outcomes regarding their utility.[2]

Traditionally, surgeons have believed that drains reduce the risk of postoperative fluid accumulation, abscess formation, and wound infection. They are often used as a safety measure-providing both a psychological reassurance to the surgeon and a perceived clinical safeguard. Yet, the introduction of foreign material in the surgical site itself may predispose to infection, act as a conduit for ascending bacterial contamination, cause pain, restrict mobility, and lead to prolonged hospital stay. Furthermore, the presence of a drain can contribute to patient anxiety, restrict ambulation, and delay discharge, contradicting the principles of enhanced recovery after surgery (ERAS).[3]

With the advent of ERAS protocols, the focus of postoperative management has shifted toward minimizing invasive procedures, reducing surgical stress, and accelerating return to normal function. These protocols emphasize early mobilization, early feeding, minimal opioid use, and avoidance of unnecessary tubes and drains. In this context, the decision to omit drains has gained renewed importance, as multiple studies indicate that omission of drains may not increase morbidity but can indeed shorten recovery time.[4]

Different abdominal procedures have varying indications for drain placement. In colorectal surgeries, drains were historically used to detect anastomotic leaks early. However, studies such as those by the Colorectal Cancer Collaborative Group have demonstrated that routine use of drains neither prevents nor detects leaks efficiently, as most leaks occur despite adequate drainage. In cholecystectomy, particularly in laparoscopic procedures, randomized controlled trials have shown no significant difference in the rates of postoperative collections or infection between drained and undrained groups. Similarly, after appendectomy, especially for uncomplicated cases, the use of drains has shown no clinical benefit and may even increase wound infection rates.[5]

Aim

To compare postoperative morbidity and recovery outcomes in patients undergoing abdominal surgery with and without drain placement.

Objectives

1. To evaluate and compare the incidence of postoperative complications, including wound infection and intra-abdominal collections, in drain versus no-drain groups.
2. To assess the impact of drain placement on postoperative recovery parameters such as pain, ambulation time, and hospital stay.
3. To determine whether omission of drains improves overall patient comfort, recovery rate, and cost-effectiveness in abdominal surgeries.

MATERIAL AND METHODOLOGY

Source of Data: Data were collected from patients undergoing abdominal surgeries in the Department of General Surgery at a tertiary care teaching hospital. Both elective and emergency cases were included after obtaining informed consent and institutional ethical committee approval.

Study Design: A prospective comparative observational study was conducted to compare outcomes between two groups: patients who underwent abdominal surgeries with drains and those without drains.

Study Location: The study was carried out in the Department of General Surgery, a tertiary care teaching hospital with a high annual surgical case load.

Study Duration: The study was conducted over a period of 18 months, from January 2023 to June 2024.

Sample Size: A total of 120 patients were included, divided into two groups of 60 each (drain group and no-drain group).

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Inclusion Criteria:

1. Patients aged 18-70 years undergoing elective or emergency abdominal surgeries (e.g., cholecystectomy, appendectomy, bowel resection, perforation closure).
2. Patients who provided written informed consent.
3. Hemodynamically stable patients postoperatively.

Exclusion Criteria:

1. Patients with pre-existing intra-abdominal abscess or generalized peritonitis requiring multiple drains.
2. Patients with severe immunocompromise or coagulopathy.
3. Patients undergoing laparoscopic surgeries converted to open with major complications.
4. Those lost to follow-up before postoperative day 7.

Procedure and Methodology:

Patients were evaluated preoperatively with routine investigations. Based on intraoperative findings and surgeon's discretion, patients were assigned to either the drain group (closed suction drain placed) or no-drain group. The type of surgery, duration, estimated blood loss, and intraoperative complications were recorded. Postoperatively, all patients received standardized care protocols, including intravenous fluids, analgesics, and antibiotics. Drain output, if present, was measured daily for quantity and nature (serous, serosanguinous, bile-stained). Drains were removed when output was <30 mL/24 hours and serous in character. Pain was assessed using a Visual Analog Scale (VAS) at 12, 24, and 48 hours postoperatively. Wound infection was evaluated using CDC criteria. Intra-abdominal collection was suspected clinically and confirmed by ultrasound if indicated. The duration of hospital stay was recorded from the day of surgery to discharge. Early mobilization and initiation of oral intake were encouraged as per ERAS principles.

Sample Processing: Drain fluid, if turbid or purulent, was sent for microbiological analysis to determine bacterial growth and antibiotic sensitivity. In cases of wound infection, pus swabs were similarly processed. Ultrasound-guided aspiration samples from intra-abdominal collections were examined microbiologically when applicable.

Statistical Methods: Data were entered into Microsoft Excel and analyzed using SPSS version 26. Descriptive statistics were expressed as mean ± standard deviation (SD) for continuous variables and as frequencies (%) for categorical variables.

Comparisons between groups were done using:

- **Independent t-test** for continuous variables (e.g., hospital stay, pain scores)
- **Chi-square test or Fisher's exact test** for categorical variables (e.g., wound infection, abscess formation).A *p-value* <0.05 was considered statistically significant. Effect sizes and 95% confidence intervals (CIs) were calculated for key outcomes.

Data Collection: Data were collected prospectively from patient records, operative notes, and postoperative follow-up charts. Each patient was followed up until discharge and reviewed at two weeks postoperatively for any delayed complications. The collected data were tabulated, compared, and analyzed to assess morbidity and recovery outcomes.

OBSERVATION AND RESULTS

Table 1: Primary outcomes: postoperative morbidity & recovery (N = 120)

Variable	Drain (n=60) n(%) or Mean ± SD	No-drain (n=60) n(%) or Mean ± SD	Test of significance	Effect size (95% CI)	p-value
Composite morbidity ≤30 days†	22 (36.7%)	14 (23.3%)	$\chi^2(1)=2.98$	RD -13.4% (-28.3% to +1.5%)	0.084

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Any SSI (CDC)	19 (31.7%)	11 (18.3%)	$\chi^2(1)=3.03$	RD -13.4% (-27.7% to +0.9%)	0.082
Re-intervention (drainage/OR)	7 (11.7%)	4 (6.7%)	$\chi^2(1)=0.95$	RD -5.0% (-14.7% to +4.7%)	0.33
30-day mortality	1 (1.7%)	0 (0.0%)	Fisher's exact	RD -1.7% (-5.0% to +1.6%)	0.32
Length of stay (days)	6.2 ± 2.1	5.1 ± 1.8	Welch t=-3.15	Mean diff -1.1 (-1.8 to -0.4)	0.002
Met ERAS discharge criteria by 72 h	23 (38.3%)	34 (56.7%)	$\chi^2(1)=4.99$	RD +18.4% (+2.5% to +34.3%)	0.024

†Composite morbidity included: SSI (superficial/deep/organ-space), intra-abdominal collection, anastomotic/bile/urinary leak, ileus needing NG decompression, or re-intervention.

Table 1 compares overall morbidity and early recovery between the drain and no-drain groups among 120 patients. Composite morbidity within 30 days was higher in the drain group (36.7%) than in the no-drain group (23.3%), though this difference did not reach statistical significance ($\chi^2 = 2.98$, p = 0.084). A similar pattern was seen for any surgical-site infection (SSI) defined by CDC criteria-31.7 % with drains versus 18.3 % without drains (p = 0.082). Re-intervention, including re-exploration or drainage procedures, occurred in 11.7 % of patients with drains compared to 6.7 % without drains, a nonsignificant difference (p = 0.33). Only one death (1.7 %) occurred, in the drain group, yielding no significant mortality difference.

Recovery parameters showed more definitive contrasts. The mean hospital stay was significantly shorter in patients without drains (5.1 ± 1.8 days) than in those with drains (6.2 ± 2.1 days), with a mean difference of -1.1 days (95 % CI -1.8 to -0.4; p = 0.002). Moreover, 56.7 % of patients in the no-drain group met ERAS discharge criteria within 72 hours, compared to only 38.3 % in the drain group (p = 0.024). Thus, while postoperative morbidity did not differ significantly, omission of drains was associated with faster recovery and earlier discharge.

Table 2: Postoperative complications: wound infection & intra-abdominal events (N = 120)

Complication	**Drain (n=60) n(%)**	**No-drain (n=60) n(%)**	**Test of significance**	**Effect size (95% CI)**	**p-value**
Superficial SSI	12 (20.0%)	7 (11.7%)	$\chi^2(1)=1.67$	RD -8.3% (-20.5% to +3.9%)	0.20
Deep/organ-space SSI	7 (11.7%)	4 (6.7%)	$\chi^2(1)=0.95$	RD -5.0% (-14.7% to +4.7%)	0.33
Intra-abdominal collection (US/CT-confirmed)	8 (13.3%)	6 (10.0%)	$\chi^2(1)=0.34$	RD -3.3% (-13.9% to +7.3%)	0.56
Clinically suspected anastomotic/enteric leak‡	3 (5.0%)	2 (3.3%)	Fisher's exact	RD -1.7% (-8.6% to +5.2%)	0.65
Bile leak after HPB procedure	2 (3.3%)	1 (1.7%)	Fisher's exact	RD -1.6% (-7.3% to +4.1%)	0.56
Post-op ileus needing NG tube (>48 h)	9 (15.0%)	6 (10.0%)	$\chi^2(1)=0.83$	RD -5.0% (-16.3% to +6.3%)	0.36

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Readmission ≤30 days (complication-related)	6 (10.0%)	4 (6.7%)	$\chi^2(1)=0.42$	RD -3.3% (-12.9% to +6.3%)	0.52

‡Where applicable (patients with anastomosis).

Table 2 analyzes specific postoperative complications. Superficial SSI occurred in 20 % of patients with drains and 11.7 % without, showing a non-significant risk difference of -8.3 % (p = 0.20). Deep or organ-space SSIs were also slightly higher with drains (11.7 %) than without (6.7 %), but again nonsignificant (p = 0.33). Intra-abdominal collections confirmed by ultrasonography or CT were recorded in 8 patients (13.3 %) with drains versus 6 (10 %) without (p = 0.56).

Serious sequelae were uncommon in both groups. Anastomotic or enteric leaks were detected in 5 % of drain and 3.3 % of no-drain patients (p = 0.65), and bile leaks following hepatopancreatobiliary procedures were rare (3.3 % vs 1.7 %, p = 0.56). Prolonged postoperative ileus requiring nasogastric decompression beyond 48 hours occurred in 15 % of drain and 10 % of no-drain cases (p = 0.36). Readmission within 30 days for complication management was similarly low in both cohorts (10 % vs 6.7 %, p = 0.52). Collectively, these data show that omission of drains did not increase the incidence of wound or intra-abdominal complications, reinforcing the safety of selective or non-routine drainage.

Table 3: Recovery parameters: pain, ambulation, bowel function, and stay (N = 120)

Parameter	Drain (n=60) Mean ± SD	No-drain (n=60) Mean ± SD	Test of significance	Effect size (95% CI)	p-value
VAS pain at 12 h (0-10)	6.2 ± 1.3	5.4 ± 1.1	Welch t=-3.53	Mean diff -0.8 (-1.2 to -0.3)	0.0007
VAS pain at 24 h (0-10)	5.8 ± 1.2	4.9 ± 1.1	Welch t=-4.27	Mean diff -0.9 (-1.3 to -0.5)	<0.001
Time to first ambulation (h)	22.7 ± 6.8	18.9 ± 5.9	Welch t=-3.33	Mean diff -3.8 (-6.1 to -1.5)	0.0012
Time to oral liquids (h)	17.6 ± 5.4	14.9 ± 4.7	Welch t=-3.04	Mean diff -2.7 (-4.5 to -0.9)	0.0029
Time to flatus (h)	33.8 ± 9.7	30.4 ± 8.8	Welch t=-2.06	Mean diff -3.4 (-6.6 to -0.2)	0.041
Length of stay (days)	6.2 ± 2.1	5.1 ± 1.8	Welch t=-3.15	Mean diff -1.1 (-1.8 to -0.4)	0.002

Table 3 highlights quantitative recovery indicators. Postoperative pain, measured on the Visual Analog Scale (VAS), was consistently lower in the no-drain group. Mean pain scores at 12 hours (6.2 ± 1.3 vs 5.4 ± 1.1; p = 0.0007) and 24 hours (5.8 ± 1.2 vs 4.9 ± 1.1; p < 0.001) demonstrated statistically significant relief when drains were omitted.

Functional recovery was also quicker without drains. The time to first ambulation averaged 22.7 ± 6.8 hours in the drain group versus 18.9 ± 5.9 hours in the no-drain group (p = 0.0012). Oral intake was resumed earlier (17.6 ± 5.4 h vs 14.9 ± 4.7 h; p = 0.0029), and first passage of flatus occurred sooner (33.8 ± 9.7 h vs 30.4 ± 8.8 h; p = 0.041). The hospital stay, reiterated from Table 1, favored the no-drain group by about one day (p = 0.002). These results show that avoidance of drains significantly improves comfort, reduces pain, and expedites postoperative milestones such as ambulation, oral intake, and bowel activity.

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Table 4: Patient comfort, recovery rate & cost-effectiveness (N = 120)

Outcome	Drain (n=60)	No-drain (n=60)	Test of significance	Effect size (95% CI)	p-value
Patient-reported comfort at 48 h (0-10)	6.1 ± 1.4	7.3 ± 1.2	Welch t=+4.47	Mean diff +1.2 (+0.7 to +1.7)	<0.001
QoR-15 score at 72 h (0-150)	116.8 ± 12.9	124.3 ± 11.7	Welch t=+3.32	Mean diff +7.5 (+3.0 to +12.0)	0.0012
Met ERAS discharge criteria by 72 h	23 (38.3%)	34 (56.7%)	$\chi^2(1)=4.99$	RD +18.4% (+2.5% to +34.3%)	0.024
Discharged by postoperative day ≤4	21 (35.0%)	33 (55.0%)	$\chi^2(1)=5.01$	RD +20.0% (+3.1% to +36.9%)	0.025
Direct hospital cost (INR)§	38,720 ± 9,800	33,140 ± 8,900	Welch t=-3.39	Mean diff -5,580 (-8,820 to -2,340)	0.0009
30-day unplanned OPD visits	14 (23.3%)	9 (15.0%)	$\chi^2(1)=1.48$	RD -8.3% (-21.7% to +5.1%)	0.22

Table 4 focuses on subjective comfort, recovery quality, discharge rate, and hospital cost. Patients without drains reported substantially higher comfort scores at 48 hours (7.3 ± 1.2 vs 6.1 ± 1.4; $p < 0.001$) and better quality of recovery (QoR-15) at 72 hours (124.3 ± 11.7 vs 116.8 ± 12.9; $p = 0.0012$). The proportion of patients meeting ERAS discharge criteria within 72 hours was 56.7 % in the no-drain group compared with 38.3 % in the drain group ($p = 0.024$), and 55 % of no-drain patients were discharged by postoperative day ≤ 4 compared to 35 % with drains ($p = 0.025$).

Economic evaluation revealed that the mean direct hospital cost was significantly lower in the no-drain group (₹ 33,140 ± 8,900) versus ₹ 38,720 ± 9,800 in the drain group ($p = 0.0009$), reflecting reduced material use and shorter stay. Unplanned outpatient visits within 30 days were slightly fewer in the no-drain group (15 %) than the drain group (23.3 %), though not statistically significant ($p = 0.22$).

DISCUSSION

The re-intervention and 30-day mortality signals in Table 1 are low and comparable, again consistent with older Cochrane findings and contemporary overviews that failed to show a protective effect of drains on severe endpoints after colorectal procedures. Where your dataset is most compelling is recovery: length of stay was shorter by 1.1 days and ERAS discharge by 72 h was more frequent without drains (RD +18.4%; p=0.024). Avoiding routine tubes (including intra-abdominal drains) is a core ERAS tenet; recent ERAS guidance for elective colorectal surgery explicitly advises against intra-abdominal drains, which matches your earlier discharge and shorter LOS. Abu A et al.(2022)[6]

Table 2 breaks down specific postoperative events and again shows no statistically significant advantage to drains for superficial/deep SSI, intra-abdominal collections, or readmission. This pattern echoes the Cochrane review and subsequent meta-analyses in colorectal surgery (no reduction in leak/abscess with drains) and extends to hepatobiliary and cholecystectomy cohorts where RCTs and reviews similarly show no benefit of prophylactic drainage-including in acute cholecystitis managed laparoscopically. In emergency/contaminated scenarios, contemporary WSES guidance emphasizes source control and percutaneous drainage for collections when indicated, rather than routine prophylactic drains at index surgery-conceptually compatible with your low and comparable rates of collections and leaks. Blanco FJ et al.(2025)[7]

Table 3 (pain and functional milestones) strongly favors the no-drain arm: lower VAS pain at 12-24 h, earlier

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ambulation, earlier oral intake, and earlier flatus-all statistically significant. These gains are mechanistically plausible (a drain is a painful foreign body and can restrict mobility) and are exactly what ERAS pathways report when "tubes and drains" are minimized. Your 4-hour advantage in first ambulation and 2.7-hour advantage to oral liquids map well onto ERAS reports that removing routine drains facilitates earlier mobilization and feeding, which, in turn, shortens LOS. Kushner B et al.(2021)[8]

Table 4 adds patient-centered and economic endpoints. Comfort at 48 h and QoR-15 at 72 h were significantly better without drains; more patients met ERAS discharge criteria and were discharged by day ≤ 4; and direct in-hospital costs were lower (mean -₹5,580). This triangulates with ERAS literature linking fewer tubes/drains to better patient-reported recovery and reduced length of stay/costs. Veziant J et al.(2021)[9] While pancreatic surgery historically has been "drain-friendly," even there recent randomized data (PANDRA programs) show noninferiority-and in some analyses fewer complications-when omitting routine drains after pancreatic resections, underscoring that the default-to-drain paradigm is being re-evaluated across specialties. Miller BT et al.(2023)[10]

CONCLUSION

The present comparative study demonstrates that the routine use of intra-abdominal drains after surgery does not confer any significant advantage in reducing postoperative morbidity, wound infection, or intra-abdominal complications. Although the composite morbidity and SSI rates were numerically higher in the drain group, the differences were statistically insignificant. Conversely, patients in the no-drain group experienced better postoperative comfort, less pain, earlier ambulation, earlier return of bowel function, shorter hospital stay, and lower overall treatment costs.

These findings are consistent with emerging evidence supporting selective rather than routine use of drains in abdominal surgery. The study affirms that omitting routine drainage neither increases postoperative risk nor compromises safety, but instead enhances recovery, patient satisfaction, and adherence to Enhanced Recovery After Surgery (ERAS) protocols. The practice of drain placement should, therefore, be individualized based on intraoperative findings, contamination level, and patient risk factors rather than applied universally.

LIMITATIONS OF THE STUDY

1. **Single-center design:** The study was conducted in a single tertiary-care institution, which may limit the generalizability of results to other healthcare settings with different surgical protocols.
2. **Moderate sample size:** With a sample size of 120 patients, the study might be underpowered to detect very small differences in rare complications such as anastomotic or bile leaks.
3. **Heterogeneous procedures:** The inclusion of various types of abdominal surgeries (elective and emergency) may have introduced procedural variability despite standardized postoperative care.
4. **Short follow-up period:** Postoperative follow-up was limited to 30 days, and long-term outcomes such as incisional hernia or late abscess formation were not evaluated.
5. **Non-randomized allocation:** Although efforts were made to match baseline characteristics, selection bias related to surgeon discretion in drain placement cannot be fully excluded.

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