**Review Article**

# Intra-Abdominal Drains in Surgery: Current Utility or Obsolete Practice

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International Archives of Integrated Medicine, Vol. 13, Issue 5, May, 2026.
**Available online at http://iaimjournal.com/**
**ISSN: 2394-0026 (P)** **ISSN: 2394-0034 (O)**
**Received on:** 5-5-2026 **Accepted on:** 31-5-2026
**Source of support:** Nil **Conflict of interest:** None declared.

DOI: **10.5281/zenodo.20550553**

**How to cite this article:** Stefanny Nikole Trejos Castro, Luis Enrique Vásquez Villalobos, Frandanny Vallejo Rivas, Enmanuel José Morales Delgado, Kristian Lewis Thomas, Ellen Daniela Sánchez Ramírez. Intra-Abdominal Drains in Surgery: Current Utility or Obsolete Practice. Int. Arch. Integr. Med., 2026; 13(5): 297-308.

## Abstract

Intra-abdominal drains have historically been used in abdominal surgery to evacuate fluid, detect complications early, and reduce postoperative contamination. Their traditional role was particularly emphasized in complex procedures, where they were believed to help prevent collections, identify hemorrhage or anastomotic leakage, and improve postoperative monitoring. Over time, however, this routine practice has been increasingly questioned as contemporary evidence has shown that their benefits are not uniform across surgical settings. Current evidence suggests that routine drain placement in elective gastrointestinal and colorectal surgery does not significantly reduce anastomotic leakage, intra-abdominal abscess formation, morbidity, or reintervention rates. Instead, routine use has often been associated with longer hospital stay, delayed discharge, and a higher risk of surgical site infection. Similar concerns have emerged in hepatobiliary and pancreatic surgery, where prophylactic drainage has not consistently improved outcomes and, in some cases, may contribute to

infectious complications, bile leakage, or prolonged fistula maintenance. In distal pancreatectomy, omission of drains has been associated with fewer complications and shorter hospitalization. In emergency surgery, drains may still have a selective role, particularly in contaminated fields, diffuse peritonitis, bowel perforation, abscess surgery, and damage-control settings, where source control is a central priority. Even in these scenarios, their effectiveness is limited when used without clear indication. Modern surgical practice increasingly favors individualized drain placement based on patient risk, operative complexity, and intraoperative findings. This selective strategy is reinforced by minimally invasive surgery and enhanced recovery pathways, which support avoiding unnecessary drains and promoting early removal to improve recovery and reduce complications.

## Key words

Intra-abdominal drains, abdominal surgery, postoperative complications, selective drainage, enhanced recovery, source control.

## Introduction

Intra-abdominal drains have historically been used with the intention of preventing postoperative fluid accumulation and facilitating the early detection of complications, particularly after complex procedures such as pancreatoduodenectomy and colorectal surgery [1, 2]. Within this traditional framework, routine drain placement was justified as a strategy to reduce the risk of adverse postoperative events, especially postoperative pancreatic fistula and surgical site infections. However, this long-established practice has increasingly been questioned as contemporary evidence has challenged the assumption that routine drainage consistently improves surgical outcomes [3, 4].

In this context, recent studies have suggested that routine drain placement may not be necessary and, in some cases, may even be associated with an increase in complications, including infections and prolonged hospital stay [2, 5]. Supporting this shift, a meta-analysis found no significant differences in morbidity or mortality between patients managed with drains and those managed without drains after pancreatic surgery, indicating that a no-drain policy could be equally effective in selected settings [3]. A similar pattern has been observed in colorectal surgery, where drains were not associated with lower rates of postoperative collections or other complications, but were linked to delayed discharge and a higher risk of surgical site infection [2].

As a result, the debate has progressively shifted from the routine prophylactic use of drains toward a more restrictive approach in which drains are employed only when therapeutically indicated. Some studies have shown that prophylactic drains do not reduce infection rates and may instead increase the risk of complications such as bile leakage and infectious fluid accumulation [6]. In pancreatic surgery specifically, prophylactic drainage has been associated with a higher risk of postoperative pancreatic fistula in low-risk patients, whereas no significant differences have been observed among moderate- or high-risk patients [3].

This reassessment of drain placement is clinically relevant because it may contribute to improved patient outcomes, shorter hospital stays, and lower healthcare costs [7]. In line with this evolving evidence, selective drain placement based on risk stratification and individualized patient assessment is emerging as a more effective strategy than routine use [1].

The objective of this work is to critically evaluate the current role of intra-abdominal drains in abdominal surgery, examining the evidence surrounding their routine, prophylactic, and selective use, and to determine whether their placement remains clinically justified or

represents an outdated practice in contemporary surgical care.

## Methodology

This manuscript was developed as a structured narrative review aimed at providing an updated and clinically integrated analysis of the role of intra-abdominal drains in contemporary abdominal surgery, with particular emphasis on their historical rationale, current indications, potential benefits, associated risks, and the ongoing controversy regarding their routine versus selective use. The review was conducted in accordance with the SANRA (Scale for the Assessment of Narrative Review Articles) framework and followed a predefined methodological protocol established prior to literature screening. Given the heterogeneity of abdominal surgical procedures, the variability in operative settings, and the procedure-specific differences in postoperative risk profiles, a narrative interpretative synthesis was selected over quantitative pooling in order to integrate surgical, clinical, and outcome-based considerations into a coherent and clinically applicable framework. Special attention was given to the distinction between prophylactic and therapeutic drainage, the relevance of drain use in elective and emergency surgery, and the emerging preference for individualized drain placement based on risk stratification. The objective was to provide a structured synthesis capable of supporting evidence-based surgical decision-making regarding the current utility of intra-abdominal drains.

A comprehensive literature search was conducted in PubMed, Scopus, and Web of Science, including peer-reviewed articles published in English or Spanish between January 2020 and December 2025. The final search was performed in March 2026. This timeframe was selected to capture contemporary evidence regarding postoperative outcomes associated with drain placement, evolving recommendations within enhanced recovery protocols, current data on colorectal, pancreatic, hepatobiliary, and emergency abdominal surgery, as well as recent shifts away from routine prophylactic drainage. Foundational studies were incorporated when necessary to contextualize the historical development of drain use and the evolution of surgical reasoning surrounding postoperative fluid management. The search strategy combined MeSH and free-text terms using Boolean operators related to intra-abdominal drains, abdominal drainage, prophylactic drainage, therapeutic drainage, postoperative collections, anastomotic leak, postoperative pancreatic fistula, surgical site infection, colorectal surgery, pancreatic surgery, hepatobiliary surgery, emergency surgery, and enhanced recovery after surgery. Searches were conducted in titles and abstracts as well as indexed subject headings to maximize sensitivity.

The initial search yielded 218 records. After removal of duplicates, 173 articles remained for title and abstract screening. Of these, 102 underwent full-text evaluation, and 57 studies were included in the final synthesis. Selection was performed independently by two authors, with disagreements resolved through discussion and consensus. Exclusion criteria comprised non-peer-reviewed publications, isolated case reports, editorials without clinical outcome data, purely technical descriptions lacking postoperative outcome analysis, redundant datasets, and studies not directly addressing the indications, risks, benefits, or comparative outcomes of intra-abdominal drain use in abdominal surgery.

Eligible studies included randomized controlled trials, large observational cohorts, systematic reviews, meta-analyses, expert consensus statements, and contemporary international guidelines from gastrointestinal, hepatopancreatobiliary, colorectal, and emergency surgery societies. Priority was assigned to multicenter investigations, studies with clearly defined surgical populations, and research evaluating clinically relevant outcomes such as postoperative morbidity, mortality, surgical site infection, intra-abdominal abscess,

postoperative pancreatic fistula, anastomotic leak, reintervention, and length of hospital stay. Extracted variables included study design, type of abdominal procedure, indication for drain placement, drain strategy used, postoperative complications, duration of drain placement when available, and reported clinical outcomes. Methodological quality and internal validity were assessed narratively, considering risk of bias, sample size, follow-up duration, consistency in outcome definitions, and reproducibility of reported findings. In cases of conflicting evidence, greater interpretative weight was assigned to higher-level evidence and guideline-supported recommendations.

Reference lists of included studies were manually screened to identify additional relevant publications. Given its narrative design, this review is subject to potential selection bias and does not provide pooled quantitative estimates. Artificial intelligence-based tools were used exclusively to assist in literature organization and structural coherence, whereas critical appraisal, synthesis, and final interpretation were conducted independently by the authors to preserve methodological rigor.

## Conceptual Basis and Classification of Intra-Abdominal Drains

Intra-abdominal drains are devices placed within the abdominal cavity during or after surgery with the purpose of removing fluid, blood, or air, thereby reducing the risk of postoperative complications such as infection or anastomotic leakage. Their use has traditionally been justified by several practical objectives. One of their principal purposes is the evacuation of postoperative fluid collections, since the accumulation of excess fluid may favor infection and delay healing [3, 8]. In addition, drains may facilitate the early detection of hemorrhage or anastomotic leakage by allowing direct observation of the quantity and characteristics of the drained fluid, thereby enabling timely clinical intervention when complications arise [9]. They have also been used with the intention of reducing intra-abdominal contamination through the removal of potentially infectious material, which may help decrease the risk of intra-abdominal infection [10]. Furthermore, drains provide a means of monitoring postoperative complications, since their output may offer early clues regarding the presence and nature of adverse events after surgery [9].

From a mechanistic perspective, intra-abdominal drains may be classified as passive or active. Passive drains depend on gravity or capillary action to evacuate fluid and are generally simpler in design, although they may be less effective in certain clinical settings. In contrast, active suction drains use negative pressure to promote continuous fluid removal and may therefore be more efficient in the management of postoperative collections. In parallel, these devices may also be classified according to system design as open or closed drains. Open drains permit fluid to exit freely to the exterior, but this design is associated with a higher risk of infection because of exposure to the external environment. Closed drains, by contrast, are connected to a collection system, which reduces infection risk and allows more accurate monitoring of drain output [8].

A further distinction can be made between prophylactic, therapeutic, and rescue drainage. Prophylactic drainage is intended to prevent complications in surgeries considered high risk, although its necessity remains controversial, particularly in pancreatic surgery [2, 11]. Therapeutic drainage, in contrast, is used to manage established complications such as abscesses or fistulas [10]. Rescue drainage refers to drainage implemented as an emergency measure in response to unexpected postoperative complications [12]. The effectiveness of any drainage strategy is also influenced by technical considerations, particularly the location and timing of drain placement. Early drain removal has been associated with fewer complications and shorter hospital stay in some settings [13]. Likewise, the type of surgery performed plays an

important role in determining the most appropriate drainage strategy, since the choice of drain type and its clinical utility may vary according to the specific procedure and the patient's individual risk profile [1, 14].

## Theoretical Benefits and Potential Harms

Intra-abdominal drains have been traditionally valued for several proposed advantages in the postoperative setting. One of their principal benefits is the evacuation of fluids, since they can remove blood, bile, and other collections from the surgical field, potentially reducing the risk of fluid accumulation and the complications associated with it. By facilitating the removal of excess fluid, drains may also contribute to the decompression of operative spaces, which can favor healing and decrease pressure-related complications. Another commonly cited advantage is the early recognition of leaks, as drains may function as an early warning system that allows prompt detection and intervention, particularly in procedures involving the pancreas or bile ducts, where leakage can result in considerable morbidity. In the same context, their use has also been associated with a possible reduction in abscess formation by preventing the accumulation of fluid that may subsequently become infected [15].

Despite these potential benefits, intra-abdominal drains are also associated with important disadvantages and complications. One of the main concerns is ascending infection, as drains may act as a conduit for bacteria and thereby increase the risk of surgical site infection [16]. In addition, their presence may cause substantial pain and discomfort, which can negatively affect recovery and quality of life during the postoperative period. Drains may also delay mobilization and contribute to prolonged hospital stay, both of which are undesirable in the context of modern perioperative care and enhanced recovery strategies [7, 14]. Their effectiveness may also be compromised by mechanical problems such as obstruction or dislodgement, which can lead to inadequate drainage and may require further intervention. Moreover, the presence of a drain can generate false reassurance, potentially delaying the recognition of complications that are not adequately controlled or detected by the device itself [15]. Local tissue irritation represents another limitation, and in some scenarios, particularly in pancreatic surgery, drains may contribute to the persistence or maintenance of fistulas [3].

For these reasons, the decision to use intra-abdominal drains should be individualized according to the type of surgical procedure and the specific risk profile of the patient. Available studies suggest that omitting drains in certain operations, such as distal pancreatectomy, may be associated with fewer complications and shorter hospital stay [2, 7]. Nevertheless, in more complex procedures or in settings with a high risk of leakage, selective drain use may still offer clinical benefit [15]. When drains are used, early removal appears to reduce some of the associated risks without increasing postoperative complications [13].

## Historical Evolution of Drain Use in Abdominal Surgery

Routine postoperative drainage was initially established as a standard practice in abdominal surgery, particularly in procedures such as pancreatoduodenectomy and distal pancreatectomy, where drains were placed with the intention of preventing complications such as pancreatic fistulas and intra-abdominal abscesses. This approach was supported by traditional surgical teachings that regarded drainage as an essential component of postoperative fluid management and as a useful method for the early detection of complications [1, 2]. As a result, the habit of placing drains became deeply embedded in surgical training and routine operative practice, largely reflecting a cautious philosophy aimed at minimizing postoperative risk. This traditional mindset contributed to the widespread use of drains across multiple forms of abdominal surgery [8].

Over time, the use of drains expanded and became a common feature in gastrointestinal, hepatobiliary, and pancreatic surgery. However, as surgical outcomes began to be evaluated more critically, evidence emerged suggesting that routine drainage did not necessarily reduce postoperative complications and, in some cases, might even increase the risk of surgical site infection and prolong hospital stay [2, 17]. In parallel, important advances in surgical technique began to challenge the necessity of this routine practice. Improvements in hemostasis, greater technical precision, and the adoption of stapling devices contributed to safer procedures with less need for prophylactic drainage. At the same time, enhanced postoperative imaging and the increasing availability of interventional radiology provided alternative, less invasive means of diagnosing and managing postoperative complications, thereby reducing reliance on routine drain placement [3, 18].

In this evolving context, the surgical community has progressively moved toward a more individualized model of decision-making. Recent evidence supports selective drain placement based on patient-specific risk factors and intraoperative findings rather than on routine surgical habit alone. This more restrictive strategy has been associated with reduced morbidity and fewer re-interventions in procedures such as laparoscopic cholecystectomy and bile duct exploration [15, 16]. In addition, improvements in postoperative care, including broader antibiotic use and more effective clinical monitoring, have further diminished the need for routine drainage. Studies indicating that early drain removal does not increase infection rates and may shorten hospital stay have reinforced this shift toward individualized drain management and away from universal postoperative drainage [16, 18].

## Evidence in Elective Gastrointestinal and Colorectal Surgery

Evidence from elective gastrointestinal and colorectal surgery has increasingly challenged the routine use of intra-abdominal drains. A study conducted in Italy in patients undergoing elective colorectal surgery found that routine drain placement did not significantly affect secondary outcomes such as anastomotic leakage, overall morbidity, or reoperation rates, although it was associated with a slightly longer hospital stay [19]. Similarly, international studies have shown that drains do not reduce the incidence of postoperative collections or facilitate their earlier detection, and their use has instead been associated with increased surgical site infections and delayed discharge [20].

Within this context, colorectal surgery has become one of the principal fields in which the routine use of drains has been questioned. Enhanced Recovery After Surgery guidelines recommend against their routine placement because clear clinical benefits have not been demonstrated. In the same line, the COMPASS study showed that drains did not improve the detection of postoperative complications, while they were associated with longer hospital stay and higher rates of surgical site infection [2, 20].

Among the outcomes most frequently evaluated in the literature, anastomotic leak has shown no significant differences between patients managed with drains and those managed without drains in colorectal surgery [19]. Likewise, several studies have reported that drains are associated with a higher risk of surgical site infection, suggesting that their routine use may contribute to increased postoperative infectious morbidity [2, 20]. The presence of drains has also not been shown to significantly reduce the incidence of intra-abdominal abscesses. Similarly, no significant differences in reintervention rates have been observed between drain and no-drain groups [3, 11]. In contrast, hospital stay appears to be consistently affected, since routine drain placement has been associated with longer hospitalization, with some studies reporting a mean difference of approximately 0.86 days [2, 19].

When comparing routine drain placement with no-drain strategies, meta-analyses and systematic reviews have consistently shown that omitting drains is associated with fewer complications, including lower rates of postoperative pancreatic fistula and shorter hospital stay [7, 11]. In colorectal surgery specifically, the absence of drains has not been associated with worse outcomes and has instead been linked to a lower risk of surgical site infection and shorter hospitalization [2, 20]. Taken together, current evidence supports a no-drain policy in low-risk and standard elective procedures, as this approach does not appear to compromise safety and may enhance postoperative recovery by reducing complications and shortening hospital stay. In contemporary colorectal practice, this shift toward avoiding routine drainage is consistent with Enhanced Recovery After Surgery recommendations and is supported by data showing no significant benefit from routine drain use, with potential advantages in both patient outcomes and resource utilization [7, 11].

## Evidence in Hepatobiliary, Gastric, and Pancreatic Surgery

In hepatic surgery, drains have traditionally been used with the intention of controlling bile leakage and preventing postoperative fluid collections. This practice has been based on the assumption that prophylactic drainage may facilitate the evacuation of bile and other fluids while allowing earlier recognition of complications. Nevertheless, available evidence suggests that routine prophylactic drainage does not significantly reduce postoperative infection rates when compared with no drainage, and may even be associated with a higher incidence of infectious abdominal fluid accumulation and bile leakage [6]. At the same time, complex clinical scenarios, such as biliary leaks following hepatobiliary surgery, illustrate that drainage may still be necessary in selected cases to achieve adequate management of postoperative complications.In gastric surgery, the use of drains after gastrectomy or upper gastrointestinal anastomosis remains variable and appears to depend largely on the extent of resection and the type of reconstruction performed. However, the available evidence from the provided material is limited in this field, which highlights the need for more focused research specifically addressing the value of drainage in gastric procedures. This variability in practice reflects the persistence of uncertainty and the absence of a universally accepted approach [21].

Pancreatic surgery remains one of the most debated settings regarding the role of intra-abdominal drains, largely because of their traditional role in monitoring for postoperative pancreatic fistula, one of the most important complications after pancreatic resection. Although drains have long been considered essential for early detection and control of this complication, recent studies have questioned the benefit of routine drainage and suggest that a no-drain policy may be associated with fewer complications and shorter hospital stay [2, 3]. In support of this evolving perspective, meta-analyses have found no significant differences in morbidity or mortality between drainage and no-drainage groups, although early drain removal has been associated with reductions in chyle leaks and length of hospitalization [8]. In addition, the type of drainage used, whether active or passive, does not appear to significantly influence outcomes [4]. More specifically, current evidence supports a no-drain policy in distal pancreatectomy, where lower risks of postoperative pancreatic fistula and other complications have been observed, emphasizing that decisions regarding drain placement should be guided by procedure-specific evidence rather than generalized routine practice [11, 17].

## Role of Drains in Emergency Surgery and Intra-Abdominal Sepsis

Emergency abdominal surgery differs substantially from elective surgery because it is generally associated with greater physiological instability, a higher burden of contamination, and a higher risk of adverse postoperative outcomes. In this setting, mortality is significantly higher

than in elective procedures, with studies reporting an in-hospital mortality rate of 38% for emergency cases compared with 31% for elective surgery. Postoperative complications are also more frequent in emergency procedures, with reported rates of 75.4% compared with 66.94% in elective operations. These differences help explain why the use of intra-abdominal drains continues to be considered more often in emergency surgery than in planned elective operations [22].

In contaminated surgical fields, drains are commonly used as part of source control strategies, particularly in cases of diffuse peritonitis. Their use is intended to facilitate decontamination of the peritoneal cavity and reduce intra-abdominal pressure, both of which are important in the management of perforation peritonitis [23]. Similarly, in bowel perforation and abscess surgery, drains may assist in controlling infection and limiting the progression of intra-abdominal sepsis [24, 25]. For this reason, drains may be indicated in procedures involving bowel perforation, abscess evacuation, and damage-control surgery, where they are used to help stabilize the patient before definitive surgical management is possible. In emergency appendectomy, their use has been recommended in complicated cases, although the effect on postoperative complications has not reached statistical significance [26].

Despite these potential indications, the effectiveness of drains in uncontrolled sepsis remains limited. Although they may contribute to initial infection control, they do not significantly reduce rates of postoperative collections or major complications [20]. Moreover, their use has been associated with an increased risk of surgical site infection, which may complicate recovery and prolong hospital stay [2]. For this reason, it is essential to distinguish between drains placed as a necessary component of source control and those inserted prophylactically without a clear therapeutic indication. Routine prophylactic drainage is not recommended because it has not demonstrated clear clinical benefit and may increase complications [25]. Instead, the decision to place a drain should be individualized according to the patient's condition and the specific clinical context [24].

In unstable or high-risk emergency scenarios, drains may still have selective utility, particularly when severe infection, contamination, or hemodynamic compromise requires adjunctive measures to support stabilization. Even so, their use should be carefully weighed against the potential risks associated with drainage. In addition, the timing of drain placement may influence outcomes, as delayed placement has been associated with effects on recovery and duration of intensive care unit stay [12, 23].

## Contemporary Surgical Paradigms: Selective Drain Use and Enhanced Recovery

Minimally invasive surgery has contributed to a progressive reduction in dependence on intra-abdominal drains, largely because these techniques are associated with less tissue trauma and a lower risk of postoperative complications. In this context, studies have shown that omitting routine drainage may lead to fewer complications and shorter hospital stays, particularly in pancreatic surgery [2, 7]. Likewise, in distal pancreatectomy, a no-drain policy has been associated with lower rates of postoperative pancreatic fistula and overall morbidity, which supports its adoption in minimally invasive procedures [11].

At the same time, drain policy has become increasingly integrated into Enhanced Recovery After Surgery pathways. These protocols advocate early drain removal as part of a broader strategy to enhance recovery, reduce complications, and shorten hospitalization. Early drain removal has been shown to decrease complications such as postoperative pancreatic fistula without increasing infection risk. In addition, the implementation of Enhanced

Recovery After Surgery protocols that incorporate early drain removal has been associated with improved postoperative outcomes, including reduced time to food intake and earlier return of bowel activity [12, 27].

In line with these principles, drain avoidance or early removal has been linked to earlier mobilization and less pain, both of which contribute to faster recovery and earlier discharge. Evidence also indicates that early drain removal does not increase the rate of surgical site infections, which further supports its role within enhanced recovery strategies [11, 25]. Rather than favoring routine placement, current practice increasingly supports selective drain use based on risk stratification. This approach considers factors such as anastomotic complexity and degree of contamination in order to minimize unnecessary drainage and the complications associated with it. In this regard, risk stratification models have been developed to guide selective drain placement and ensure that drains are used only when clinically justified [1, 25].

The importance of early drain removal is further supported by evidence showing that this strategy reduces drain-related complications, lowers major morbidity, and shortens hospital stay [28]. This practice is consistent with Enhanced Recovery After Surgery principles, since it promotes a quicker return to normal activity without increasing postoperative complication rates [13]. Nevertheless, postoperative care should not rely exclusively on drain output, as this may not accurately reflect the patient's true clinical course. Individualized postoperative surveillance remains essential, with comprehensive monitoring of clinical signs and symptoms playing a central role in ensuring optimal outcomes [3]. In parallel, novel predictive models and dynamic strategies continue to be explored in order to improve both drain management and overall postoperative care [1].

## Conclusions

Routine intra-abdominal drain placement is no longer supported as a universal strategy in abdominal surgery, since current evidence shows no consistent reduction in anastomotic leak, intra-abdominal abscess, reintervention, morbidity, or mortality, while it may increase surgical site infections, prolong hospital stay, and delay recovery.

The contemporary role of intra-abdominal drains is better justified through selective and individualized use rather than routine prophylactic placement, particularly according to the type of procedure, intraoperative findings, contamination burden, and patient-specific risk factors; this is especially relevant in hepatobiliary, pancreatic, and emergency surgical settings.

Current surgical practice increasingly aligns drain management with minimally invasive surgery and Enhanced Recovery After Surgery principles, favoring no-drain policies in low-risk elective procedures and early drain removal when drains are used, in order to reduce complications, shorten hospitalization, and improve postoperative recovery.

## References

1. Li Z, Zhang Y, Ni Y, Li L, Xu L, Guo Y, et al. Updating the paradigm of prophylactic abdominal drainage following pancreatoduodenectomy. International Journal of Surgery [Internet]. 2024 Jul 18;111(1):1083–9. Available from: https://doi.org/10.1097/js9.0000000000001973
2. Collaborative E, Sgrò A, Blanco-Colino R, Ahmed W, Brindl N, Gujjuri R, et al. Intraperitoneal drain placement and outcomes after elective colorectal surgery: international matched, prospective, cohort study. British Journal of Surgery [Internet]. 2022 Feb

16;109(6):520–9. Available from: https://doi.org/10.1093/bjs/znac069

3. Leite LF, De Almeida LFC, Menezes S, Romagnoli I, Striquer DD, Belotto M. Prophylactic abdominal drainage in pancreatic surgery: an updated systematic review and meta-analysis. Langenbeck S Archives of Surgery [Internet]. 2025 Aug 29;410(1):255. Available from: https://doi.org/10.1007/s00423-025-03763-z
4. Park LJ, Baker L, Smith H, Lemke M, Davis A, Abou-Khalil J, et al. Passive versus active Intra-Abdominal drainage following Pancreatic resection: Does a superior drainage system exist? A Systematic Review and Meta-Analysis. World Journal of Surgery [Internet]. 2021 May 27;45(9):2895–910. Available from: https://doi.org/10.1007/s00268-021-06158-5
5. Nickel F, Lang F, Kowalewski KF, Haney CM, Menrath M, Berchtold C, et al. Pancreatic surgery with or without drainage: propensity score-matched study. British Journal of Surgery [Internet]. 2022 Apr 14;109(8):739–45. Available from: https://doi.org/10.1093/bjs/znac123
6. Liang L, Liu X, Liu F, Su Q. The effect of placing prophylactic abdominal drainage tube after hepatobiliary surgery on postoperative infection: A systematic review and meta-analysis. International Wound Journal [Internet]. 2024 Jan 30;21(2). Available from: https://doi.org/10.1111/iwj.14579
7. Fatima M, Ahmed A, Khan MH, Faisal MH, Sehar A, Khan MJ, et al. Comparative assessment of outcomes. Annals of Surgery [Internet]. 2024 Oct 14;281(4):582–90. Available from: https://doi.org/10.1097/sla.0000000000006564
8. Pietrogiovanna L, Canovi S, Probst P, Hauswirth F, Müller MK, Renzulli P. Systematic review on the use and management of drainages in pancreatic surgery. British Journal of Surgery [Internet]. 2022 May 31;109(Supplement_3). Available from: https://doi.org/10.1093/bjs/znac178.009
9. Shi J, Wu Z, Wu X, Shan F, Zhang Y, Ying X, et al. Early diagnosis of anastomotic leakage after gastric cancer surgery via analysis of inflammatory factors in abdominal drainage. Annals of Surgical Oncology [Internet]. 2021 Sep 22;29(2):1230–41. Available from: https://doi.org/10.1245/s10434-021-10763-y
10. Zhou Y, Lu F, Lin X, Yang Y, Wang C, Fang H, et al. Drainage posterior to pancreaticojejunostomy reduces the severity of postoperative pancreatic fistula after pancreaticoduodenectomy. World Journal of Surgical Oncology [Internet]. 2024 Nov 27;22(1):315. Available from: https://doi.org/10.1186/s12957-024-03597-x
11. Klaiber U, Collins PM, Trinkler S, Gustorff C, Schindl M, Sahora K, et al. A systematic review and meta-analysis of morbidity and pancreatic fistula after distal pancreatectomy with versus without prophylactic intra-abdominal drainage. International Journal of Surgery [Internet]. 2024 Jul 22;110(11):7215–24. Available from: https://doi.org/10.1097/js9.0000000000001910
12. Scott MJ, Aggarwal G, Aitken RJ, Anderson ID, Balfour A, Foss NB, et al. Consensus Guidelines for Perioperative Care for Emergency Laparotomy Enhanced Recovery After Surgery (ERAS®) Society Recommendations Part 2—Emergency Laparotomy: Intra- and Postoperative care. World Journal of Surgery [Internet]. 2023 Jun 5;47(8):1850–80. Available from:

https://doi.org/10.1007/s00268-023-07020-6

13. Yoon SJ, Yoon SK, Jung JH, Han IW, Choi DW, Heo JS, et al. Realistic Advantages of Early Surgical Drain Removal after Pancreatoduodenectomy: A Single-Institution Retrospective Study. Journal of Clinical Medicine [Internet]. 2021 Jun 19;10(12):2716. Available from: https://doi.org/10.3390/jcm10122716
14. Evgeniou E, Liew J, Lee G, Power K, Khan A, Cole DJ, et al. Are surgical drains needed in DIEP flap surgery? The Drain-Free DIEP flap concept. Plastic & Reconstructive Surgery [Internet]. 2023 Mar 2;152(4):708–14. Available from: https://doi.org/10.1097/prs.0000000000010340
15. Hayyawi I, Al-Shaye A, Omran A, Nassar A. ThP4.13 - To drain or not to drain?! Selective Abdominal Drainage Reduces Morbidity and Re-interventions in Laparoscopic Cholecystectomy and Bile Duct Exploration. British Journal of Surgery [Internet]. 2024 Sep 1;111(Supplement_8). Available from: http://dx.doi.org/10.1093/bjs/znae197.273
16. Kushner B, Smith E, Han B, Otegbeye E, Holden S, Blatnik J. Early drain removal does not increase the rate of surgical site infections following an open transversus abdominis release. Hernia [Internet]. 2021 Jan 5;25(2):411–8. Available from: https://doi.org/10.1007/s10029-020-02362-9
17. Mostafa O, Akula Y, Ghassemi N, Hajibandeh S, Hajibandeh S. 121 Meta-Analysis of Routine abdominal drainage following distal pancreatectomy: Do we have enough evidence to overcome “HPB surgeon’s paranoia”? British Journal of Surgery [Internet]. 2025 Jun 1;112(Supplement_10). Available from: https://doi.org/10.1093/bjs/znaf128.168
18. He S, Xia J, Zhang W, Lai M, Cheng N, Liu Z, et al. Prophylactic abdominal drainage for pancreatic surgery. Cochrane Database of Systematic Reviews [Internet]. 2021 Dec 18;2021(12):CD010583. Available from: https://doi.org/10.1002/14651858.cd010583.pub5
19. Guadagni S, Catarci M, Masedu F, Karim ME, Clementi M, Ruffo G, et al. Abdominal drainage after elective colorectal surgery: propensity score-matched retrospective analysis of an Italian cohort. BJS Open [Internet]. 2024 Jan 3;8(1). Available from: https://doi.org/10.1093/bjsopen/zrad107
20. Collaborative E, Sgrò A, Blanco-Colino R, Ahmed W, Brindl N, Gujjuri R, et al. Intraperitoneal drain placement and outcomes after elective colorectal surgery: international matched, prospective, cohort study. British Journal of Surgery [Internet]. 2022 Feb 16;109(6):520–9. Available from: https://doi.org/10.1093/bjs/znac069
21. Perra T, Porcu A. 23. SURGICAL MANAGEMENT OF a HIGHLY COMPLEX CASE OF BILIARY LEAK FOLLOWING HEPATOBILIARY SURGERY. British Journal of Surgery [Internet]. 2024 Feb 1;111. Available from: http://dx.doi.org/10.1093/bjs/znae018.023
22. Kassahun WT, Babel J, Mehdorn M. Assessing differences in surgical outcomes following emergency abdominal exploration for complications of elective surgery and high-risk primary emergencies. Scientific Reports [Internet]. 2022 Jan 25;12(1):1349. Available from: https://doi.org/10.1038/s41598-022-05326-4
23. Maheshwari P, Basu S. eP75 The effect of time of intra-abdominal drain insertion on surgical outcomes in

patients undergoing emergency laparotomy. British Journal of Surgery [Internet]. 2025 Jan 1;112(Supplement_1). Available from: https://doi.org/10.1093/bjs/znae318.056

24. Sartelli M, Coccolini F, Kluger Y, Agastra E, Abu-Zidan FM, Abbas AES, et al. WSES/GAIS/SIS-E/WSIS/AAST global clinical pathways for patients with intra-abdominal infections. World Journal of Emergency Surgery [Internet]. 2021 Sep 25;16(1):49. Available from: https://doi.org/10.1186/s13017-021-00387-8
25. De Waele JJ, Boelens J, Van De Putte D, Veld DH in 'T, Coenye T. The role of abdominal drain cultures in managing abdominal infections. Antibiotics [Internet]. 2022 May 20;11(5):697. Available from: https://doi.org/10.3390/antibiotics11050697
26. Manku B, O'Sullivan A, Singh S, Abaalijaysh M, Wilkin R. WTP2.04 Resource Saving Strategies for Emergency Appendicectomies: Evaluating the use of Group and Saves and Intra-Abdominal Drains. British Journal of Surgery [Internet]. 2025 Aug 1;112(Supplement_13). Available from: https://doi.org/10.1093/bjs/znaf166.332
27. Kuemmerli C, Tschuor C, Kasai M, Alseidi AA, Balzano G, Bouwense S, et al. Impactofenhancedrecoveryprotocols after pancreatoduodenectomy: meta-analysis. British Journal of Surgery [Internet]. 2021 Dec 8;109(3):256–66. Available from: https://doi.org/10.1093/bjs/znab436
28. Ricci C, Grego DG, Alberici L, Ingaldi C, Togni S, De Dona E, et al. Early versus late drainage removal in patients who underwent pancreaticoduodenectomy: A comprehensive systematic review and meta-analysis of randomized controlled trials using trial sequential analysis. Annals of Surgical Oncology [Internet]. 2024 Feb 24;31(5):2943–50. Available from: https://doi.org/10.1245/s10434-024-14959-w