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Prophylactic Abdominal Drainage after Bariatric Surgery: A Narrative Review of the Evidence and Practical Considerations for Drain Selection

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Abstract

Background. Surgeons have long placed an intra-abdominal drain after sleeve gastrectomy and gastric bypass to detect staple-line leak or bleeding early and to control a leak without reoperation. Enhanced-recovery pathways and large registry analyses have challenged this practice. This review summarises the evidence on whether, when and how to drain after metabolic and bariatric surgery.

Methods. Four PubMed/MEDLINE searches were run through the NCBI E-utilities on 6 November 2026 (publication dates 1 January 1990 to 31 October 2026), supplemented by targeted look-ups. Records were screened in two stages; outcomes were extracted as reported, without re-pooling. Every reference was checked against PubMed and Crossref (DataCite for the one Zenodo record).

Results. The searches returned 2345 records (2169 unique); 81 reports were included. Only small randomised trials compared drain with no drain (66 and 84 patients after gastric bypass); both found more pain with drains and no detectable benefit. Registry analyses of 142,631 to 526,723 patients associated drains with higher adjusted odds of leak and reoperation and, in the most recent analyses, of organ-space infection and prolonged stay; these associations are probably confounded by selective drain use in higher-risk cases. Reported sensitivity of drains for leak ranged from 0% to 94.1%. Many leaks present after the usual drain-removal window. Drain amylase, judged against study-specific cut-offs, had high sensitivity and specificity in three single-centre series. The 2021 ERAS Society guideline and Canadian and Italian consensus statements advise against routine drainage; the 2016 ERAS guideline judged it probably unnecessary.

Conclusions. Current evidence does not support routine prophylactic drainage after primary bariatric surgery. Selective use in revisional operations, difficult anastomoses or recognised bleeding risk is common practice but remains unproven. If a drain is used, its type, position and removal should be planned.

Keywords: bariatric surgery; sleeve gastrectomy; Roux-en-Y gastric bypass; one-anastomosis gastric bypass; prophylactic drainage; anastomotic leak; postoperative haemorrhage; enhanced recovery after surgery; drain amylase; surgical drains

1. Introduction

Metabolic and bariatric surgery (MBS) is now one of the most frequently performed elective abdominal operations. National societies affiliated to the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) reported 507,806 surgical and endoluminal procedures in 2020 and 598,834 in 2021, with sleeve gastrectomy (SG) the most common operation [1]. Laparoscopic SG, Roux-en-Y gastric bypass (RYGB) and one-anastomosis gastric bypass (OAGB) are safe operations in experienced hands, but a minority of patients develop early complications that can be life-threatening: staple-line or anastomotic leak, intraluminal or intra-abdominal bleeding, and intra-abdominal abscess.

The frequency of these events depends on procedure, patient and definition. A systematic analysis of 29 publications (4,888 patients) found a leak rate of 2.4% after SG, 89% of leaks being in the proximal third of the stomach and most diagnosed after discharge [2]. A meta-analysis of 9,991 SG cases identified 198 leaks in 8,922 patients (2.2%) [3]. Among 46,133 sleeve gastrectomies reported by 130 surgeons at the Fourth International Consensus Summit, high leak occurred in 1.1% and haemorrhage in 1.8% [4]. A meta-analysis of 44,318 OAGB patients found a leak prevalence of 1%, with 62.1% of leaks requiring reoperation [5]. Early postoperative bleeding after RYGB was associated with male sex, older age, hypertension and revisional surgery in a meta-analysis of 23 studies (232,488 patients) [6].

Intra-abdominal drains were adopted in bariatric surgery because they appeared to offer three benefits: early warning of a leak or bleed (the “sentinel” function), evacuation of blood or enteric content, and conversion of a free leak into a controlled fistula that might heal without reoperation [7,8]. Early series reported that drains allowed the diagnosis of a proportion of leaks within 48 hours and non-operative management of half of them [7]. Against this, critics pointed to the lack of randomised evidence, to leaks presenting after drain removal or without any change in drain output, and to drain-related pain, infection and rare mechanical complications [9–11].

The question is not unique to bariatric surgery. In gastrointestinal surgery generally, systematic reviews have shown that prophylactic drains do not reduce complications after colorectal anastomosis, cholecystectomy or hepatic resection [12–15], and the Cochrane review of gastrectomy for cancer found no evidence of benefit [16]. Consensus in 2004 still favoured drainage after oesophageal resection and total gastrectomy, but explicitly on expert-opinion grounds, and called for trials in upper gastrointestinal surgery [12]. Enhanced recovery after surgery (ERAS) programmes, which aim to remove tubes and lines that delay mobilisation, have since been adapted to bariatric surgery [17,18].

This review addresses four questions: (1) what comparative evidence exists for and against prophylactic abdominal drainage after SG, RYGB, OAGB and revisional procedures; (2) how well drains and drain-fluid analysis detect leak and bleeding; (3) what current guidelines recommend; and (4) if a drain is used, which device

characteristics and management practices are relevant. A companion review by the same author covers closed-suction and passive drain design across surgical specialties in more depth [19]; the device section here is limited to issues relevant to bariatric practice.

2. Methods

2.1 Design

This is a narrative review supported by a structured, reproducible literature search. It is not a systematic review. No protocol was registered, study selection and data extraction were carried out by a single author, formal risk-of-bias assessment was not performed, and no new meta-analysis was undertaken. The PRISMA 2020 flow-diagram format was used only to report the search transparently.

2.2 Information sources and searches

Four searches of PubMed/MEDLINE were run through the NCBI E-utilities (esearch) on 6 November 2026, limited to publication dates 1 January 1990 to 31 October 2026. The searches covered (S1) drains and drainage in bariatric surgery, (S2) drains or drain fluid used to diagnose leak or bleeding after bariatric surgery, (S3) bariatric guidelines, consensus statements and ERAS pathways, and (S4) systematic reviews and meta-analyses of leak or bleeding after bariatric surgery. The exact query strings and hit counts are listed in Appendix Table A1. Cochrane reviews were captured through their MEDLINE indexing. Embase was not available to the author and was not searched. The searches were supplemented by targeted PubMed look-ups for named guidelines, registries and frequently cited studies, and by drain-design references identified in the companion review [19].

2.3 Eligibility

Reports were eligible if they provided original data, pooled data or formal recommendations on prophylactic intra-abdominal drains after SG, RYGB, OAGB or revisional bariatric surgery (use, outcomes, diagnostic yield, drain-fluid markers, adverse events), or on alternative early-warning tools used in the same setting. Reports on drains used to treat an established leak or collection (percutaneous,

endoscopic or pigtail drainage) were excluded, except where they illustrated device-related complications. Reports on body-contouring surgery after weight loss were excluded. Device-design studies from other specialties were included only to inform the drain-selection section.

2.4 Selection, extraction and verification

Stage 1 applied predefined title rules to all unique records, followed by the author's check of the excluded titles. Stage 2 screened titles and abstracts; full texts were read where available in PubMed Central or from the publisher. For each included report the following were extracted as reported: design, procedure, number of patients, comparison, outcome definitions and effect estimates. Values not reported in the accessible source were recorded as "NR". Effect estimates were not recalculated. Guideline wording was taken only from the full text or abstract of the guideline itself. Where the drain-specific wording of a guideline could not be read, this is stated rather than inferred. Bibliographic data were retrieved with efetch and compared with the Crossref record for each DOI; results are listed in the supplementary file *references_verification.csv*. All figures were drawn by the author with matplotlib (Python) at 300 dpi. Schematic figures are original drawings and do not depict any specific commercial product.

2.5 Results of the search

The searches returned 2345 records (S1 1069; S2 149; S3 892; S4 235), of which 2169 were unique after removal of 176 duplicates. Stage-1 title rules retained 480 records; the remaining 1689 were excluded (mainly obesity guidelines unrelated to perioperative care, therapeutic endoscopic or percutaneous drainage, and body-contouring surgery). Of the 480 records screened at stage 2, 60 were assessed in detail, and 52 of these were included. The 8 assessed records that were not included had no abstract or accessible full text (n = 3), concerned only therapeutic drainage of an established leak (n = 1), or contained no drain-specific data or recommendation (n = 4). A further 29 reports came from targeted look-ups and the companion review, giving 81 included reports (Figure 1).

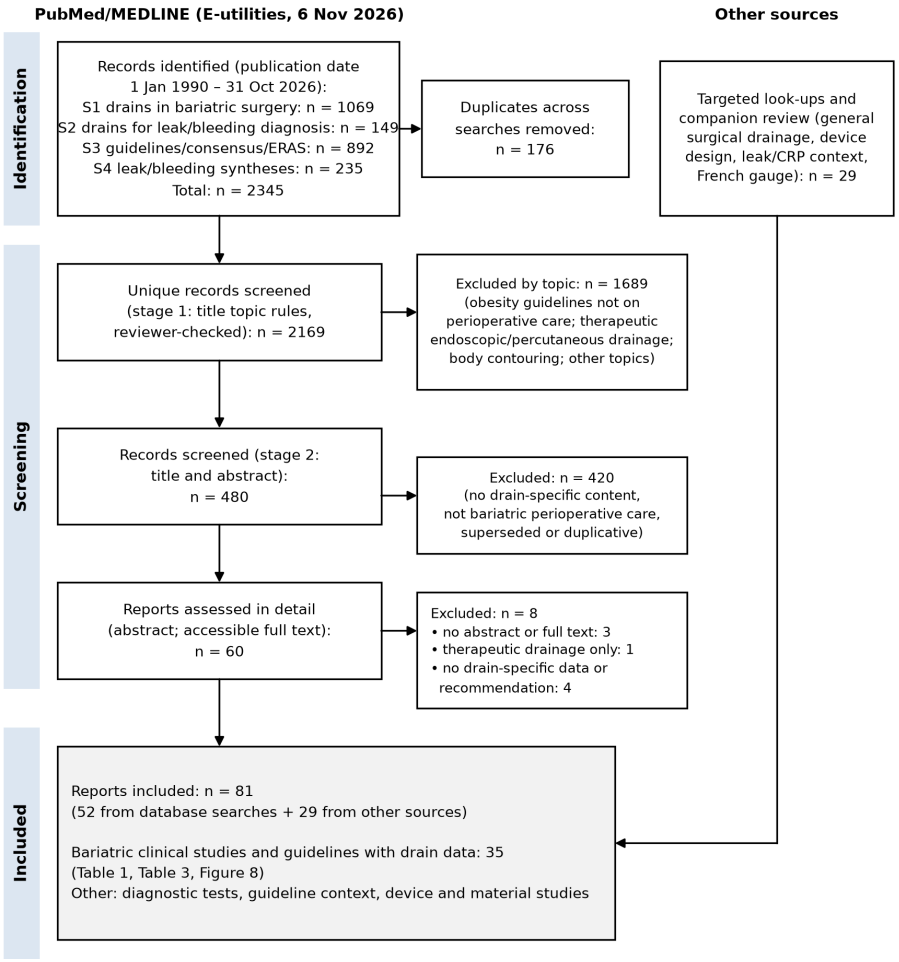


Figure 1. Study identification and selection (PRISMA 2020-style flow diagram). Counts are the numbers returned by the PubMed E-utilities searches run on 6 November 2026 (publication dates 1 January 1990 to 31 October 2026) and the numbers of records handled at each stage of this review. Drawn by the author with matplotlib.

3. Rationale for and against prophylactic drainage

3.1 Arguments for drainage

The case for a prophylactic drain rests on three claimed functions. The first is **detection**: a change in the volume or character of drain output (fresh blood, turbid, bilious or salivary fluid, methylene blue, or a high amylase concentration) may reveal a leak or haemorrhage before clinical deterioration. In a retrospective series of 593 laparoscopic RYGB patients with two 19-Fr closed-suction drains, bleeding was diagnosed from sanguineous drain output together with a falling haematocrit in 8 of 24 bleeding patients, and 5 of 10 leaks were diagnosed within 48 hours from the characteristics of

drain output [7]. In a case series of six haemorrhages after bariatric surgery, bleeding was recognised through the drain on the day of operation in the three patients who had one [20].

The second is **control**: a drain already lying next to the staple line or anastomosis might allow a contained leak to be managed by antibiotics, nil by mouth and nutritional support, rather than by reoperation. In the 593-patient series, non-operative management with drainage and parenteral nutrition succeeded in 5 of the 10 leaks [7]. In a prospective series of 100 RYGB patients with routine closed-suction drains and early contrast studies, three radiological leaks were treated non-operatively without reoperation [8]. A systematic review of 18 RYGB studies estimated that drains enabled non-operative treatment of leakage in 12.5% to 100% of leak patients across 11 reports [21].

The third is **evacuation** of blood or fluid, which might reduce the formation of clot or collections behind the stomach. This was suggested in the case series cited above, in which conservative management of bleeding was followed by reoperation or percutaneous drainage in patients without a drain [20].

3.2 Arguments against drainage

Each of these functions has been questioned. Detection depends on the drain being in the right place, patent and still in situ when the complication occurs. Many leaks after SG present late: in a multi-surgeon cohort of 1,550 sleeve gastrectomies, leaks presented at a mean of 17.3 days (range 1–67) [22], and in a pooled analysis most leaks were diagnosed after discharge [2]. In a retrospective series of 353 SG patients, half of the drained patients who leaked did so after the fourth postoperative day, when the drain had already been removed, and the oral methylene-blue test through the drain was negative in the other half [10]. Bleeding into the lumen of the stomach or bowel is not visible in an abdominal drain at all: in a series of 352 gastric bypasses without routine drains, five of the six patients who needed transfusion had bled into the gastrointestinal tract, and all had developed tachycardia [9].

Drains can also cause harm. Pain was greater with a drain in two randomised trials after RYGB [23,24], and the side on which the drain exits influenced early pain in a third trial [25]. Drain-related surgical site infection was recorded in 4.1% of 335 drained SG patients [26].

Peritoneal effluent from 24-Fr drains left for seven days after open RYGB showed marked rises in tumour necrosis factor-α and interleukin-1β and bacterial contamination, even in patients without complications [27]. Mechanical complications are rare but described: small-bowel obstruction from a loop twisting around a drain after RYGB [11], erosion of a drain into the gastric pouch after OAGB [28], and drain inclusion in the gastric pouch in four RYGB patients with chronic gastrojejunal fistula, which closed once the drain was repositioned endoscopically [29]. Authors reporting these complications advised that drains should not be placed in contact with the anastomosis or staple line [29].

Finally, drains conflict with the logic of enhanced recovery. ERAS pathways aim to remove tubes, lines and catheters early so that patients can mobilise, eat and be discharged on the first or second postoperative day [17,18,30]. With discharge on day 1, the window in which in-hospital monitoring of drain output can provide information is short.

4. Evidence by procedure

The comparative evidence is summarised in Table 1. Its overall quality is low. Only three small randomised trials addressed drains in bariatric patients (two drain versus no drain, one drain exit side), together with one randomised comparison of drain types; the remaining evidence is observational. Large registry studies dominate by sample size but cannot separate the effect of a drain from the reasons it was placed.

Table 1. Comparative and large observational studies of prophylactic abdominal drainage after bariatric surgery, in chronological order. Values are as reported in the cited abstract or full text; NR, not reported in the accessible source; NS, not significant; aOR, adjusted odds ratio; GI, gastrointestinal; GJ, gastrojejunal; LOS, length of stay; POD, postoperative day; PR, prevalence ratio; SSI, surgical site infection; UGI, upper gastrointestinal contrast study. Intervals in parentheses are 95% CIs.

Study (year)	Design; setting	Procedure	N (drain / no drain)	Main findings as reported
Serafini (2002) [8]	Prospective series; routine closed-suction drains + early contrast study	RYGB (75 open, 25 lap)	100 (all drained)	3 radiological leaks managed non-operatively; none reoperated
Chousleb (2004) [7]	Retrospective; two 19-Fr Blake drains	Lap RYGB	593 (all drained)	Bleeding 24 (4.4%), 8 diagnosed from drain output + haematocrit; leaks 10 (1.68%), 5 diagnosed < 48 h from drain; 5/10 managed non-operatively
Dallal (2007) [9]	Retrospective; no routine drains or UGI	Lap gastric bypass	352 (5 selective drains)	No adverse events attributed to drain omission; 5/6 transfusions for GI-tract bleeding
Albanopoulos (2011) [10]	Retrospective comparative	SG	353 (201 / 152)	Leak 4% vs 2.6%, bleeding 2.9% vs 1.9%, abscess 2.5% vs 1.9% (NS); half of leaks in drained patients after POD 4
Chang (2011) [31]	Retrospective comparative	Lap gastric bypass	180 (90 / 90)	Leak 1 vs 1; minor complications 6.7% vs 8.9% (P = 0.578); LOS 5.2 vs 4.7 d (P = 0.135); flatus 1.6 vs 1.2 d (P = 0.006)
Kavuturu (2012) [32]	Retrospective, before/after practice change	Lap RYGB	755 (272 / 483)	GJ leak 1.47% vs 0.62% (p = 0.154); reoperation NS
Liscia (2014) [21]	Systematic review (18 studies; no RCT)	RYGB	NR	Drain sensitivity for leak 0–94.1% (10 reports); non-operative treatment with drain 12.5–100% (11 reports)
Doumouras (2017) [33]	Registry (MBSAQIP 2015), multivariable	SG + gastric bypass	142,631	Leak OR 1.30 (1.07–1.57); reoperation OR 1.17 (CI 1.06–1.30); morbidity OR 1.19 (CI 1.14–1.25); readmission OR 1.12 (1.06–1.19); mortality NS
Currò (2017) [34]	Two consecutive series (standard vs fast track)	SG	200 (100 / 100)	No difference in outcome; complications in undrained group diagnosed clinically and by CT
Gundogan (2018) [23]	RCT	Lap RYGB	66 (30 / 36)	Pain day 1: 4.5 vs 3 (p = 0.02); day 3: 2 vs 0 (p = 0.0004); no difference in complications or LOS; 3 no-drain patients needed a drain
Peña (2020) [24]	RCT	Lap RYGB	84 (45 / 39)	Pain day 1: 3.1 vs 1.1 (P = 0.02); Clavien I–II 9% vs 1% (P = 0.37); no major complications
Seyfried (2020) [35]	Retrospective, before/after practice change	SG + RYGB	361 (166 / 195)	Complications 6 vs 7; leak and reoperation NS; LOS +1.3 d with drain
Clapp (2020) [36]	Registry (MBSAQIP 2015–2017)	RYGB, SG, revisions	488,460 (100,221 drained)	Drain use RYGB 33.1% to 24.6%, SG 20.3% to 13.6%; drains linked to provocative test (PR 2.24) and swallow study (PR 1.93)

Study (year)	Design; setting	Procedure	N (drain / no drain)	Main findings as reported
Gray (2020) [37]	Registry (MBSAQIP 2017)	RYGB + SG	148,260 (23,190 / 125,070)	Higher odds of superficial, deep and organ-space SSI and of reoperation/intervention (ORs NR in abstract)
Salman (2021) [38]	Prospective cohort	SG	614 (125 / 489)	Morbidity 3.2% vs 1.6% (p = 0.25); leak 0.8% vs 0.2% (p = 0.36); transfusion, reoperation NS
Bao (2024) [39]	Meta-analysis (RCT + retrospective)	Bariatric (mixed)	NR	Surgical complications OR 1.70; death OR 1.68; reoperation OR 1.49; wound infection OR 1.04 (NS)
Aragone (2024) [26]	Retrospective; routine Blake-type drain, removed POD 7	SG	335 (all drained)	Leak 6 (1.79%), bleeding 5 (1.49%); no diagnostic or therapeutic benefit; drain-related SSI 14 (4.1%)
Meyer (2025) [40]	Registry (MBSAQIP 2020–2022)	Primary SG, RYGB, other	526,723	Use 8.7% to 6.1%; aOR serious complications 1.24, leak 2.1, organ-space infection 2.0, reoperation 1.2, excess LOS 1.45
Meyer (2025) [41]	Registry (MBSAQIP 2020–2022)	Conversional/ revisional	64,495	Use 19.1% to 14.4%; aOR serious complications 1.45, leak 2.25, organ-space infection 2.12, reoperation 1.37, excess LOS 2.06
Thawabteh (2025) [42]	Retrospective; passive Jackson-Pratt drain	78.1% SG; remainder other procedures	494 (82.0% drained)	Complications 3.0% (bleeding 1.4%); drain volume not correlated with heart rate or blood pressure
Hsu (2026) [43]	Retrospective; uniform drain-free ERAS	Primary + revisional	1,122 (none drained)	30-day morbidity 3.2%; leak 0.4% (median 43 h); GI bleeding 1.2%; > 92% discharged POD 1

4.1 Sleeve gastrectomy

No randomised trial of drain versus no drain after SG was identified. Retrospective comparisons have consistently found no diagnostic or therapeutic advantage. In 353 SG patients (201 drained, 152 not), staple-line leak (4% vs 2.6%), bleeding (2.9% vs 1.9%) and abscess (2.5% vs 1.9%) did not differ significantly, and drains did not facilitate detection [10]. The same authors suggested that patients with previous gastric banding or intraperitoneal bleeding might benefit from a drain left for more than five days, because abscesses were more frequent in these groups [10]. Two consecutive series of 100 patients each (standard protocol with nasogastric tube and drain, then fast-track without either) had similar outcomes. In the undrained group, an abscess, a fistula and a bleed were diagnosed on clinical grounds, haemoglobin and computed tomography (CT)

[34]. In a prospective cohort of 614 SG patients, the 125 who received drains (20.3%) had similar morbidity (3.2% vs 1.6%, p = 0.25) and leak rates (0.8% vs 0.2%, p = 0.36) to those without drains [38].

In a single-centre series of 335 SG patients who all received a Blake-type drain along the staple line, removed as outpatients on postoperative day 7, the drain neither ensured early diagnosis nor allowed conservative management of the 6 leaks (1.79%) and 5 bleeds (1.49%). Drain-related surgical site infection occurred in 14 patients (4.1%) [26]. In a Palestinian cohort of 494 patients (78.1% SG), 82.0% of whom had a passive Jackson-Pratt drain, drain output volume did not correlate with heart rate or blood pressure. Only a weak inverse correlation between bloody drain output and haemoglobin was found, on the first postoperative day; the authors concluded that clinical assessment, especially vital signs, was the most effective way to identify complications [42].

4.2 Roux-en-Y and one-anastomosis gastric bypass

RYGB is the only procedure for which randomised data exist. In a trial of 66 patients after laparoscopic RYGB, median pain scores were higher with a drain on day 1 (4.5 vs 3, p = 0.02) and day 3 (2 vs 0, p = 0.0004), without differences in complications or length of stay; three patients allocated to no drain (8.3%) required one [23]. In a second trial (84 patients), pain on day 1 was higher with a drain (3.1 vs 1.1, p = 0.02), and no major complications occurred in either arm [24]. Both trials were far too small to detect differences in leak or reoperation. In a third randomised trial of 50 patients, all of whom were drained, an exit through the right-sided 5-mm port was associated with less early pain than a left-sided exit [25].

Observational RYGB studies span the shift in practice. Early series reported benefit: drains contributed to the diagnosis of bleeding and leak and to non-operative management in the 593-patient series [7] and in the 100-patient series combining drains with early contrast studies [8]. Later series found no advantage. A series of 352 laparoscopic gastric bypasses without routine drains or contrast studies reported no adverse events attributable to their omission; drains were placed selectively in five difficult anastomoses (1.4%) [9]. In 180 laparoscopic gastric bypasses (90 drained, 90 not), there was one leak in each group, and patients without drains passed flatus earlier (1.2 vs 1.6 days, p = 0.006) [31]. In 755 RYGB patients before

and after a change in practice, gastrojejunal leak (1.47% with drains vs 0.62% without, p = 0.154) and reoperation rates did not differ [32]. The 2014 systematic review of 18 RYGB studies, none randomised, concluded that evidence-based recommendations could not be given [21]. A German series of 361 SG and RYGB operations found that drains were the strongest factor associated with a longer hospital stay (+1.3 days) [35].

No comparative study of drain versus no drain specific to OAGB was identified. OAGB data relevant to drainage come from the leak meta-analysis, in which the most common reoperation for leak was peritoneal washout and drainage (30.8% of leak patients) [5], and from a case report of drain erosion into the gastric pouch [28]. Recommendations for OAGB therefore rest on extrapolation from RYGB and SG.

4.3 Revisional and conversional surgery

Revisional operations are technically more demanding, and revisional surgery is an independent risk factor for early bleeding after RYGB (risk ratio 1.35, 95% CI 1.12–1.62) [6]. Drains are used more often in these cases: in the MBSAQIP data set, 19.1% of 64,495 conversional or revisional procedures received a drain in 2020, falling to 14.4% in 2022 [41]. Drain placement was predicted by older age, higher BMI, smoking, previous venous thromboembolism, non-sleeve revisional procedures and an intraoperative leak test. After adjustment it was associated with serious complications (adjusted odds ratio [aOR] 1.45), anastomotic leak (aOR 2.25), organ-space infection (aOR 2.12), reoperation (aOR 1.37) and excess length of stay (aOR 2.06) [41]. The authors noted that the reasons for drain placement were not recorded. They also reported that practice differed between their own centres: one does not drain revisional cases, whereas another drains complex revisions and performs a leak test before drain removal [41].

At the other end of the spectrum, a single high-volume surgeon reported 1,122 consecutive primary and revisional laparoscopic procedures (2018–2024) in which no patient received a prophylactic drain. Within a standardised ERAS pathway with structured bedside assessment, serial biomarkers and criteria-driven imaging, 30-day morbidity was 3.2%. Leak occurred in five patients (0.4%; median 43 hours) and overt gastrointestinal bleeding in 13 (1.2%), and more

than 92% were discharged on day 1 [43]. Such series show that a drain-free strategy is feasible in selected high-volume settings, including revisional surgery, but they have no control group.

4.4 Registry data and meta-analysis

Four analyses of the American MBSAQIP registry describe practice and outcomes on a national scale (Figure 2). Between 2015 and 2017, drains were placed in 100,221 of 488,460 procedures; the proportion fell from 33.1% to 24.6% after RYGB and from 20.3% to 13.6% after SG. Drained patients were more likely to have had a provocative leak test (prevalence ratio 2.24) and a postoperative swallow study (1.93) [36]. In 2015 data (142,631 patients), drains were associated with higher adjusted odds of leak (OR 1.30, 95% CI 1.07–1.57), reoperation, all-cause morbidity and readmission, with no change in mortality [33]. Drain use in 2017 (15.6% of 148,260 cases) was associated with superficial, deep and organ-space surgical site infection and with reoperation or reintervention [37]. By 2020–2022, drain use in primary procedures had fallen from 8.7% to 6.1% of 526,723 patients. It remained associated with serious complications (aOR 1.24), leak (aOR 2.1), organ-space infection (aOR 2.0), reoperation (aOR 1.2) and excess length of stay (aOR 1.45) [40].

A 2024 meta-analysis that combined randomised and retrospective studies reported pooled associations of drainage with surgical complications (OR 1.70), death (OR 1.68) and reoperation (OR 1.49), but not with wound infection (OR 1.04). The authors cautioned that the associations came mainly from retrospective cohorts [39].

These associations should not be read as proof that drains cause leaks. Surgeons drain operations they consider difficult or patients they consider high-risk, and registry adjustment cannot capture intraoperative concerns such as tissue quality, bleeding or a doubtful staple line. The registries do show that, at a population level, drains have not been associated with any measurable protective effect, and that drain use has fallen steadily without an observed rise in adverse outcomes.

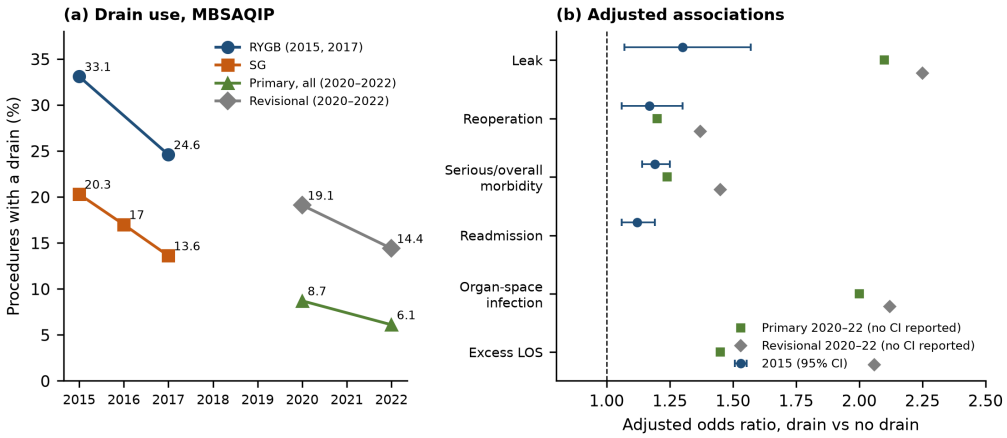


Figure 2. Drain use after bariatric surgery in the MBSAQIP registry and its association with outcomes, as reported. (a) Proportion of procedures with a drain: RYGB and SG 2015–2017 [36], primary procedures 2020–2022 [40] and conversional/revisional procedures 2020–2022 [41]; the 2016 RYGB value was not reported in the accessible text and is omitted. (b) Adjusted odds ratios for outcomes in drained versus undrained patients: 2015 data with 95% CIs [33]; 2020–2022 primary and revisional data, for which CIs were not reported in the abstracts (points only) [40,41]. These are observational associations subject to confounding by indication. Drawn by the author with matplotlib.

5. Diagnostic performance of drains for leak and bleeding

5.1 Drain output as a sentinel

The sentinel function of a drain depends on three conditions: the complication must occur while the drain is in place, the leaking content or blood must reach the drain, and the change in output must be recognised and acted upon. In the RYGB systematic review, sensitivity of drainage for postoperative leak ranged from 0% to 94.1% across 10 reports [21]. This range is too wide to support reliance on a drain for leak detection. Several of the comparative studies reported that complications in undrained patients were recognised from tachycardia, fever, pain or a falling haemoglobin, and confirmed by CT [9,32,34].

Timing is a central limitation (Figure 3). In the Palestinian cohort, 79.1% of patients still had their drain on day 1, 33.8% on day 2, 10.5% on day 3 and 3.8% on day 4 [42]. In contrast, the mean time to leak presentation in a cohort of 1,550 SG patients was 17.3 days [22], and half the leaks in the drained arm of a 353-patient SG series occurred after day 4, when the drain had been removed [10]. In the drain-free ERAS series, most major events were diagnosed after the typical drain-removal window and often after day 1, although leaks were diagnosed at a median of 43 hours [43]. A drain can therefore only act as a sentinel for the minority of complications that occur very

early, unless it is left for a week or longer. Prolonged drainage has its own costs, including the inflammatory and microbiological changes described after seven days [27] and the drain-related infections reported with outpatient removal on day 7 [26].

For bleeding, drain output is a direct sign only when blood accumulates in the peritoneal cavity near the drain. In the Palestinian cohort, drain output volume did not correlate significantly with heart rate or blood pressure [42]. In the series without routine drains, bleeding was recognised from tachycardia and the need for transfusion, mostly from intraluminal sources [9]. Conversely, in the 593-patient RYGB series, a sanguineous drain output combined with a falling haematocrit contributed to the diagnosis in 8 of 24 bleeding patients [7].

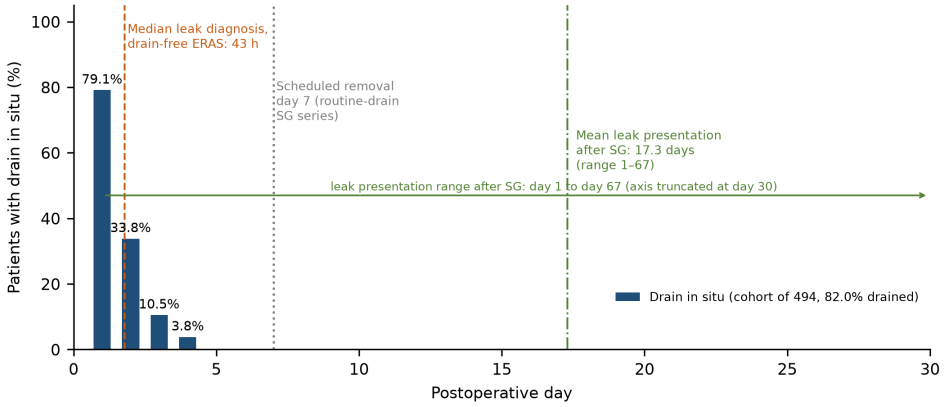


Figure 3. Timing of drain removal relative to the reported timing of leak presentation. Bars: proportion of patients with a drain still in place on postoperative days 1–4 in a cohort of 494 patients (82.0% drained) [42]. Markers: median time to leak diagnosis in a drain-free ERAS series (43 h) [43]; mean time to leak presentation after SG (17.3 days; range 1–67) [22]; scheduled outpatient drain removal on day 7 in a routinely drained SG series [26]. In a further SG series, half the leaks in drained patients occurred after day 4, when drains had been removed [10]. Values as reported; studies differ in population and definitions. Drawn by the author with matplotlib.

5.2 Drain-fluid amylase

Saliva contains amylase, so a leak from the gastric pouch, gastrojejunostomy or sleeve staple line may raise amylase in the drain fluid. Three single-centre studies evaluated this marker (Table 2, Figure 4). After RYGB, a drain amylase above 400 IU/L on day 1 identified gastrojejunostomy leaks with a sensitivity of 94.1% and a specificity of 90.0% in 350 patients (17 leaks). The negative predictive value was 99.6%, but the positive predictive value only 33.3% [44]. In 170 RYGB patients, a drain amylase above three times the serum value had a sensitivity of 100% and a specificity of 95.9%, and a

value above 250 IU/L had a sensitivity of 100% and a specificity of 99.4% [45]. After SG, a cut-off of 814.18 IU/L on day 1, derived by receiver-operating characteristic analysis, achieved a sensitivity of 83.33% and a specificity of 100% in 167 patients with 6 leaks [46].

These results should be interpreted with caution. The cut-offs differ by procedure and study, were derived and tested on the same patients, and rest on few events (6 to 17 leaks). The positive predictive value can be low when the prevalence of leak is around 1–5% [44]. Drain amylase also requires a drain, so it does not help with leaks presenting after removal. Its main value may be negative: a low day-1 drain amylase, together with normal clinical findings, supports early drain removal and discharge [44,46].

Table 2. Reported diagnostic performance of drain-fluid amylase and of alternative tests for leak or infectious complications after bariatric surgery. Values as reported; cut-offs are study-specific and not externally validated. CRP, C-reactive protein; NPV, negative predictive value; POD, postoperative day; PPV, positive predictive value; ROC, receiver-operating characteristic; UGI, upper gastrointestinal.

Study (year)	Procedure; N; leaks	Marker and timing	Cut-off	Sensitivity	Specificity	PPV / NPV
Maher (2009) [44]	RYGB; 350; 17	Drain amylase, POD 1	> 400 IU/L	94.1%	90.0%	33.3% / 99.6%
Ribeiro (2018) [45]	RYGB; 170; NR	Drain amylase, POD 1 and 4	> 3 × serum amylase	100%	95.9%	NR / NR
Ribeiro (2018) [45]	RYGB; 170; NR	Drain amylase, POD 1 and 4	> 250 IU/L	100%	99.4%	NR / NR
Romano (2021) [46]	SG; 167; 6	Drain amylase, POD 1	≥ 814.18 IU/L (ROC-derived)	83.33%	100%	100% / 99.38%
Mbadiwe (2015) [47]	Mixed; 19 studies, 10,139	Routine UGI contrast ≤ 2 days	—	0.54 (pooled)	1.00 (pooled)	0.67 / 0.98
Lee (2019) [48]	Mixed; 6 studies, 2,770	Serum CRP, POD 1/3/5	Derived per day	NR (pooled)	NR (pooled)	19–21% / 98–99%

5.3 Alternatives to the drain

Clinical signs are the first line of detection in every guideline-based pathway. Tachycardia, fever, tachypnoea, abdominal or shoulder pain, oliguria and a falling haemoglobin should prompt investigation whether or not a drain is present [9,32,42]. Serum C-reactive protein (CRP) has been studied as a biochemical screen. In a Bayesian meta-analysis of seven studies (1,401 patients), a day-1 CRP cut-off of 6.1 mg/dL had a pooled area under the curve of 0.92 and a negative likelihood ratio of 0.16 [49]. In a second meta-analysis (six studies, 2,770 patients), the negative predictive value of CRP for infectious

complications was 98–99% on days 1, 3 and 5, while the positive predictive value was only 19–21% [48]. Routine upper gastrointestinal contrast studies within two days of surgery had a pooled sensitivity of 0.54 and a specificity of 1.00 for leak in 19 studies (10,139 patients) [47]. CT and, where indicated, endoscopy or diagnostic laparoscopy complete the pathway; in one series, a leak was found at laparoscopy in a tachycardic patient with a normal contrast study [9].

In summary, no single tool reliably detects every leak. Drain output and drain amylase add information while the drain is present. CRP and clinical assessment can rule complications out in most patients, and contrast studies are specific but insensitive (Figure 4). A conceptual sequence integrating these tools is shown in Figure 5.

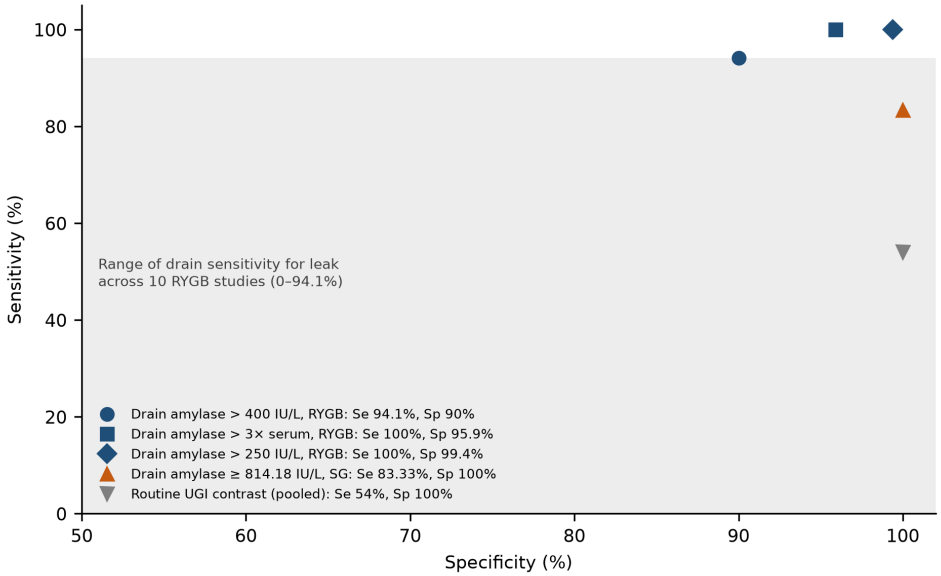


Figure 4. Reported diagnostic performance of drain-based and alternative tests for leak or infectious complications after bariatric surgery (values as reported; no re-analysis). Drain amylase after RYGB at > 400 IU/L [44], > 3× serum and > 250 IU/L [45]; drain amylase after SG at ≥ 814.18 IU/L [46]; routine upper gastrointestinal contrast study, pooled [47]. The grey band shows the range of drain sensitivity for leak (0–94.1%) reported across 10 RYGB studies [21]. CRP meta-analyses reported AUC and likelihood ratios or predictive values rather than pooled sensitivity and specificity and are described in the text [48,49]. Drawn by the author with matplotlib.

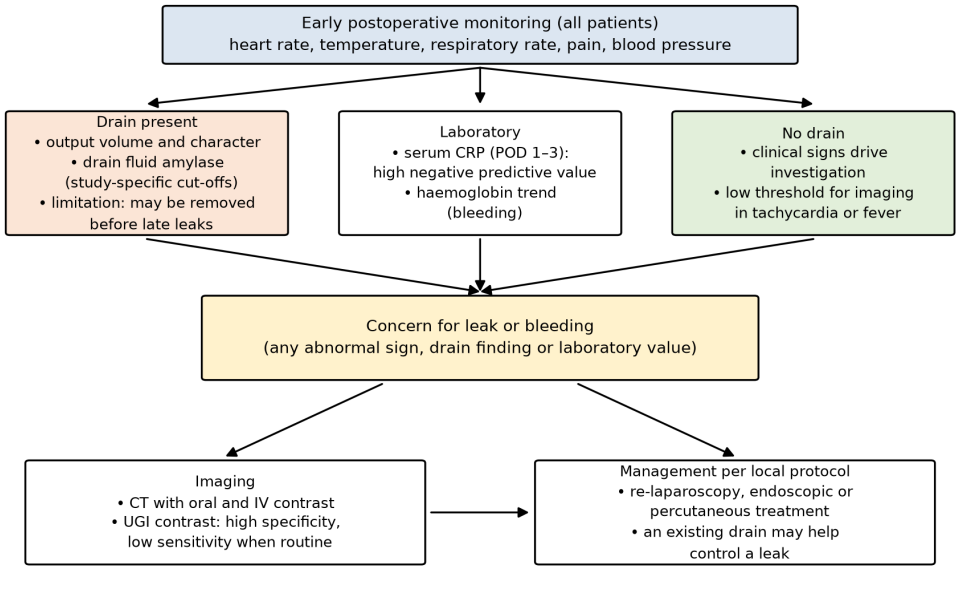


Figure 5. Conceptual sequence for early detection of leak or bleeding after bariatric surgery, with or without a drain. This figure is a synthesis of the literature reviewed here [9,32,44,47–49] and is not a clinical guideline; thresholds and imaging choices must follow local protocols. Drawn by the author with matplotlib.

6. Guidelines and consensus statements

Table 3 compares the guidance identified. The ERAS Society guideline of 2016 reviewed the RYGB systematic review and the 755-patient comparative study. It noted the absence of randomised trials and concluded that, despite the lack of evidence in bariatric surgery, “systematic use of abdominal drainage might be unnecessary”, as in other types of gastrointestinal surgery [17]. The 2021 update, graded with GRADE, recommended that “nasogastric tubes and abdominal drains should not be used routinely in bariatric surgery”. The level of evidence is printed in the recommendation table as “weak” and the recommendation grade as “strong” [18]. The text states that “there is no evidence supporting routine abdominal drainage or nasogastric decompression following bariatric surgery” [18].

National consensus statements reached the same conclusion. The Canadian ERAS consensus (14 elements) recommended avoiding abdominal drains and urinary catheters [30]. The Italian ERABS consensus of the national bariatric and anaesthesia societies stated that “routine use of abdominal drainage should be discontinued”. Its table gives evidence level 2, quality B and strength of

recommendation A [50]. A Czech adaptation adopted the 2021 ERAS guideline with local comments [51]; its drain-specific wording was not available to the author and is not quoted.

The American Society for Metabolic and Bariatric Surgery (ASMBS) has published position statements on the prevention, detection and treatment of gastrointestinal leak (2009, updated 2015) [52,53]. Their drain-specific wording could not be read in the sources available to the author, so they are listed in Table 3 without quotation. IFSO position statements identified in the search addressed other topics, such as OAGB and same-day discharge [54,55], and no IFSO recommendation specific to prophylactic drains was found. The sixth international consensus conference on SG addressed drainage only as treatment: for acute leak in stable patients, endoscopic pigtail drainage was judged the best first-line endoscopic option (82% agreement) [56]. This is therapeutic drainage of an established leak and is a separate question from prophylactic drainage.

Table 3. Guidance on prophylactic abdominal drainage after bariatric surgery. Quotations are taken from the cited guideline; where the drain-specific wording could not be read, this is stated. ASMBS, American Society for Metabolic and Bariatric Surgery; ERABS, enhanced recovery after bariatric surgery; GI, gastrointestinal; NR, not reported in the accessible source.

Source (year)	Scope and method	Statement on prophylactic abdominal drains (as published)	Grading as published
ERAS Society, Thorell et al. (2016) [17]	Perioperative care in bariatric surgery; literature 1966–2015; GRADE	No RCTs of prophylactic drainage in bariatric surgery; “systematic use of abdominal drainage might be unnecessary”	Not quoted (recommendation table not accessed)
ERAS Society, Stenberg et al. (2021 update, publ. 2022) [18]	Update; literature to December 2020; GRADE	“Nasogastric tubes and abdominal drains should not be used routinely in bariatric surgery”	Level of evidence printed as “weak”; recommendation “strong”
Canadian consensus, Dang et al. (2020) [30]	14 ERAS elements; GRADE	Recommendation to avoid abdominal drains and urinary catheters	NR in abstract
Italian ERABS consensus, Marinari et al. (2022) [50]	National surgical and anaesthesia societies; Oxford 2011 levels	“Routine use of abdominal drainage should be discontinued in ERABS”	Evidence level 2, quality B; recommendation strength A
ASMBS position statements on leak (2009; 2015) [52,53]	Prevention, detection and treatment of GI leak	Drain-specific wording not verified by the author (full text not accessible); not quoted	—
International SG consensus conference (2025) [56]	Expert voting (≥ 70% = consensus)	Addresses therapeutic drainage only: endoscopic pigtail drainage judged best first-line endoscopic option for acute leak in stable patients (82%)	Consensus percentage
General GI surgery, Petrowsky et al. (2004) [12]	Systematic review and meta-analyses	No RCTs for upper GI surgery; drainage after total gastrectomy supported by consensus only	Recommendation grade D (expert opinion) for total gastrectomy

ERAS programmes as a whole appear safe in bariatric surgery. In a propensity-matched study of 464 patients, length of stay fell from 5.39 to 2.47 days after ERAS implementation, without an increase in morbidity or readmission [57]. In a multicentre cohort of 1,419 patients, higher adherence to ERAS recommendations was associated with shorter stay without more complications [58]. A 2026 meta-analysis of ten studies reported a 0.95-day reduction in length of stay with ERAS [59]. Because drain avoidance is only one of many ERAS elements, these studies cannot isolate its effect.

7. Selective drainage: who might benefit?

If routine drainage is not supported, the practical question is whether some patients benefit from a selectively placed drain. Surgeons' own selection criteria can be inferred from registry analyses. Drains were more likely in older patients, in those with higher BMI, partially dependent functional status, renal insufficiency, previous venous thromboembolism or hypoalbuminaemia, and after anastomotic rather than sleeve procedures [40]. In revisional surgery, they were also more likely after non-sleeve revisions and when an intraoperative leak test was performed [41]. Patients with drains were more often given a provocative leak test and a postoperative swallow study [36]. These criteria reflect perceived risk. Whether drains improve outcomes in these patients is unknown, because no study has randomised high-risk patients.

The clinical situations in which authors have argued for a selective drain are:

- **Revisional or conversional surgery**, particularly after previous gastric banding or RYGB revision, because of higher leak and bleeding risk and denser adhesions [6,10,41].
- **A technically difficult staple line or anastomosis**, or a doubtful intraoperative leak test. Drains were placed for this reason in 1.4% of one series [9]. However, a routine intraoperative leak test has not been shown to predict later SG leaks [22,60].
- **Recognised bleeding risk**: intraoperative oozing, early start of therapeutic anticoagulation, or patient factors associated with early bleeding [6,20,42]. In the Palestinian cohort, haemoglobin fell more between days 1 and 2 when anticoagulation was started on day 1 [42].

- **Settings without rapid access to CT, interventional radiology or reoperation**, where earlier warning may be valued. This argument has not been tested in published studies.

Against these, the drain-free series that included revisional cases [43] and the MBSAQIP revisional analysis [41] suggest that even in higher-risk groups, routine drainage is not clearly beneficial. Figure 6 summarises the considerations as a decision aid derived from the literature. It is not a clinical guideline, and it does not replace surgical judgement or local protocols.

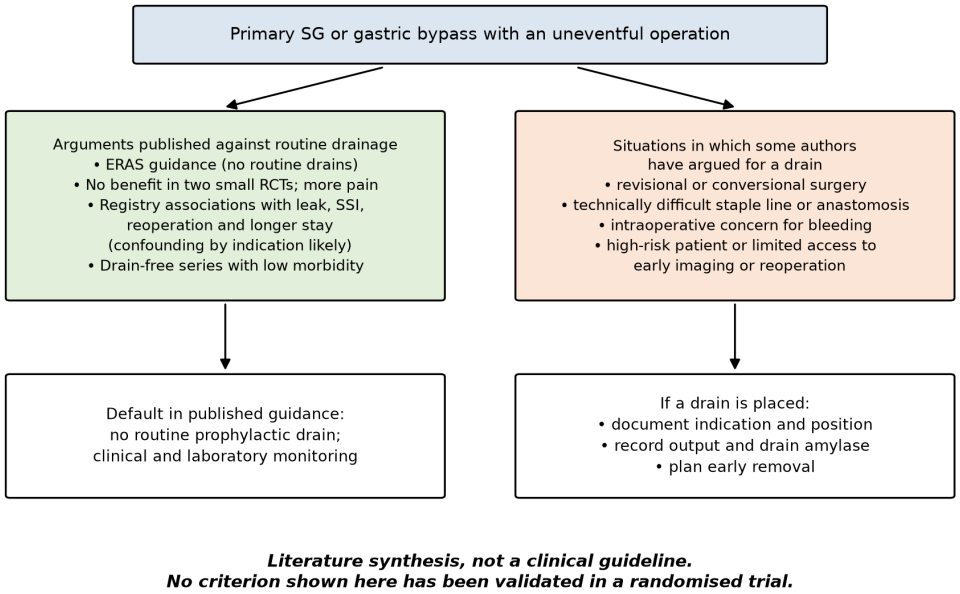


Figure 6. Considerations for selective prophylactic drainage after bariatric surgery: a decision aid synthesised from the literature reviewed [6,18,30,40,41,43,50]. **Literature synthesis, not a clinical guideline.** The boxes indicate where published authors have argued for or against a drain; none of the criteria has been validated in a randomised trial. Drawn by the author with matplotlib.

8. Drain types and selection considerations

When a surgeon decides to drain, the device still has to be chosen. Device-level evidence specific to bariatric surgery is very limited, and most of what follows is extrapolated from other specialties and bench studies. The general principles and evidence are reviewed in more detail in the companion review [19]; this section summarises the points most relevant to bariatric practice (Table 4, Figure 7).

8.1 Closed-suction versus passive drainage

Drains are classified as passive (gravity, siphon or capillary action, open or closed to a bag) or active closed-suction systems, in which a bulb, spring-loaded or evacuated reservoir applies negative pressure [61–63]. In the bariatric literature, closed-suction drains predominate: two 19-Fr Blake drains at the gastrojejunostomy and jejunojejunostomy [7], a 24-Fr Blake drain [27] and Blake-type drains along the sleeve staple line [26]. A passive Jackson-Pratt drain was used in the Palestinian cohort [42]. No bariatric study compared suction with passive drainage. Bench studies show that the negative pressure of closed-suction reservoirs is highest when they are empty (−71 to −175 mmHg in three common systems) and falls as they fill [64]. Evacuators generated only about half their maximal pressure once 25% full [65]. Peak suction also differs between bulbs and depends on reservoir size and how the bulb is compressed [66,67]. “Stripping” the tubing transiently raises negative pressure [64]. In practice, the reservoir must be emptied and re-primed regularly if suction is intended, and the recorded output reflects reservoir behaviour as well as intra-abdominal events.

8.2 Material: silicone, PVC and latex

Most abdominal drains now in use are silicone, chosen partly to avoid latex allergy [68]. Latex drains provoke more fibrotic reaction, which can be useful where a fibrous tract is wanted [68]; intraoperative latex hypersensitivity to Penrose drains has been reported [69]. Polyvinyl chloride (PVC) is widely used for tubing and collection systems. Flexible PVC contains phthalate plasticisers such as di(2-ethylhexyl) phthalate (DEHP), which are not chemically bound and can migrate from the device; the extent depends on temperature, contact time and DEHP content [70,71]. For an abdominal drain left in place for a few days the clinical relevance is uncertain, but material choice is one of the device characteristics a hospital can specify. Silicone is not risk-free: bowel perforation by open silicone drains has been reported, and the authors advised careful placement and early removal [72].

The only randomised comparison of drain types in bariatric surgery allocated 33 patients undergoing banded RYGB to a latex tubular drain, a tubulolaminar drain or a silicone channelled drain. The silicone channelled drain drained larger volumes between days 3

and 7, caused less discomfort and was less often contaminated by more pathogenic bacteria. The authors judged it less likely to occlude, which they considered important for detecting delayed dehiscence [73].

8.3 Size, profile and side holes

Drain size is usually given in French (Fr) or Charrière units; 1 Fr equals one-third of a millimetre of external diameter [74], so a 19-Fr drain has an outer diameter of about 6.3 mm and a 24-Fr drain about 8 mm. Larger drains do not necessarily drain better: fluid flow through closed-suction drains increased with tubing diameter and intracavitary length in vitro, but perforated drains carried fluid faster than fluted drains [65]. Clotting is a common cause of obstruction [75]. In 100 cardiac surgery patients, occlusion occurred in 16% of Blake (fluted) drains and in 52% of multichannel drains [76]. Soft fluted silicone drains were less painful to remove than rigid drains in a patient-controlled trial [77], and flat silicone drains were less painful than round perforated drains after mastectomy, with similar seroma rates [78]. Whether these patient-comfort findings apply to abdominal drains after bariatric surgery has not been studied.

8.4 Position, fixation and removal technique

The drain tip should lie in the dependent space likely to collect fluid, such as the left subphrenic space alongside a sleeve or behind a gastrojejunostomy. It should not rest against the staple line or anastomosis, given the reports of drain erosion and inclusion in the pouch [28,29], and it should not form loops around which bowel can twist [11]. The skin exit site affects pain: a right-sided exit was less painful than a left-sided one after gastric bypass [25]. Inadvertent suturing of the drain during wound closure can lead to breakage at removal and a retained fragment [79]. In a cadaver study, drains became tethered when sutured through the tubing or caught with heavier sutures [80]. Local anaesthetic infiltration around the drain reduced pain on removal in orthopaedic patients [81].

Table 4. Characteristics of common abdominal drain types relevant to bariatric surgery. Evidence specific to bariatric patients is limited to the cited series and one small randomised comparison of drain types [73]; other entries are extrapolated from other specialties or bench studies. Device design across specialties is reviewed in the companion paper [19]. NR, not reported; PVC, polyvinyl chloride.

Drain type	Mechanism	Typical material and profile	Reported use in bariatric series	Potential advantages	Limitations and evidence
Closed-suction, round perforated (bulb or spring reservoir)	Active negative pressure	Silicone or PVC; round tube with side holes	Not specified in most reports	Closed system; measurable output; suction maintains tissue apposition	Suction falls as reservoir fills [64,65]; side holes can block with clot [75]
Closed-suction, fluted/channel (e.g. Blake-type)	Active; capillary flow along channels	Silicone; fluted or channelled profile	19-Fr [7]; 24-Fr [27]; along staple line [26]	Less painful removal than rigid drains [77]; lower occlusion than multichannel drains in cardiac surgery [76]	Slower in vitro flow than perforated drains [65]; no bariatric comparison with other profiles
Flat perforated	Active or passive	Silicone; flat profile	NR	Less pain than round perforated drains after mastectomy [78]	No abdominal or bariatric data
Closed passive (gravity to bag)	Gravity/ siphon	Silicone or PVC tube to collection bag	Jackson-Pratt used passively [42]	No suction injury; simple	Output depends on position and siphon; no bariatric comparison with suction
Open passive (Penrose, corrugated, tubulolaminar)	Capillary/ overflow to dressing	Latex or silicone	Latex tubular and tubulolaminar drains in RCT of drain types [73]	Low cost; latex encourages tract formation [68]	More discomfort and more pathogenic contamination than silicone channelled drain [73]; latex hypersensitivity [69]

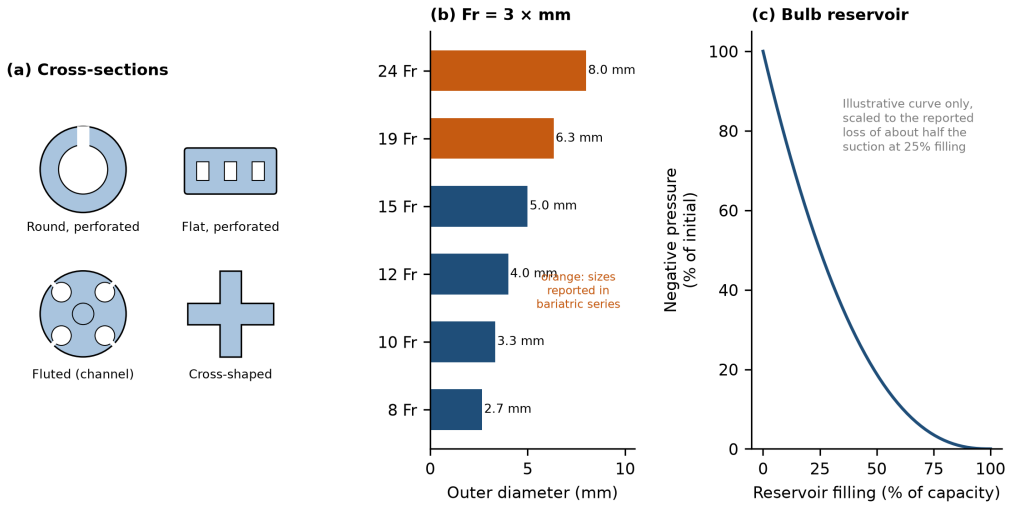


Figure 7. Schematic of common drain designs (original drawings, not to scale and not representing any specific commercial product). (a) Cross-sections of round perforated, flat perforated, fluted (channel) and cross-shaped silicone profiles; (b) French gauge, where Fr = 3 × outer diameter in mm [74], with the sizes reported in bariatric series [7,27]; (c) closed-suction system with a bulb reservoir, whose negative pressure falls as it fills [64,65]. Drawn by the author with matplotlib.

9. Drain management and removal criteria

No validated output threshold for drain removal after bariatric surgery was identified. Removal practices in the included studies ranged from removal 24 hours after a normal contrast study [8], through removal of most drains by day 2 or 3 [42], to scheduled outpatient removal on day 7 [26]. In a group of complex revisional cases, a leak test was performed before drain removal [41]. Day-1 drain amylase below a study-specific cut-off, together with normal clinical findings, has been proposed to support early removal [44,46]. These cut-offs have not been externally validated.

Where a drain is used, the literature reviewed here supports the following management points: a documented reason and planned duration; recording of output volume and character at defined intervals; a defined trigger for investigation (bloody or enteric output, rising volume, a high drain amylase, or abnormal vital signs regardless of output); regular emptying and re-priming of suction reservoirs; and removal as soon as the drain has served its purpose [64,65,72]. Because a drain cannot exclude a leak, abnormal clinical signs or CRP should lead to imaging even when drain output is unremarkable [32,48,49]. Removal of a drain that has eroded into the pouch or lies against a leak may itself be therapeutic, as in the reports of fistula closure after drain repositioning [28,29].

10. Health-economic and patient-reported considerations

No formal cost-effectiveness analysis of prophylactic drainage in bariatric surgery was identified. The cost consequences of a drain include the device, nursing care, drain-related infections and, most importantly, length of stay. In the German series, drains were associated with a 1.3-day longer postoperative stay [35]. In the MBSAQIP analyses, drains were associated with excess length of stay after primary (aOR 1.45) and revisional (aOR 2.06) surgery [40,41]. Two smaller studies found no difference in length of stay [23,31]. Drain-related surgical site infection was recorded in 4.1% of one drained SG series and was treated with oral antibiotics and drain removal [26].

ERAS pathways, of which drain avoidance is one element, have been associated with shorter stay without higher morbidity [57–59]. The Italian consensus found that ERABS did not increase overall surgical costs [50]. An IFSO position statement found no significant difference in complications or readmissions between same-day discharge and conventional stay in four randomised trials (2,026 patients) [55]. In same-day or day-1 discharge pathways, a drain either has to be removed before discharge, when its sentinel value is small, or managed at home, with the infection risk reported for outpatient removal on day 7 [26].

From the patient's perspective, the only patient-reported outcome studied in randomised trials is pain. Drains increased pain on day 1, and in one trial on day 3 [23,24], and the exit site influenced early pain [25]. Patient discomfort with different drain types was assessed only in the small RYGB trial of drain materials [73]. No study measured quality of recovery, sleep, mobilisation or patient preference in relation to drains after bariatric surgery.

11. Knowledge gaps and future research

The evidence base is small and dominated by observational studies (Figure 8). The main gaps are:

1. **No adequately powered randomised trial** of drain versus no drain after SG, OAGB or revisional surgery. The two RYGB trials (66 and 84 patients) were powered for pain, not for leak or reoperation [23,24]. Because leak occurs in about 1–2% of

patients [2,3,5], a superiority trial on leak-related outcomes would need many thousands of patients. Non-inferiority, registry-based randomised or cluster designs may be more feasible.

2. **Confounding by indication** in registries. Future registry analyses should record why a drain was placed (for example a difficult staple line, bleeding, revision or a positive leak test) and use methods such as propensity matching within strata of surgeon-declared risk [40,41].
3. **Inconsistent definitions** of leak, bleeding, drain output and drain-related complications, and few reports of timing relative to drain removal.
4. **Diagnostic studies of drain fluid** with derived but not validated cut-offs and few events [44–46]. Prospective validation, with standardised sampling days and comparison against CRP and clinical scores, is needed.
5. **Device-specific outcomes.** Only one small bariatric trial compared drain designs [73]. Comparisons of size, profile, material and suction regimen in bariatric surgery are absent.
6. **Patient-reported and economic outcomes** beyond pain and length of stay, and evidence from low-resource settings where access to CT and reintervention differs.

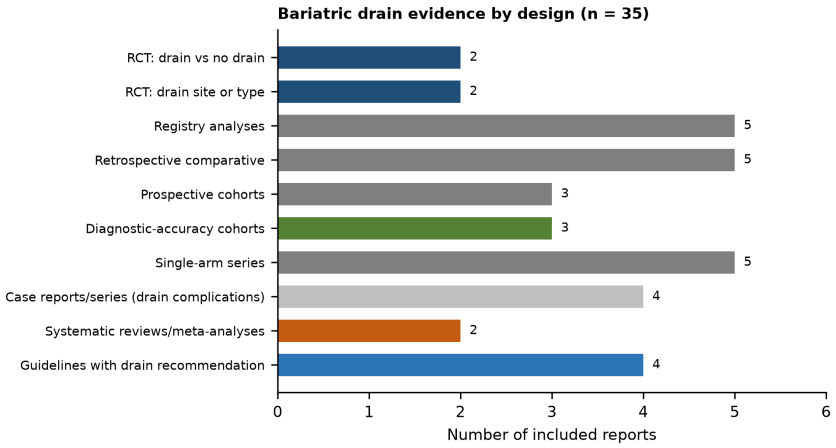


Figure 8. Design of the bariatric clinical studies and recommendations on prophylactic drains included in this review (n = 35; device studies from other specialties and general context references excluded). RCT, randomised controlled trial; SR/MA, systematic review/meta-analysis. Classification by the author from the published design. Drawn by the author with matplotlib.

12. Conclusions

Current evidence does not support routine prophylactic abdominal drainage after primary SG or gastric bypass. Small randomised trials after RYGB showed more pain and no detectable benefit. Observational studies show that drains often miss leaks, especially those presenting after drain removal, and that most complications are recognised from clinical signs, laboratory tests and imaging. Large registries show steadily falling drain use and no measurable protective association, although their adverse associations are probably inflated by selective use in difficult cases. The ERAS Society 2021 guideline and the Canadian and Italian consensus statements recommend against routine drainage.

Selective drainage in revisional surgery, after a technically difficult staple line or anastomosis, or where bleeding risk is recognised, is common and may be reasonable. It remains unproven and should not be regarded as a safety guarantee. When a drain is used, its purpose, position, monitoring and removal should be planned. Drain amylase may help to decide early removal, but its cut-offs need validation. Device characteristics such as material, profile, size and reservoir behaviour affect comfort, patency and the interpretation of output, but bariatric outcome data for specific designs are lacking.

13. A note from the manufacturer’s perspective

The author is the general manager of Suzhou Shenyun Medical Equipment Co., Ltd., a medical device manufacturer founded in 2020. The company’s product lines include bariatric surgery devices such as gastric calibration tubes, and surgical drainage products: silicone drains in round, flat, cross-shaped and spiral profiles, suction reservoirs, drain introducers and collection bags. Further product information is available at https://sybariatric.com.

From a manufacturer’s standpoint, the evidence reviewed here has three implications. First, demand for prophylactic drains in primary bariatric surgery is expected to keep falling, and a manufacturer should not promote routine drainage contrary to current guidance. Second, where drains are used selectively, surgeons need devices whose characteristics are clearly documented (material, outer diameter in Fr, profile, perforation or channel pattern, reservoir volume and negative-pressure behaviour), so that a device can be

matched to the clinical purpose. Third, manufacturers can support independent research by providing device specifications to investigators. This review makes no claim that any product improves clinical outcomes.

Declarations

Conflict of interest. The author is the General Manager of Suzhou Shenyun Medical Equipment Co., Ltd., which manufactures and sells surgical drainage products and other devices used in bariatric surgery. The author therefore has a commercial interest in the subject of this review. Readers should consider this when interpreting the review, particularly Sections 8 and 13.

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Use of AI-assisted tools. An AI writing assistant was used to script the literature searches, organise extracted data, draft text and produce figures under the author's direction. All references were checked against PubMed and Crossref (DataCite for the Zenodo record), and all numerical values were checked against the cited abstracts or full texts. The author takes responsibility for the content.

Ethics. Not applicable (review of published literature; no patient data).

Data availability. Search strings and hit counts are given in Appendix Table A1. The reference verification file (*references_verification.csv*), listing PMID, DOI and the result of PubMed and Crossref checks for every reference, is provided with this article. All plotted values are taken from the cited publications.

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Appendix

Table A1. PubMed search strings and hit counts (NCBI E-utilities esearch, run 6 November 2026).

Search	Purpose	Query string (PubMed syntax)	Hits
S1	Drains/ drainage in bariatric surgery	`(drain[tiab] OR drains[tiab] OR drainage[tiab] OR drained[tiab] OR "Drainage"[mh]) AND (bariatric[tiab] OR "metabolic surgery"[tiab] OR "sleeve gastrectomy"[tiab] OR "gastric bypass"[tiab] OR "one anastomosis gastric bypass"[tiab] OR "mini gastric bypass"[tiab] OR "Bariatric Surgery"[mh] OR "Gastric Bypass"[mh] OR ("Gastrectomy"[mh] AND obes*[tiab]))`	1,069
S2	Drains or drain fluid for leak/bleeding diagnosis	`(drain[tiab] OR drains[tiab] OR drainage[tiab] OR "drain amylase"[tiab] OR "drain fluid"[tiab]) AND (leak[tiab] OR leaks[tiab] OR leakage[tiab] OR fistula[tiab] OR bleeding[tiab] OR haemorrhage[tiab] OR hemorrhage[tiab]) AND (diagnos*[tiab] OR sensitivity[tiab] OR detect*[tiab] OR "early warning"[tiab] OR sentinel[tiab]) AND (bariatric[tiab] OR "metabolic surgery"[tiab] OR "sleeve gastrectomy"[tiab] OR "gastric bypass"[tiab] OR "one anastomosis gastric bypass"[tiab] OR "mini gastric bypass"[tiab] OR "Bariatric Surgery"[mh] OR "Gastric Bypass"[mh] OR ("Gastrectomy"[mh] AND obes*[tiab]))`	149
S3	Guidelines, consensus and ERAS	`(guideline[pt] OR practice guideline[pt] OR consensus[ti] OR guideline*[ti] OR "position statement"[ti] OR "enhanced recovery"[ti] OR ERAS[ti]) AND (bariatric[tiab] OR "metabolic surgery"[tiab] OR "sleeve gastrectomy"[tiab] OR "gastric bypass"[tiab] OR "one anastomosis gastric bypass"[tiab] OR "mini gastric bypass"[tiab] OR "Bariatric Surgery"[mh] OR "Gastric Bypass"[mh] OR ("Gastrectomy"[mh] AND obes*[tiab]))`	892
S4	Leak/bleeding syntheses	`(leak[tiab] OR leaks[tiab] OR leakage[tiab] OR bleeding[tiab] OR haemorrhage[tiab] OR hemorrhage[tiab] OR "staple line"[tiab]) AND (meta-analysis[pt] OR systematic review[pt]) AND (bariatric[tiab] OR "metabolic surgery"[tiab] OR "sleeve gastrectomy"[tiab] OR "gastric bypass"[tiab] OR "one anastomosis gastric bypass"[tiab] OR "mini gastric bypass"[tiab] OR "Bariatric Surgery"[mh] OR "Gastric Bypass"[mh] OR ("Gastrectomy"[mh] AND obes*[tiab]))`	235
Total		`All searches limited to publication date 1990/01/01–2026/10/31 (pdat)`	2,345 (2,169 unique after removal of 176 duplicates)