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REVIEW

Prevalence and pooled risk factors of stoma outlet obstruction after colorectal surgery with diverting ileostomy: a systematic review and meta-analysis

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Abstract

Background Stoma outlet obstruction (SOO) is a significant complication following colorectal surgery with diverting ileostomy, but its prevalence and associated risk factors are not fully understood. This meta-analysis aimed to quantify the prevalence of SOO and identify key risk factors influencing its occurrence.

Methods A systematic review and meta-analysis of 19 studies comprising 3287 patients were conducted. Pooled prevalence and odds ratios (ORs) for risk factors were calculated using a random-effects model. Subgroup and sensitivity analyses were performed to explore heterogeneity, and publication bias was assessed using funnel plots and Egger's regression test.

Results The pooled prevalence of SOO was 14% (95% CI = 11–18%, $I^2 = 84.9\%$). Subgroup analysis revealed higher prevalence in studies focusing on benign conditions (20%) and smaller sample sizes (< 100 patients, 16%). Key risk factors included high-output syndrome (OR = 4.23, 95% CI = 2.28–7.85), increased rectus abdominis thickness (OR = 3.51, 95% CI = 2.27–5.41), and laparoscopic surgery (OR = 4.04, 95% CI = 1.62–10.04). While publication bias was detected, but the trim-and-fill method indicated that the adjusted prevalence remained basically consistent with the overall pooled estimate.

Conclusions SOO occurs in approximately 14% of patients undergoing colorectal surgery with diverting ileostomy. Key modifiable factors included high-output syndrome, rectus abdominis thickness, and laparoscopic surgery.

Keywords Stoma outlet obstruction · Colorectal surgery · Diverting ileostomy · Risk factors · Meta-analysis

Introduction

Colorectal surgery is pivotal in managing various colorectal diseases, including malignancies, inflammatory bowel diseases, and diverticular conditions. A critical aspect of these surgical interventions is the prevention of anastomotic leakage, a complication associated with significant morbidity and mortality. To mitigate this risk, surgeons often employ diverting ileostomy, which serves as a temporary fecal diversion to protect the distal anastomosis during the healing process [1, 2]. Despite its protective intent, diverting ileostomy is not without complications. One notable issue is stoma outlet obstruction (SOO), characterized by a blockage at the stoma site leading to symptoms such as abdominal pain, nausea, vomiting, and cessation of stoma output [3, 4]. SOO can result in prolonged hospital stays, additional surgical interventions, and a diminished quality of life for patients. Understanding the prevalence and identifying risk factors associated with SOO are essential for improving patient outcomes and guiding surgical practices [5].

The current literature presents varying incidence rates of SOO, reflecting differences in study populations, surgical techniques, and definitions of the condition. For instance, a retrospective cohort study reported an incidence of 5.6% in patients with sporadic rectal cancer and 27.3% in patients with ulcerative colitis undergoing stoma surgery [6]. Another study found an incidence of 18.4% among patients who underwent colorectal surgery with diverting ileostomy [7]. These variations underscore the need for a comprehensive analysis to ascertain the true prevalence of SOO. Increasing evidence indicated that several risk factors were associated with SOO, which including underlying ulcerative colitis, loop ileostomy construction, surgical site infections,

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and increased rectus abdominis thickness [7–9]. Currently, there is a lack of available evidence to systematically explore the risk factors of stoma outlet obstruction after colorectal surgery with diverting ileostomy.

Given the clinical significance of SOO and the variability in reported data, this meta-analysis aims to systematically evaluate the prevalence of SOO in patients undergoing colorectal surgery with diverting ileostomy. Furthermore, it seeks to identify and quantify the risk factors associated with SOO to provide evidence-based insights that can inform clinical practice and enhance patient care.

Materials and methods

This meta-analysis was conducted in accordance with the Guidelines for Meta-Analyses and Systematic Reviews of Observational Studies (MOOSE) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards [10, 11]. The processes of search strategy, data extraction, quality assessment, and statistical analysis were independently performed by two researchers (CK and LHP), with a third reviewer (GJX) consulted to resolve any discrepancies.

Literature search strategy

A comprehensive literature search was performed across multiple databases, including PubMed, EMBASE, and the Cochrane Library from the inception to October 2024. The search strategy incorporated a combination of Medical Subject Headings (MeSH) terms and keywords related to "stoma outlet obstruction," "colorectal surgery," "diverting ileostomy," "prevalence," "risk factors," and their variants using appropriate Boolean operators. SOO was defined as the inability to pass stool or gas through the stoma, often accompanied by abdominal distension and other symptoms indicative of bowel obstruction. A diagnosis of SOO requires radiological confirmation, typically through cross-sectional imaging such as CT scans. The detailed search strategies are showed in supplementary 1.

Inclusion and exclusion criteria

We included studies that reported the prevalence of SOO following colorectal surgery with diverting loop ileostomy without language limitation, with a clear definition of SOO. Studies were excluded if they did not provide sufficient data on SOO prevalence or case reports, reviews, editorials, and conference abstracts.

Data extraction and quality assessment

Two independent reviewers (CK and LHP) screened titles and abstracts for eligibility. Full-text articles of potentially relevant studies were retrieved and assessed against the inclusion criteria. Discrepancies were resolved through discussion or consultation with a third reviewer (GJX). Data extracted included study characteristics (author, year of publication, country, study design), patient demographics (sample size, age, gender distribution), and clinical details (underlying diseases and type of ileostomy constructed), and outcomes (incidence/prevalence of SOO, identified risk factors, and their corresponding effect sizes). The quality of included studies was assessed using the Newcastle–Ottawa Scale (NOS) for observational studies [12]. Studies were rated as low, moderate, or high quality based on selection, comparability, and outcome assessment domains. Studies scoring 7 or higher were considered high quality.

Statistical analysis

The primary outcome was the prevalence of SOO in patients undergoing colorectal surgery with diverting ileostomy, while the secondary one was to identify risk factors associated with the development of SOO. Pooled prevalence rates of SOO were calculated using the DerSimonian-Laird random-effects model to account for potential heterogeneity among studies. Heterogeneity was assessed using the I^2 statistic, with values > 50% indicating substantial heterogeneity. To explore potential sources of heterogeneity, subgroup analyses were conducted based on underlying disease (benign colorectal lesions vs. colorectal cancer), sample size (less than 100 vs. no less than 100), NOS scores (less than 7 points vs. no less than 7 points), study center (single-center vs. multi-center), and study region (Japan vs. others). We also explore the robustness of the overall pooled estimate using sensitivity analyses. Sensitivity analyses were performed by excluding studies with a high risk of bias (NOS score < 7) and assessing the impact of individual studies on the overall results by sequentially omitting each study. For identified risk factors, odds ratios (ORs) with 95% confidence intervals (CIs) were computed with a random-effects model. Multivariate or adjusted ORs reported in at least two studies were extracted for meta-analyses. Publication bias was evaluated using funnel plots and Egger or Begg's regression test, with a p-value < 0.05 indicating significant publication bias [13]. If bias was detected, the trim-and-fill method was applied to adjust the pooled effect size [14]. All statistical analyses were performed using Stata version 12.0 (StataCorp, College Station, TX).

Results

Study selection

A total of 1258 items were identified through database searches. After the removal of duplicates, 632 studies remained for screening. Title and abstract review excluded 592 studies, leaving 40 full-text articles for detailed assessment. Among these, 21 studies were excluded for the following reasons: no relevant data ($n = 10$), absence of prevalence or risk factor analysis ($n = 6$), conference abstracts only ($n = 2$), and unsuitable study designs such as case reports or reviews ($n = 3$). Ultimately, a total of 19 studies met the inclusion criteria and were included in the meta-analysis [3, 4, 7–9, 15–28] (Fig. 1). Of all the included studies, three studies also reported other types of ostomies including end ileostomies and loop colostomies [4, 16, 24]. However, we merely extracted data involving diverting loop ileostomy in these studies for further investigation.

Characteristics of included studies

These included studies, conducted between 2005 and 2024, involved a total of 3287 patients undergoing colorectal surgery with diverting ileostomy. Most studies were conducted in Japan ($n = 17$), with one study from China and another from Italy (Table 1). The majority of studies ($n = 18$) were single-center, while one study was multi-center. Study populations included patients with colorectal cancer, inflammatory bowel disease, familial adenomatous polyposis, and other conditions. Diagnostic methods for SOO predominantly included clinical symptoms and imaging techniques such as CT or X-ray. The NOS quality scores ranged from 6 to 8, with 63% of studies rated as high quality (NOS ≥ 7).

Prevalence of stoma outlet obstruction

The pooled prevalence of SOO was 14% (95% CI = 11–18%), with substantial heterogeneity observed among studies ($I^2 = 84.9\%$, $p < 0.001$) (Fig. 2). Individual study estimates varied from 5.4% (Sasaki et al., 2021) [21] to 28% (Hara et al., 2020) [7].

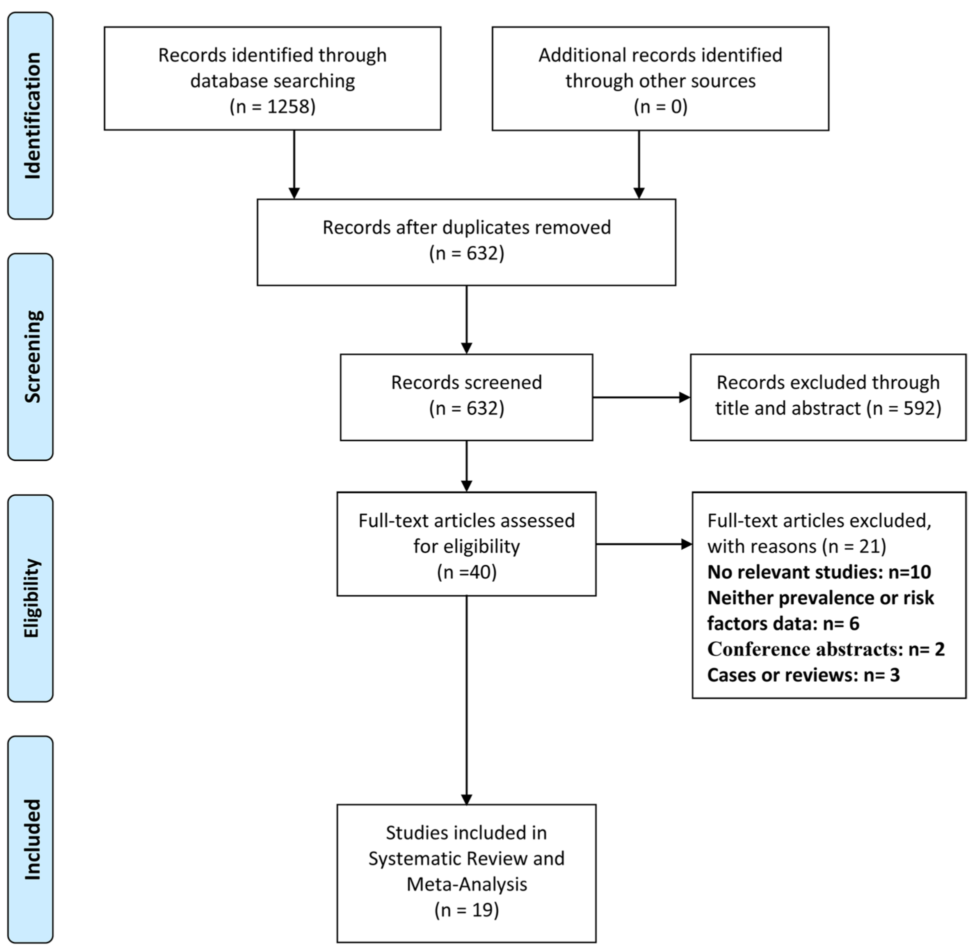

Fig. 1 PRISMA flow diagram of study selection process

Table 1 Baseline characteristics of included studies

Author (year)	Country	Enrollment period	Disease diagnosis	Surgical approach	Sample size	SOO diagnosis methods	Study center	NOS score
Takaaki Fujii (2005) [15]	Japan	2008–2012	IBD, FAP, and rectal cancer	Loop diverting ileostomy	61	X-ray and CT	Single-center	6
Gaku Ohira (2018) [16]	Japan	2010–2015	IBD, FAP, and CRC	Total colectomy or proctocolectomy with ileostomy	88	CT	Single-center	7
Koichi (2019) [17]	Japan	2007–2017	Rectal cancer	Laparoscopic rectal cancer surgery with loop ileostomy	230	CT	Single-center	7
Tomoaki (2020 [4]	Japan	2008–2020	UC	RPC and IPAA with diverting ileostomies	90	Clinical symptoms and CT	Single-center	7
Yutaro Hara (2020) [7]	Japan	2015–2018	IBD, colon perforation, and CRC	Colorectal surgery and diverting ileostomy	103	Clinical symptoms and CT	Single-center	7
Hiroya Enomoto (2021) [19]	Japan	2014–2020	Rectal cancer	Anterior rectal resection and diverting ileostomy	100	Clinical symptoms and CT	Single-center	7
Ryo Maemoto (2021) [20]	Japan	2011–2019	IBD, FAP, and rectal cancer	Laparoscopic colorectal surgery with diverting ileostomy	155	Clinical symptoms and CT	Single-center	7
Ryota Mori (2021) [22]	Japan	2010–2020	UC with cancer or dysplasia	IPAA with diverting ileostomy	68	CT	Single-center	6
Shigemasa Sasaki (2021) [21]	Japan	2013–2015	Rectal cancer	Laparoscopic rectal cancer surgery with loop ileostomy	261	Clinical symptoms and CT	Single-center	8
Tomoki Abe (2021) [18]	Japan	2014–2020	Rectal cancer	Rectal cancer surgery with loop ileostomy	125	Clinical symptoms and CT	Single-center	7
Kiyomitsu Kuwahara (2022) [9]	Japan	2014–2021	IBD and CRC	Laparoscopic colorectal surgery with diverting ileostomy	63	Clinical symptoms and CT	Single-center	6
Koichiro Kumano (2023) [24]	Japan	2019–2022	Rectal tumors	Diverting stoma construction following rectal resection	27	X-ray	Single-center	6
P Caprino (2023) [23]	Italy	2010–2021	UC	IPAA with diverting ileostomy	75	Clinical symptoms and CT	Single-center	6
Xiaowei Wang (2023) [25]	China	2022	Rectal cancer	Rectal cancer surgery with loop ileostomy	38	Clinical symptoms and CT	Single-center	6
Keisuke Ihara (2024) [3]	Japan	2006–2021	UC	Proctocolectomy and diverting ileostomy	68	Clinical symptoms and CT	Single-center	7
Masaya Kawai (2024) [27]	Japan	2005–2017	Rectal cancer	Rectal cancer surgery with loop ileostomy	400	Clinical symptoms and CT	Single-center	6

Table 1 (continued)

Author (year)	Country	Enrollment period	Disease diagnosis	Surgical approach	Sample size	SOO diagnosis methods	Study center	NOS score
Takayuki Ogino (2024) [28]	Japan	2010–2023	UC and FAP	RPC and IPAA with diverting ileostomies	106	Clinical symptoms and CT	Multi-center	7
Yoshiko Matsumoto (2024) [8]	Japan	2016–2021	No available	Loop ileostomy	188	Clinical symptoms and CT	Single-center	7
Yuta Imaizumi (2024) [26]	Japan	2018–2022	Rectal cancer	Rectal cancer surgery with loop ileostomy	92	Clinical symptoms and CT	Single-center	7

CRC, colorectal cancer; *CT*, computed tomography; *FAP*, familial adenomatous polyposis; *IBD*, inflammatory bowel disease; *IPAA*, ileal pouch-anal anastomosis; *NOS*, Newcastle–Ottawa Scale; *RPC*, restorative proctocolectomy; *SOO*, stoma outlet obstruction; *UC*, ulcerative colitis

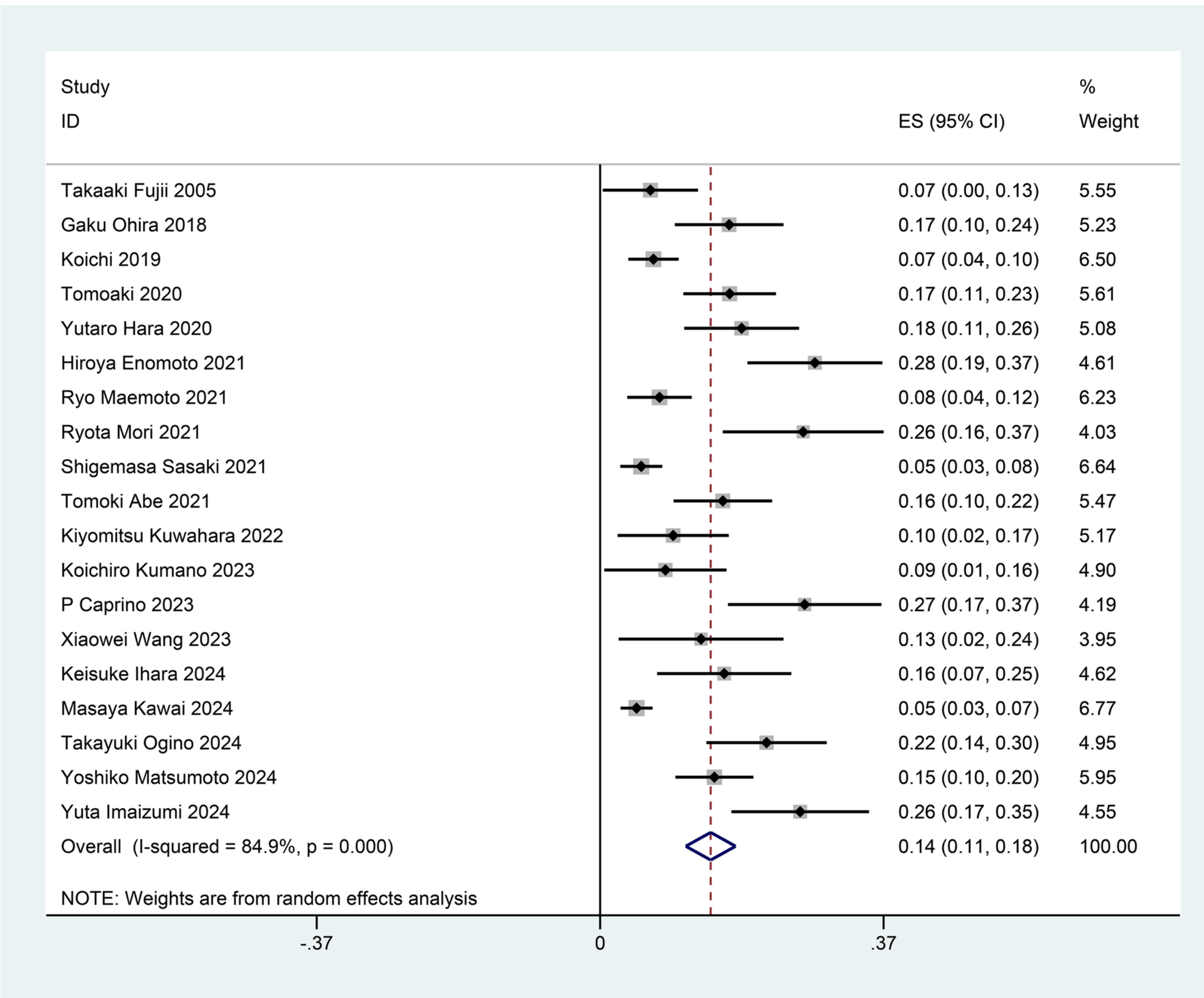

Fig. 2 Forest plot of the prevalence of stoma outlet obstruction after colorectal surgery with diverting ileostomy

Table 2 Subgroup analysis of the prevalence of stoma outlet obstruction after colorectal surgery with diverting ileostomy

Outcomes	Number of studies	OR (95% CI)	Heterogeneity, I^2 (%)
Pooled results	19	0.14 (0.11–0.18)	84.9
Subgroup analyses based on disease diagnosis			
Benign colorectal lesions (IBD,FAP, and others)	9	0.20 (0.17–0.24)	9.4
CRC	12	0.12 (0.08–0.15)	86.3
Subgroup analyses based on sample size			
Less than 100	8	0.16 (0.10–0.22)	74.6
No less than 100	11	0.13 (0.10–0.17)	87.3
Subgroup analyses based on quality of NOS scores			
Less than 7 points	7	0.13 (0.07–0.19)	82.6
No less than 7 points	12	0.15 (0.11–0.20)	84.9
Subgroup analyses based on study center			
Single-center	18	0.14 (0.11–0.17)	84.5
Multi-center	1	0.22 (0.14–0.30)	NA
Subgroup analyses based on study region			
Japan	17	0.14 (0.11–0.17)	85.1
Others	2	0.20 (0.07–0.33)	69.2

NOS, Newcastle–Ottawa Scale; *IBD*, inflammatory bowel disease; *FAP*, familial adenomatous polyposis; *CRC*, colorectal cancer; *NA*, no available

We also conducted subgroup analyses to explore sources of heterogeneity (Table 2). Studies focusing on benign colorectal conditions (e.g., IBD and FAP) reported a higher prevalence (20%, 95% CI = 17–24%, I^2 = 9.4%) compared to CRC-related cases (12%, 95% CI = 8–15%, I^2 = 86.3%). Smaller studies (< 100 patients) reported a higher prevalence (16%, 95% CI = 10–22%, I^2 = 74.6%) than larger studies (≥ 100 patients, 13%, 95% CI = 10–17%, I^2 = 87.3%). Studies conducted in Japan reported a prevalence of 14% (95% CI = 11–17%, I^2 = 85.1%), while studies outside Japan had a prevalence of 20% (95% CI = 7–33%, I^2 = 69.2%). Multi-center studies reported a higher prevalence (22%, 95% CI = 14–30%) compared to single-center studies (14%, 95% CI = 11–17%).

Subsequently, sensitivity analyses were performed to assess the robustness of findings by excluding studies with NOS scores < 7 and sequentially omitting individual studies. After removing these lower-quality studies, the pooled prevalence was recalculated based on the remaining high-quality studies (n = 12). The revised prevalence estimate was 13% (95% CI = 10–16%), with a slight reduction in heterogeneity (I^2 = 82.6%). To evaluate the influence of individual studies on the pooled prevalence estimates, a leave-one-out sensitivity analysis was performed. Each study was sequentially removed from the meta-analysis, and the pooled prevalence was recalculated. None of the individual omissions led to substantial changes in the overall prevalence, which ranged from 13 to 15% (Fig. 3).

Risk factors for SOO

This meta-analysis identified several key risk factors for SOO after colorectal surgery with diverting ileostomy. The pooled adjusted ORs and heterogeneity provided insights into their significance and consistency across studies (Table 3).

HOS is defined as a condition in which stoma output exceeds 1500 mL per day, often leading to electrolyte imbalances, dehydration, malnutrition, and renal dysfunction. HOS emerged as the most significant risk factor for SOO, with a pooled OR of 4.23 (five studies; 95% CI = 2.28–7.85, I^2 = 0%). The strong and consistent association across five studies highlights the critical role of excessive stoma output in causing mechanical obstruction and functional stoma failure [3, 18, 22, 26, 28]. Effective postoperative management of stoma output is essential to reduce this risk.

Increased rectus abdominis muscle thickness was significantly associated with SOO, with a pooled OR of 3.51 (five studies; 95% CI: 2.27–5.41, I^2 = 0%) [4, 18, 19, 21, 26]. The mechanical impact of thicker abdominal musculature, which may compress or narrow the stoma lumen, emphasizes the importance of preoperative anatomical evaluation and stoma site selection.

Laparoscopic surgery was associated with a fourfold increased risk of SOO (three studies; pooled OR = 4.04, 95% CI = 1.62–10.04, I^2 = 0%) [3, 16, 28], which underscoring

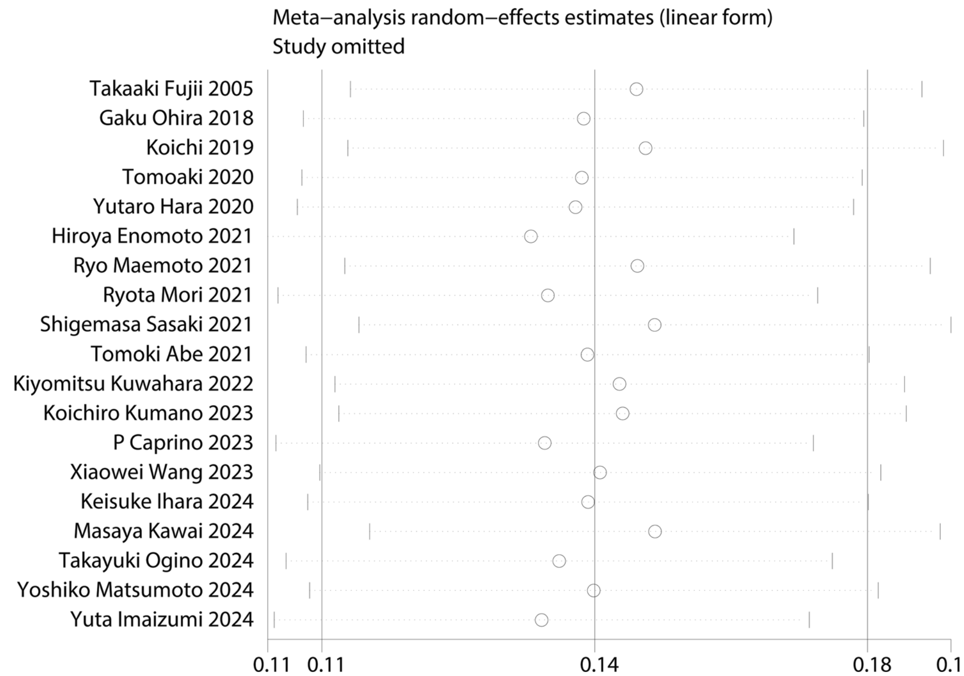

Fig. 3 Sensitivity analysis for the pooled prevalence of stoma outlet obstruction after colorectal surgery with diverting ileostomy

Table 3 Risk factors of stoma outlet obstruction after colorectal surgery with diverting ileostomy

Risk factors	Number of trials	Pooled adjusted OR (95% CI)	I^2 (%)
Age < 60	4	1.37 (0.62–3.02)	63.8
Gender (female)	3	0.40 (0.08–2.03)	58.7
BMI	2	1.01 (0.85–1.21)	0
Total proctocolectomy	2	3.95 (0.59–26.33)	65
Laparoscopic surgery	3	**4.04 (1.62–10.04)**	0
Thickness of subcutaneous fat at stomal site	4	1.27 (0.65–2.48)	57.7
Stoma site(Left side)	2	3.13 (0.86–11.38)	11.9
Rectus abdominis thickness	5	**3.51 (2.27–5.41)**	0
High-output syndrome	5	**4.23 (2.28–7.85)**	0

OR, odds ratio; *CI*, confidence interval

the need for precise surgical technique and training in laparoscopic cases.

Total proctocolectomy showed an elevated, but non-significant, risk of SOO (two studies; pooled OR = 3.95, 95% CI = 0.59–26.33, $I^2 = 65\%$) [16, 20]. The high heterogeneity suggests variability in patient populations and surgical techniques. This factor may warrant further investigation in larger, standardized studies. Left-sided stomas demonstrated a pooled OR of 3.13 (two studies; 95% CI = 0.86–11.38, $I^2 = 11.9\%$), although the result was not statistically significant [8, 16]. This trend may reflect anatomical differences affecting stoma functionality, but more research is needed to clarify its impact. Several factors, including subcutaneous fat thickness (pooled OR = 1.27, 95% CI = 0.65–2.48, $I^2 = 57.7\%$), age < 60 years (pooled OR = 1.37, 95% CI = 0.62–3.02, $I^2 = 63.8\%$), female gender (pooled OR = 0.40, 95% CI = 0.08–2.03, $I^2 = 58.7\%$), and BMI (pooled OR = 1.01, 95% CI = 0.85–1.21, $I^2 = 0\%$), were not significantly associated with SOO. The lack of significant findings suggests limited contributions of these factors to SOO risk.

Publication bias

Publication bias was assessed using funnel plots and Egger's regression test. Visual inspection of the funnel plot indicated asymmetry (Fig. 4), suggesting potential bias. Egger's regression test confirmed this ($p = 0.003$). To address bias, the trim-and-fill method was applied and two "missing" studies were identified. After adding these missing studies, the adjusted pooled prevalence was 13.2% (95%

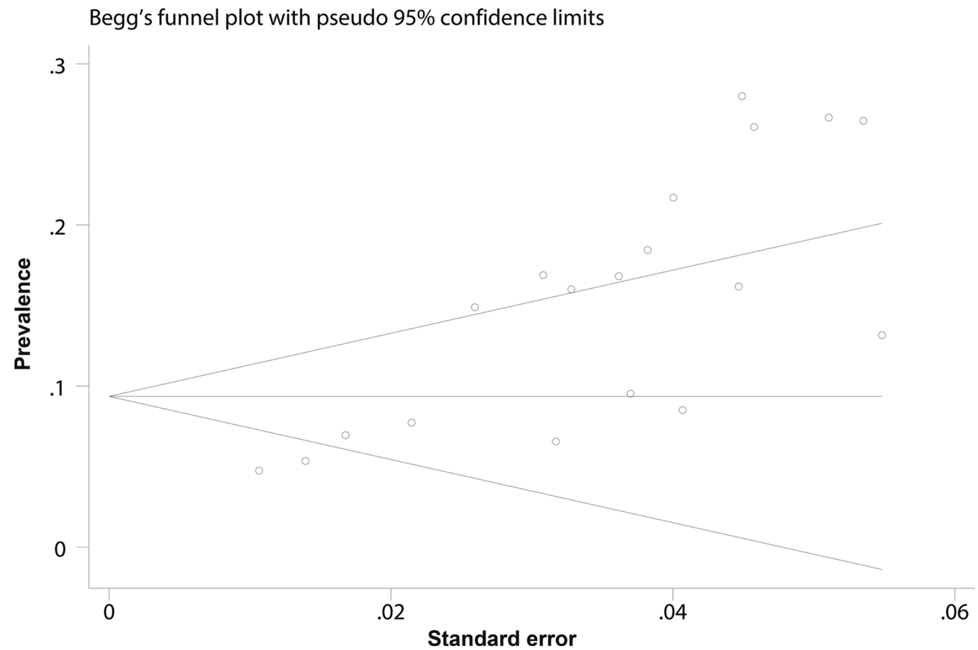

Fig. 4 Funnel plot for assessing publication bias

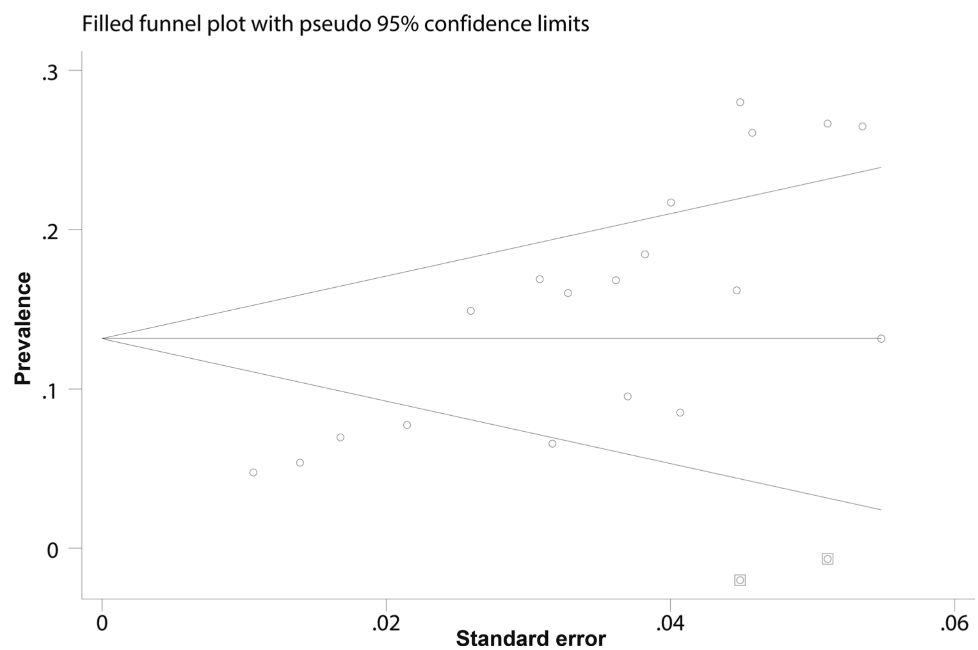

Fig. 5 Funnel plot based on the trim-and-fill method was applied and two "missing" studies were identified

CI = 10–16.3%), which was basically consistent with the primary analysis (Fig. 5).

Discussion

Summary of key findings

This meta-analysis provides a comprehensive evaluation of the prevalence and associated risk factors of SOO following colorectal surgery with diverting ileostomy. The pooled prevalence of SOO was estimated at 14%. Notably, HOS, increased rectus abdominis muscle thickness, and laparoscopic surgical approach were identified as significant risk factors for SOO.

Interpretation of results

The overall prevalence of SOO at 14% underscores its clinical significance as a postoperative complication requiring proactive management. Substantial heterogeneity (I^2 = 84.9%) among studies suggests that patient selection, surgical approaches, and healthcare practices significantly influence SOO rates. Higher SOO prevalence in patients with benign colorectal conditions may be attributable to more complex surgical procedures and higher physiological demands in this population. For example, IBD and FAP often require extensive resections and reconstructive procedures [29, 30], which may predispose patients to mechanical or functional complications at the stoma site.

The strong association between HOS and SOO (pooled OR = 4.23) emphasizes the role of excessive stoma output in the pathophysiology of SOO. HOS is thought to contribute to SOO through several mechanisms, including bowel distension, impaired motility, and fluid shifts that interfere with normal bowel function. The excessive fluid output can also lead to electrolyte imbalances and dehydration, further complicating postoperative recovery and promoting the development of SOO [31]. Also, HOS can occur as a secondary effect following the resolution of SOO, particularly as bowel function begins to return. However, when present in the perioperative phase, high-output stoma may contribute to the development of SOO due to its effects on fluid balance, electrolyte disturbances, and bowel edema. Proper management of HOS through electrolytes and stoma output control may mitigate its contribution to SOO. This finding underscores the importance of meticulous postoperative monitoring and interventions aimed at controlling stoma output through dietary modifications, pharmacological agents, or fluid management strategies. Increased rectus abdominis muscle thickness, identified as a significant risk factor (pooled OR = 3.51), highlights the anatomical challenges that may arise during stoma formation. Thicker abdominal musculature can compress the stoma lumen, particularly when combined with suboptimal stoma site selection [4, 5]. Preoperative imaging and assessment of abdominal wall thickness may help guide surgical planning to mitigate this risk. Laparoscopic surgery was associated with a fourfold increased risk of SOO. While tactile feedback may be reduced during laparoscopic surgery, the impact on stoma formation is minimized as it is performed extracorporeally. However, the learning curve and the complexity of laparoscopic procedures, particularly for less experienced surgeons, may still contribute to the risk of SOO. Surgeons with less experience or lower procedural volume may have a higher risk of complications, highlighting the importance of surgical training in minimizing this complication [32–34]. These findings suggest that surgeons performing laparoscopic procedures should receive specialized training in stoma formation techniques to minimize complications.

Clinical and public health implications

The findings of this study have important implications for clinical practice and public health. The diagnosis of SOO is often challenging due to its overlap with other postoperative conditions, such as paralytic ileus and small bowel obstruction. Cross-sectional imaging, including CT scans, is crucial to differentiate SOO from these conditions. Identifying HOS as a significant risk factor for SOO underscores the need for vigilant postoperative monitoring and interventions targeting stoma output. Clinicians should consider using fluid thickening agents, dietary modifications, and antidiarrheal medications to manage excessive output and reduce the risk of obstruction. Preoperative assessment of rectus abdominis muscle thickness using imaging modalities such as ultrasound or CT can guide stoma site selection, particularly in patients with a thicker abdominal wall. Surgeons may consider alternative sites or techniques, such as lateralizing the stoma or minimizing tension during creation, to optimize outcomes. The association between laparoscopic surgery and increased SOO risk highlights the importance of skill development and precision in minimally invasive procedures. Institutions should prioritize training programs that focus on stoma formation techniques, emphasizing the importance of achieving optimal stoma angulation and minimizing tension. Furthermore, the higher prevalence of SOO in smaller studies and multi-center studies may reflect variability in surgical expertise or institutional protocols, suggesting the need for standardization of care practices.

Future studies should aim to address the limitations identified in this analysis and provide more granular insights into the mechanisms underlying SOO. Prospective cohort studies with standardized definitions of SOO and consistent diagnostic criteria are essential to validate the findings and enhance comparability across studies. Randomized controlled trials evaluating preventive strategies, such as tailored stoma site selection or enhanced postoperative management protocols, could inform evidence-based guidelines. Research should also focus on elucidating the pathophysiological mechanisms linking HOS to SOO, potentially uncovering novel therapeutic targets. For example, understanding the role of inflammatory mediators, bowel wall remodeling, and mucosal integrity in stoma dysfunction could inform targeted interventions. Additionally, studies exploring the impact of patient-specific factors, such as genetic predisposition or comorbid conditions, on SOO risk may enable personalized surgical and postoperative care. Finally, expanding research beyond Japan to include diverse healthcare settings and populations will improve the generalizability of the findings and identify potential regional or systemic factors influencing SOO outcomes.

Diverting ileostomy is commonly used to mitigate the impact of AL, yet it carries complications such as dehydration, electrolyte imbalances, and SOO. Given these risks, selective use of ileostomy based on AL risk prediction models has gained attention. McKenna et al. and Sassun et al. validated AL risk scores for left- and right-sided colectomies, respectively, demonstrating moderate predictive ability [35, 36]. These models help identify patients at low risk of AL, allowing for more judicious ileostomy use. However, they do not incorporate stoma-related complications like SOO, which can significantly impact patient recovery. Our meta-analysis underscores that SOO is a relevant morbidity associated with ileostomy, warranting consideration alongside AL risk. Future studies should aim to integrate both AL and stoma-related complications into predictive frameworks to optimize ileostomy decision-making.

Strengths and limitations

This meta-analysis has several strengths, including a comprehensive literature search, robust methodology, and subgroup analyses that explored potential sources of heterogeneity. The inclusion of studies with high-quality NOS scores (≥ 7) enhances the credibility of the findings, while sensitivity analyses demonstrated the stability of the pooled prevalence estimates. The analysis also addressed potential publication bias using the trim-and-fill method, which confirmed that the adjusted pooled prevalence remained consistent with the primary estimate.

However, certain limitations should be acknowledged. Firstly, a key limitation of this meta-analysis is the inclusion of studies with various underlying pathologies, such as rectal cancer, colorectal cancer, and inflammatory bowel disease. While this broad approach provides a comprehensive view of SOO, it introduces heterogeneity due to differences in surgical techniques, anatomical variations, and postoperative outcomes. Focusing on a single pathology could have reduced this heterogeneity but would limit the generalizability of the findings. We deliberately included multiple pathologies to enhance the applicability of our results to a wider range of patients, reflecting real-world clinical practice. Despite the heterogeneity, sensitivity analyses showed that it had minimal impact on the pooled estimates, suggesting the robustness of the findings. However, future studies focusing on specific pathologies could provide more precise risk stratification for SOO and lead to more tailored clinical interventions. Secondly, the retrospective nature of most included studies precludes causal inferences between risk factors and SOO. Thirdly, the presence of publication bias, as indicated by funnel plot asymmetry and Egger's test, suggests that smaller studies with negative findings may be underrepresented in the analysis. Finally, most studies were conducted in Japan, potentially limiting the applicability of the findings to other healthcare settings.

Conclusions

SOO is a prevalent complication following colorectal surgery with diverting ileostomy, with significant risk factors including HOS, increased rectus abdominis muscle thickness, and laparoscopic surgical approach. These findings highlight the importance of individualized patient assessment, meticulous surgical planning, and vigilant postoperative management to mitigate the risk of SOO. Future research should focus on validating these risk factors and developing targeted interventions to improve patient outcomes.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00384-025-04862-5.

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Author contributions GJX, LHP, and CK were instrumental in the conception and design of the study. GJX, LHP, and CK were responsible for organizing the database. Statistical analyses were carried out by GJX, LHP, and CK, who also drafted the manuscript and assisted in interpreting the data and further enriched the study with their additional suggestions. The manuscript was thoroughly revised and finalized by CK. All authors have read and agreed to the published version of the manuscript.

Data availability No datasets were generated or analysed during the current study.

Declarations

Institutional review board statement Not applicable.

Consent to participate Not applicable.

Competing interests The authors declare no competing interests.

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