

Self-expanding metallic stent as a bridge to surgery versus emergency resection for obstructing colorectal cancer: an overlap-weighted single-centre cohort study of definitive operative outcome

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Abstract

Background

Stenting as a bridge to surgery reduces stoma formation, but how often it allows the whole definitive operation to go well is less clear. We compared this probability after stenting and after emergency resection.

Methods

This single-centre retrospective cohort included patients with obstructing colorectal adenocarcinoma who underwent resection of the primary tumour between January 2020 and April 2026 after self-expanding metallic stent placement (SEMS-BTS) or emergency surgery (ES). Favourable definitive surgery was defined as laparoscopic resection without a stoma and without a Clavien–Dindo grade II or higher complication. Overlap weighting was based on pretreatment variables, with bootstrap confidence intervals.

Results

Sixty patients were analysed (36 SEMS-BTS, 24 ES). Favourable definitive surgery occurred in 21/36 (58.3%) and 8/24 (33.3%) patients, respectively; the weighted risk difference was 28.1 (95% CI 1.2 to 54.4) percentage points. The weighted risk difference was 31.4 (95% CI 4.2 to 56.3) for stoma avoidance, 23.8 (95% CI -1.2 to 50.2) for laparoscopic resection and -16.8 (95% CI -39.9 to 4.7) for Clavien–Dindo grade II or higher complications. Two stented patients (5.6%) had a perforation. Adding smoking, alcohol use and previous malignancy to the model attenuated the composite difference to 21.6 (95% CI -5.2 to 50.3).

Conclusions

Among patients who underwent resection of the primary tumour, a stent-first strategy was associated with more laparoscopic, stoma-free operations without significant morbidity, but the estimate was imprecise and sensitive to adjustment. Confirmation is needed in cohorts that include all patients presenting with obstruction.

Introduction

A substantial proportion of patients with colorectal cancer first present with large-bowel obstruction, and many of them need a treatment decision within hours [1]. Emergency resection relieves the obstruction and removes the tumour in one operation, but it is often performed open, in a dilated and oedematous bowel, and ends with a stoma more frequently than elective surgery [1, 2]. Placement of a self-expanding

metallic stent (SEMS) offers an alternative: the colon is decompressed endoscopically and the cancer is resected electively once the patient has recovered. European guidance now suggests that stenting as a bridge to surgery be discussed as an option for potentially curable left-sided obstruction, while acknowledging the risk of stent-related perforation [1].

Meta-analyses of randomised trials have shown that bridging with a stent reduces stoma formation and increases the use of primary anastomosis [3, 4]. The UK CReST trial, for example, found fewer stomas after stenting without a difference in 30-day mortality [2]. Not all trials have been favourable: an earlier Dutch multicentre trial was stopped early because of excess morbidity, largely stent-related perforation [5]. Concerns about long-term oncological safety remain, mainly because of perforation and possible tumour dissemination [4, 6].

These end-points are usually reported one at a time. For a patient and surgeon, however, what matters is whether the definitive operation as a whole goes well: whether it can be done laparoscopically, whether bowel continuity can be restored without a stoma, and whether the patient recovers without a significant complication. These outcomes are correlated, and an improvement in one may be offset by another. We therefore defined a single composite outcome, favourable definitive surgery, and compared its probability after a stent-first strategy and after emergency resection. To mimic the decision at presentation, adjustment was restricted to variables available before treatment, and overlap weighting was used to focus inference on patients in whom either strategy was a realistic choice [7, 8, 9].

Materials and methods

Study design and patients

This was a retrospective cohort study at the Department of Gastrointestinal Surgery, Zhuhai People's Hospital, Zhuhai, China. We identified adults with histologically confirmed colorectal adenocarcinoma presenting with acute or subacute large-bowel obstruction who underwent resection of the primary tumour between January 2020 and April 2026. Patients were managed either with SEMS placement followed by elective resection (SEMS-BTS) or with emergency resection without a stent (ES). Patients whose records documented no obstruction at presentation, or in whom obstruction developed during chemotherapy for known disease, were excluded from the primary analysis because they did not meet the definition of a first presentation with malignant obstruction. Tumour site was not an inclusion criterion and was not recorded systematically in the dataset. The study is reported in accordance with the STROBE statement [10].

The study was approved by the Ethics Committee of Zhuhai People's Hospital (approval No. (2026) Ethics Review [Research] 81, 23 July 2026). Because of the retrospective design, the committee waived the requirement for individual informed consent.

Treatment strategies

In the SEMS-BTS group, stents were placed endoscopically under fluoroscopic guidance, and elective oncological resection was scheduled after clinical recovery. In the ES group, the tumour was resected without prior stenting during the admission for obstruction. According to the case records, six of these patients had incomplete obstruction, four had an initial period of conservative management (in one of whom the obstruction resolved before surgery) and in one an attempt at decompression-tube placement had failed. The operative approach and the decision to form a stoma were made by the operating surgeons. Patients in whom stent placement did not relieve the obstruction remained in the SEMS-BTS group for all analyses.

Outcomes

The primary outcome was favourable definitive surgery, defined as the combination of laparoscopic resection, no stoma at the index operation and no postoperative complication of Clavien–Dindo grade II or higher [11]. In the dataset, absence of a complication and a grade I complication were not distinguished; this does not affect the primary outcome, which uses grade II as the threshold. The operative approach was recorded as laparoscopic or open; conversion from laparoscopic to open surgery was not recorded separately. Because the dataset recorded stoma formation but not the type of anastomosis, stoma avoidance was used as the bowel-continuity component; it is reported as such and is not equated with primary anastomosis.

Secondary outcomes were the individual components, postoperative length of stay, number of lymph nodes retrieved, retrieval of at least 16 nodes, operative time, estimated blood loss, time to first flatus and time to semi-liquid diet. In the SEMS-BTS group, the recorded clinical success or failure of the stent and stent-related perforation were described.

Covariates

The primary propensity model included five variables determined before the treatment decision: age, sex, body mass index (BMI), previous abdominal surgery and the presence of any medical comorbidity. Smoking, alcohol use and history of other malignancy were also recorded and were added in a sensitivity analysis; they were not included in the primary model to limit overfitting with 60 patients. Pathological T and N category were not used for adjustment because they are measured after treatment and may themselves be influenced by the strategy. Height and weight were not recorded for two patients in the ES group, who were wheelchair users; their BMI was imputed with the cohort median for the propensity model only.

Statistical analysis

Propensity scores were estimated with logistic regression after standardising continuous covariates. Overlap weights were assigned as one minus the propensity score for SEMS-BTS patients and the

propensity score for ES patients [7, 9]. These weights give most influence to patients with propensity scores near 0.5, in whom treatment choice was least predictable, and avoid the extreme weights that can arise with inverse probability weighting in small samples. Covariate balance was assessed with absolute standardised mean differences, with values below 0.10 regarded as adequate.

Weighted proportions and means were compared as risk differences and mean differences. For the primary outcome, the weighted risk ratio was also calculated. Ninety-five per cent confidence intervals were obtained from 2000 non-parametric bootstrap resamples at the patient level, re-estimating the propensity model and weights in each resample. The E-value was calculated to describe the minimum strength of association, on the risk ratio scale, that an unmeasured confounder would need with both treatment and outcome to explain away the observed association [12]. Two sensitivity analyses were performed. In the first, the propensity model was extended to include smoking, alcohol use and history of other malignancy. In the second, the two excluded patients were added back and all analyses were repeated in the full cohort of 62 patients.

The composite outcome and the overlap-weighted analysis were defined during re-analysis of an existing dataset and were not registered in advance. With the small sample, the analysis was intended to estimate effect sizes rather than to test multiple hypotheses, and no correction for multiplicity was applied to secondary outcomes. Analyses were performed in Python (version 3.13); the logistic model was fitted by maximum likelihood with NumPy, and data handling used pandas.

Results

Patients

Sixty-two patients met the initial criteria. Two patients in the ES group were excluded from the primary analysis, one with no obstruction recorded and one in whom obstruction developed during chemotherapy, leaving 60 patients: 36 in the SEMS-BTS group and 24 in the ES group (Fig. 1). Baseline characteristics are shown in Table 1. Median age was similar in the two groups. Before weighting, the SEMS-BTS group contained more men and fewer patients with previous abdominal surgery, and had a lower BMI, with standardised differences of 0.48, 0.37 and 0.42, respectively. Smoking was also more common in the SEMS-BTS group. Propensity score distributions overlapped across most of their range, and overlap weighting balanced all five covariates exactly (Fig. 2). The effective sample size after weighting was 49.4.

Table 1
Baseline characteristics of the primary analysis cohort

Characteristic	SEMS-BTS (n = 36)	ES (n = 24)
Age, years	68.5 (64.0–73.8)	69.5 (58.5–78.3)
Male sex	25 (69.4)	11 (45.8)
BMI, kg/m ²	21.3 (20.2–23.0)	22.4 (20.8–24.5)
BMI not recorded	0	2
Previous abdominal surgery	5 (13.9)	7 (29.2)
Any medical comorbidity	17 (47.2)	12 (50.0)
History of other malignancy	1 (2.8)	2 (8.3)
Current or former smoker	14 (38.9)	5 (20.8)
Alcohol use	6 (16.7)	5 (20.8)
Pathological stage III–IV*	24 (66.7)	13 (54.2)
Distant metastasis (pM1)*	7 (19.4)	3 (12.5)
Values are median (interquartile range) or n (%). BMI, body mass index; ES, emergency surgery; SEMS-BTS, self-expanding metallic stent as a bridge to surgery. *Pathological stage and metastasis are shown for description only and was not used for adjustment because it is determined after treatment.		

Primary outcome

Favourable definitive surgery was achieved in 21/36 (58.3%) patients after SEMS-BTS and 8/24 (33.3%) after ES. The weighted probabilities were 62.3% and 34.2%, a risk difference of 28.1 percentage points (95% CI 1.2 to 54.4) and a risk ratio of 1.82 (95% CI 1.01 to 4.16) (Table 2; Fig. 3a). The E-value for the point estimate was 3.05, and for the lower confidence limit 1.13.

Table 2
Surgical outcomes and overlap-weighted treatment effects

Outcome	SEMS-BTS (n = 36)	ES (n = 24)	Weighted effect (95% CI)
Binary outcomes (risk difference, percentage points)			
Favourable definitive surgery	21/36 (58.3%)	8/24 (33.3%)	28.1 (1.2 to 54.4)
Laparoscopic resection	30/36 (83.3%)	14/24 (58.3%)	23.8 (-1.2 to 50.2)
No stoma at index operation	29/36 (80.6%)	12/24 (50.0%)	31.4 (4.2 to 56.3)
Clavien–Dindo grade $\geq$ II	6/36 (16.7%)	8/24 (33.3%)	-16.8 (-39.9 to 4.7)
$\geq$ 16 lymph nodes retrieved	30/36 (83.3%)	17/24 (70.8%)	14.1 (-9.5 to 38.2)
Continuous outcomes (mean difference)			
Postoperative stay, days	9.0 (7.0–12.5)	12.0 (9.0–17.5)	-3.1 (-6.5 to 0.3)
Lymph nodes retrieved	26.0 (18.8–38.3)	24.0 (15.0–30.3)	4.0 (-1.8 to 9.9)
Operative time, min	200.0 (180.0–225.0)	207.5 (157.5–274.3)	0.1 (-38.3 to 36.6)
Estimated blood loss, mL	20.0 (20.0–62.5)	20.0 (20.0–62.5)	2.7 (-50.2 to 51.5)
Time to first flatus, days	3.0 (2.0–5.0)	4.0 (3.0–5.5)	-1.0 (-2.9 to 0.6)
Time to semi-liquid diet, days	5.0 (3.0–6.3)	5.0 (4.0–6.5)	-0.9 (-3.0 to 0.9)
Group values are n (%) or median (interquartile range); time to flatus and to semi-liquid diet were missing for one ES patient. Weighted effects are SEMS-BTS minus ES in the overlap-weighted population, with 95% confidence intervals from 2000 bootstrap resamples. Favourable definitive surgery: laparoscopic resection, no stoma at the index operation and no Clavien–Dindo grade II or higher complication. ES, emergency surgery; SEMS-BTS, self-expanding metallic stent as a bridge to surgery.			

Components and secondary outcomes

No stoma was formed at the index operation in 29/36 (80.6%) patients after SEMS-BTS and 12/24 (50.0%) after ES (weighted risk difference 31.4 percentage points (95% CI 4.2 to 56.3)). Resection was performed laparoscopically in 30/36 (83.3%) and 14/24 (58.3%) patients, respectively (23.8 percentage points (95% CI -1.2 to 50.2)). Clavien–Dindo grade II or higher complications occurred in 6/36 (16.7%) and 8/24 (33.3%) patients (-16.8 percentage points (95% CI -39.9 to 4.7)). In the SEMS-BTS group these comprised four grade II, one grade III and one grade IV complication; all eight in the ES group were grade II.

Median postoperative stay was 9 days after SEMS-BTS and 12 days after ES (weighted mean difference – 3.1 days (95% CI -6.5 to 0.3)). The median number of lymph nodes retrieved was 26 and 24, respectively (weighted mean difference 4.0 (95% CI -1.8 to 9.9)), and at least 16 nodes were retrieved in 30 of 36 and 17 of 24 patients (Fig. 3b). Operative time, blood loss, time to flatus and time to semi-liquid diet did not differ materially between groups (Table 2).

Stent outcomes

Among the 36 patients who received a stent, clinical success was recorded in 33 (91.7%; 95% CI 77.5% to 98.2%) and clinical failure in three (8.3%); all proceeded to resection. Two patients (5.6%; 95% CI 0.7% to 18.7%) had a stent-related perforation, both among those with clinical failure (Fig. 3c).

Sensitivity analyses

When smoking, alcohol use and history of other malignancy were added to the propensity model (effective sample size 43.4), the weighted risk difference for favourable definitive surgery was 21.6 percentage points (95% CI -5.2 to 50.3) (Fig. 3d). The corresponding differences were 26.3 percentage points (95% CI -6.7 to 53.6) for stoma avoidance, 20.4 percentage points (95% CI -6.6 to 48.5) for laparoscopic resection and – 13.7 percentage points (95% CI -40.7 to 8.7) for Clavien–Dindo grade II or higher complications.

When the two excluded patients were included (36 SEMS-BTS, 26 ES), favourable definitive surgery occurred in 21 of 36 and 9 of 26 patients. The weighted risk difference was 27.5 percentage points (95% CI 1.0 to 50.1) and the risk ratio was 1.81 (95% CI 1.08 to 3.70). Estimates for the components were similar to those of the primary analysis.

Discussion

In this cohort of patients who underwent resection of the primary tumour for obstructing colorectal cancer, a stent-first strategy was associated with a higher probability of a favourable definitive operation, meaning a laparoscopic resection without a stoma and without a Clavien–Dindo grade II or higher complication. The adjusted absolute difference was about 28 percentage points. The largest component difference was in stoma avoidance; the differences in laparoscopic resection and in complications pointed in the same direction but were imprecise. When smoking, alcohol use and previous malignancy were also adjusted for, the difference fell to about 22 percentage points and the confidence interval included zero, so the size of the association should be interpreted with caution.

The direction of these findings agrees with randomised and pooled evidence showing fewer stomas and more primary anastomoses after stent bridging [2, 3, 4]. The present analysis expresses the difference as a single outcome that is intended to reflect how surgeons and patients judge an operation. A composite of this kind shows how often the whole intended pathway is achieved, rather than reporting three correlated results separately. In this series it was achieved in fewer than two-thirds of patients even after stenting, which may help when counselling patients.

Two features of the analysis are relevant. First, adjustment was limited to variables available when the treatment decision is made. Pathological stage is measured after resection and may itself be affected by the treatment pathway; adjusting for it would not reproduce the decision faced at presentation and can bias the comparison [8, 13]. Second, overlap weighting restricts inference to patients for whom either strategy was plausible. In a small sample this gives more stable estimates than inverse probability weighting, and it achieves exact balance on the covariates in the model [7, 9].

Any advantage has to be weighed against the risks of stenting. Two of 36 patients had a stent-related perforation, and three needed surgery because the stent did not relieve the obstruction. Perforation has been associated with higher recurrence rates in earlier trial data [4, 6], and long-term outcomes could not be assessed here. The stent-first strategy is therefore best regarded as a way of improving the conditions for definitive surgery in selected patients, provided that endoscopic expertise is available and the risk of perforation is discussed with the patient.

The study has several limitations. Only patients who underwent resection of the primary tumour were included. Patients in whom a stent failed and who were then managed palliatively, or who died before surgery, would not appear in this cohort, so the results apply to patients who reach resection rather than to all patients presenting with obstruction. The sample is small and from a single centre, and the confidence intervals are correspondingly wide. The primary model included five pretreatment covariates, and adding three more weakened the estimate. Tumour site, physiological severity, ASA grade and the degree of colonic dilatation were not available. The E-value for the lower confidence limit was close to 1, so a modest unmeasured confounder could account for the lower end of the estimated effect. The composite outcome was defined during re-analysis rather than in advance, and stoma avoidance was used in place of a direct record of anastomosis. The study period spans more than 6 years, during which practice may have changed. The interval between stent placement and surgery was not available. Finally, recurrence and survival data were not available.

A multicentre study is now needed that starts from all patients presenting with malignant obstruction, takes the date of presentation as time zero and records the reasons for choosing each strategy, tumour location, imaging findings and long-term oncological outcomes.

In conclusion, among patients with obstructing colorectal cancer who underwent resection of the primary tumour, a stent-first strategy was associated with a higher probability of a laparoscopic, stoma-free operation without significant morbidity. The estimate is imprecise and sensitive to the choice of covariates, so it should inform shared decision-making rather than be taken as evidence that stenting is superior.

Declarations

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Author contributions

Liusheng Che: investigation, data curation, clinical validation, methodology, writing – original draft, writing – review and editing. Kun Liao: investigation, data curation, clinical validation, writing – review and editing. Huiying Zhu: conceptualisation, methodology, formal analysis, visualisation, writing – original draft, writing – review and editing. Cong Hu: conceptualisation, supervision, resources, investigation, validation, writing – review and editing. Qiliang Wang: methodology, validation, formal analysis, supervision, writing – review and editing. All authors approved the final manuscript.

Ethical approval

The study was approved by the Ethics Committee of Zhuhai People's Hospital (approval No. (2026) Ethics Review [Research] 81, 23 July 2026). The requirement for individual informed consent was waived because of the retrospective design.

Data availability statement

The patient-level data are not publicly available because they contain sensitive clinical information. De-identified data supporting the findings may be made available to qualified researchers on reasonable request, subject to approval by Zhuhai People's Hospital.

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Disclosures

Huiying Zhu is affiliated with and holds equity in Zhuhai Hengqin AllStar Medical Technology Ltd.; the company had no role in patient selection, data collection or clinical care. Liusheng Che, Kun Liao, Cong Hu and Qiliang Wang have no conflicts of interest or financial ties to disclose. This work was funded by the Zhuhai Hengqin Frontier Technology Application Scenario Project (grant 2530004025998).

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Figures

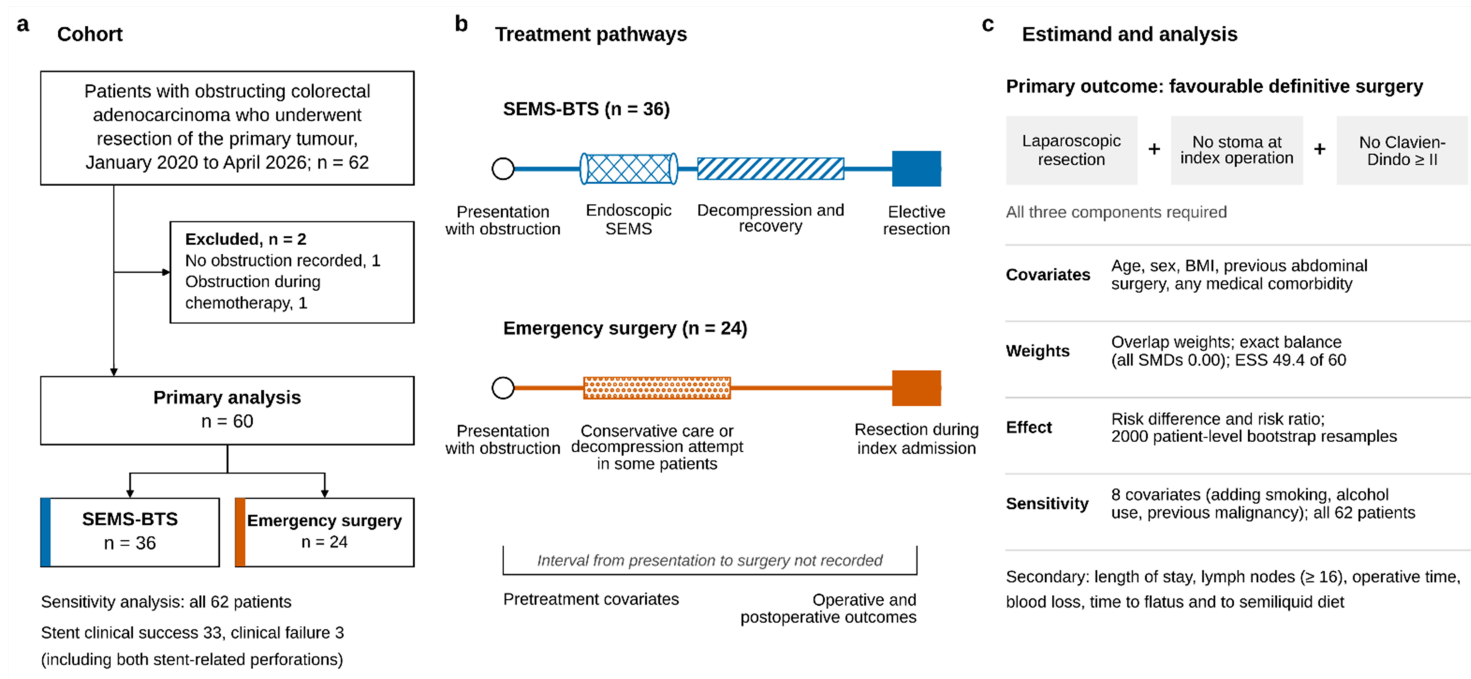


Figure 1

Study design. (a) Cohort and patient flow; both excluded patients were in the ES group. (b) Treatment pathways; in the ES group, some patients had an initial period of conservative management or an attempt at decompression before resection. (c) Primary outcome, covariates, weighting and sensitivity analyses. BMI, body mass index; ES, emergency surgery; ESS, effective sample size; SEMS-BTS, self-expanding metallic stent as a bridge to surgery; SMD, standardised mean difference.

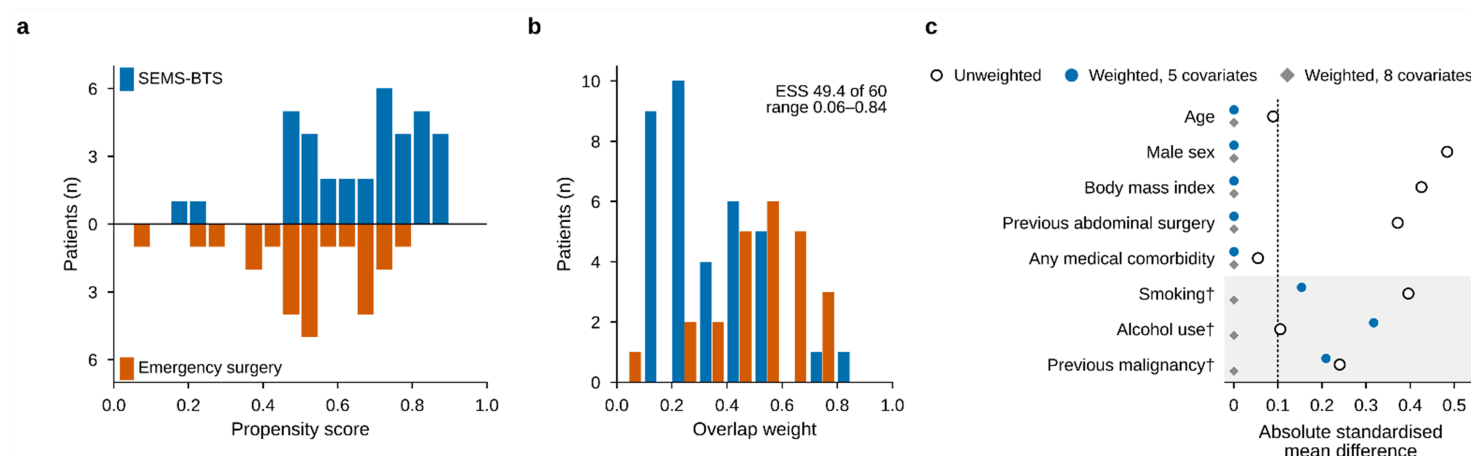


Figure 2

Propensity score overlap, overlap weights and covariate balance. (a) Distribution of propensity scores in the two groups (mirrored histogram). (b) Distribution of overlap weights. (c) Absolute standardised mean differences before weighting, after overlap weighting with the five primary covariates and after weighting with eight covariates; markers are offset vertically for legibility, and shaded rows (†) indicate covariates

not included in the primary model. The dashed line marks 0.10. ES, emergency surgery; ESS, effective sample size; SEMS-BTS, self-expanding metallic stent as a bridge to surgery.

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Figure 3

Primary outcome, lymph-node yield and stent outcomes. (a) Overlap-weighted proportions of favourable definitive surgery and its components; complications are shown as the proportion without a Clavien–Dindo grade II or higher complication. (b) Lymph nodes retrieved per patient (points, horizontally jittered) with median and interquartile range (boxes); the dashed line marks 16 nodes, and the weighted mean difference (MD) is shown with its 95% confidence interval. (c) Stent outcomes in the 36 patients who received a stent; each square represents one patient, and confidence intervals for proportions are exact. (d) Weighted risk difference (RD) for favourable definitive surgery in the primary analysis and two sensitivity analyses; the diamond marks the primary analysis and horizontal lines 95% bootstrap confidence intervals. ES, emergency surgery; ESS, effective sample size; SEMS-BTS, self-expanding metallic stent as a bridge to surgery.