

# Short-term outcomes after self-expandable metal stent insertion for obstructing colon cancer: a retrospective cohort study

Khayal Abdulmalik Alkhayal,<sup>a</sup> Sulaiman Abdullah Alshammari,<sup>a</sup> Ahmed Mohammed Al-Mazrou,<sup>a</sup> Majid Abdulrahman Almadi,<sup>b</sup> Omar Abdullah Al-Obeed,<sup>a</sup> Ahmad Mohammed Zubaidi,<sup>a</sup> Thamer Abdullah Bin Traiki,<sup>a</sup> Noura Sufyan Alhassan<sup>a</sup>

From the <sup>a</sup>Department of Surgery/General Surgery, King Saud University, Riyadh, Saudi Arabia; <sup>b</sup>Department of Internal Medicine/Gastroenterology, King Saud University, Riyadh, Saudi Arabia

**Correspondence:** Dr. Sulaiman Abdullah Alshammari · Department of Surgery/General Surgery, King Saud University, Riyadh 11451, Saudi Arabia · dr.sulimaan@gmail.com · ORCID: <https://orcid.org/0000-0002-0605-5489>

**Citation:** Alkhayal KA, Alshammari SA, Al-Mazrou AM, Almadi MA, AlObeed OA, Zubaidi AM, et al. Short-term outcomes after self-expandable metal stent insertion for obstructing colon cancer: a retrospective cohort study. *Ann Saudi Med* 2020; 40(5): 403-407. DOI: 10.5144/0256-4947.2020.403.

**Received:** July 4, 2020

**Accepted:** September 14, 2020

**Published:** October 1, 2020

**Copyright:** Copyright © 2020, Annals of Saudi Medicine, Saudi Arabia. This is an open access article under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND). The details of which can be accessed at <http://creativecommons.org/licenses/by-nc-nd/4.0/>

**Funding:** None.

**BACKGROUND:** Self-expanding metal stents (SEMS) are used as a bridge to surgery for colon cancer patients as an alternative to emergency surgery. Currently, there is a paucity of literature from Saudi Arabia on the preoperative usage of SEMS.

**OBJECTIVES:** Determine whether SEMS are associated with a higher rate of complications.

**DESIGN:** Retrospective cohort study

**SETTINGS:** Tertiary care hospital in Saudi Arabia.

**PATIENTS AND METHODS:** In patients diagnosed with obstructing colon cancer, up-front surgical resection was compared with insertion of SEMS followed by surgical resection between the years 2009 and 2013.

**MAIN OUTCOME MEASURES:** Rate of stent-related short-term complications. Secondary endpoint, postoperative complications.

**SAMPLE SIZE:** 65.

**RESULTS:** Twenty-four (36.9%) patients underwent SEMS placement; 41 (63.1%) underwent primary surgery. The median (interquartile range) hospital stay was significantly higher among the SEMS group (13 [8.5] days versus 7 [3] days in the primary surgery group,  $P < .001$ ). Five patients (20.8%) in the SEMS group developed complications: 2 (8.3%) perforations, 2 (8.3%) obstructions, and 1 (4.2%) stent migrations.

**CONCLUSION:** SEMS is associated with longer hospital stays and short-term serious complications. Further research should be conducted, preferably with a larger sample size.

**LIMITATIONS:** Retrospective design, small sample size.

**CONFLICT OF INTEREST:** None.

In the early 1990s, self-expanding metal stents (SEMS) were inserted for palliative purposes only in inoperable cases of malignant colon obstruction.<sup>1</sup> With advancements in technology, SEMS are now used as a bridge to curative surgery.<sup>2</sup> However, concerns about using SEMS were raised since there are serious complications associated with their usage that affect survival.<sup>3</sup> Various studies report complications of SEMS, namely perforation (4.5%), migration (11%), and obstruction (12%).<sup>4</sup> SEMS usage, however, is associated with a lower probability of stoma creation.<sup>5</sup> There are no studies from Saudi Arabia about SEMS usage in obstructing colon cancer. This study aims to evaluate the rate of complications associated with SEMS usage.

### PATIENTS AND METHODS

A retrospective chart review was conducted at King Khalid University Hospital in Riyadh, Saudi Arabia. From 2009 to 2013, a cohort of patients were diagnosed with obstructed colon cancer and underwent SEMS insertion then surgery, while the rest underwent up-front primary surgery. All procedures were done by either certified colorectal surgeons or acute care/general surgeons. Laparoscopy could not be offered most of the time if the patients had a distended bowel. All the patients underwent computed tomography prior to SEMS insertion or surgery. Patients who had cecal or rectal cancer causing obstruction were excluded. The data collected included demographics, pre-existing comorbidities, site of tumor, cancer stage, histopathology, stent complications, and surgical technique. Only colorectal surgeons performed laparoscopy resections. In addition, postoperative

complications were also assessed, including surgical site infection, intensive care unit admissions, and median length of hospital stay. This study was approved by the Institutional Review Board/Ethics Committee.

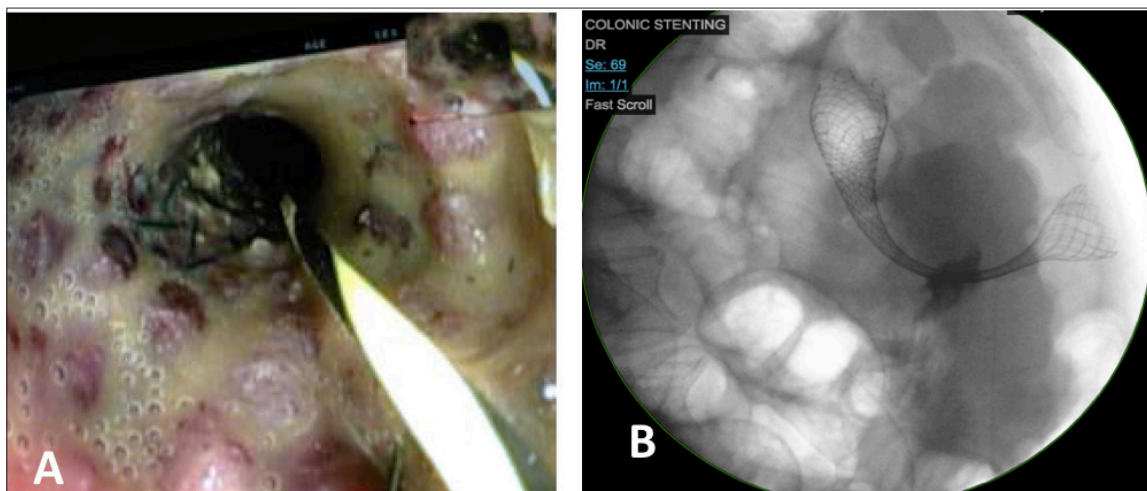
### Procedure of SEMS Insertion

For all the patients, gastroenterologists performed the endoscopic insertions of SEMS. Insertion was guided by fluoroscopy with the use of a guide wire. Uncovered (WallFlex) colonic stents 22 mm in diameter and 60 or 90 mm in length were used (**Figure 1**). The colon was prepared with a water-soluble enema prior to the procedure. The patients' vital signs and clinical conditions were monitored prior to, during, and after the procedure. Any adverse events were recorded and addressed.

The data was analyzed using IBM SPSS software version 25 (Armonk NY). The qualitative variables, such as gender, comorbidities, type of surgical approach, and postoperative complications, were reported as frequency (n) and percentage (%) and assessed by chi-square or Fisher exact tests, as appropriate. However, the quantitative variables, such as age, length of hospital stay, and total lymph nodes retrieved, were reported as mean and standard deviation or median (interquartile range), as appropriate, and they were assessed by independent t tests or Mann-Whitney U tests, as appropriate. A *P* value of <.05 was considered significant.

### RESULTS

Of the 65 patients, 24 (36.9%) underwent SEMS placement; 41 (63.1%) underwent primary surgery (**Table 1**). The median (IQR, range) between stent placement



**Figure 1.** (A) Endoscopic stent placement over guide wire. (B) Post-stent placement fluoroscopy

and surgery was 3.0 (1, 1-5). All patients underwent curative surgical resections. **Table 2** shows a significantly higher number of the patients (11 [45.8%]) who underwent SEMS had a laparoscopic surgical approach, whereas only 9 patients (22%) out of those who underwent primary surgery required a laparoscopic surgical approach ( $P=.004$ ). Also, all laparoscopic procedures were performed by colorectal surgeons, and most open-approach cases were done by acute care surgeons and general surgeons.

Seven cases were understaged due to inadequate lymph node sampling: 3 in the primary surgery group and 4 in the SEMS group (**Table 3**). The median total length of hospital stay was significantly higher—median 13.5 days (IQR 8.5)—among patients with SEMS, as compared to those who underwent only primary surgery—7 days (IQR 3) ( $P=.01$ ). Of the total number of patients in the study, 57 (87.7%) were followed over 24 months; the rest were lost to follow-up after 6 months. Presumably, they sought chemotherapy treatment at other healthcare facilities.

No significant difference was observed between the groups in postoperative adverse events (Table 4). Clavien-Dindo classification was used to assess the extent of severity in each group.<sup>6</sup> We observed that out of the 24 patients in the SEMS group, 5 (20.8%) had stent-related complications, which included 2 (8.3%) perforations, 2 (8.3%) with obstructions, and 1 (4.2%) with stent migration. There was no incidence of failed insertion. Both patients who had stent-related perforations had to be admitted to the intensive care unit.

## DISCUSSION

In our study, a laparoscopic surgical approach was performed more frequently in the stent group when the obstruction was relieved. Acute care and general surgeons generally handled patients who were not stented because most of the open surgeries were done during on-call time by acute care surgery and general surgery. In contrast, certified colorectal surgeons did most of the SEMS group procedures and also performed all laparoscopic procedures. Our findings are comparable with the studies conducted by Law et al<sup>7</sup> and Seung et al<sup>8</sup> where surgery is electively planned after SEMS usage. In such reports, laparoscopy was the preferred surgical technique. Furthermore, another study suggests that if decompression by SEMS placement is insufficient, minimally invasive surgery is difficult.<sup>9</sup>

There was no significant difference in postoperative surgical complications in patients with preoperative stent placement as compared to those who had

**Table 1.** Baseline characteristics stratified by management pathway (surgery only vs. stent followed by surgery).

Variable	Primary surgery (n=41) (63.1)	SEMS (n=24) (36.9)	P value
Age (years)	55.5 (13.5)	59.5 (11.3)	.2
<b>Gender</b>			.1
Male	14 (34.1)	14 (58.3)	
Female	27 (65.9)	10 (41.7)	
Cardiovascular disease	6 (14.6)	4 (16.7)	.8
Renal disease	1 (2.4)	3 (12.5)	.1
Stroke	2 (4.9)	2 (8.3)	.6
Diabetes	13 (31.7)	9 (37.5)	.6
Hypertension	17 (41.5)	8 (33.3)	.5
<b>Site of tumor</b>			.9
Right colon	4 (9.8)	1 (4.2)	
Transverse colon	3 (7.3)	2 (8.3)	
Left colon	9 (22.0)	6 (25.0)	
Sigmoid	7 (17.1)	4 (16.7)	
Rectosigmoid	18 (43.9)	11 (45.8)	
<b>Stage</b>			.2
I	2 (4.9)	0 (0)	
II	18 (43.9)	9 (37.5)	
III	18 (43.9)	9 (37.5)	
IV	3 (7.3)	6 (25)	
Perineural / lymphovascular invasion	13 (31.7)	7 (29.2)	.8

Data are number (%) or mean (standard deviation).

**Table 2.** Type of surgical approach by the performing surgeons.

	Approach	Primary surgery	SEMS
Colorectal	Laparoscopic	9 (22%)	11 (45.8%)
	Open	3 (7.3%)	9 (37.5%)
ACS/GS	Laparoscopic	0	0
	Open	29 (70.7%)	4 (16.7%)
Overall	Laparoscopic	9 (22%)	11 (45.8%)
	Open	32 (78%)	13 (54.2%)

Chi-square comparison of primary surgery vs SEMS,  $\chi^2=4.053$ ,  $P=.04$ .

**Table 3.** Intraoperative outcomes, hospital stay, and follow-up duration for surgery only vs. stent followed by surgery.

Variable	Primary surgery (n=41)	SEMS (n=24)	P value
Operative duration (minutes)	190.0 (108, 600)	216.0 (74.1, 96-378)	<.001
Number of patients with ≥12 lymph nodes examined	38 (92.7)	20 (83.3)	
Number of patients with <12 lymph nodes examined	3 (7.3)	4 (16.7)	
Postoperative hospital stay (days)	6.0 (2.0)	5.0 (4.3)	<.001
Total hospital stay (days)	7 (3)	13 (8.5)	<.001

Data are number (%), mean (standard deviation), or median (interquartile range, minimum-maximum). Statistical comparisons by independent t test or Mann whitney U test.

**Table 4.** Postoperative complications and Clavien-Dindo classification.

	Primary surgery (n=41)	SEMS (n=24)	P value
Surgical site infection	2 (4.9)	4 (16.7)	.1
Postoperative ileus	4 (9.8)	0 (0)	.1
UTI	4 (9.8)	1 (4.2)	.4
Pneumonia	1 (2.4)	1 (4.2)	.7
Deep vein thrombosis	0 (0)	2 (8.3)	.1
ICU admission	1 (2.4)	2 (8.3)	.3
Overall complication	12 (29.3)	10 (41.6)	.7
<b>According to Clavien-Dindo classification</b>			
Grade I	4 (9.8)	2 (8.3)	
Grade II	6 (14.6)	6 (25)	
Grade IIIa	1(2.4)	0	
Grade IIIb	0	0	
Grade IVa	1 (2.4)	2 (8.3)	
Grade IVb	0	0	
Grade V	0	0	

Data are number (%).

primary surgery. However, surgical site infection was higher among the SEMS group, 4 (16.7%), versus the primary surgery group, 2 (4.9%). All these complications occurred in the patients who had stent complications (perforation and obstruction) and had to have open surgery. Some reports failed to demonstrate a significant difference in the short-term outcomes between the two groups.<sup>4,10</sup> Other studies revealed that stent placements for colon cancer are associated with reduced overall complications.<sup>11,12</sup> One study reported a significant reduction in intensive care admission, wound infections, abdominal abscesses, and respiratory complications in the stent group.<sup>13</sup>

Another finding of the present study is that the stent group is associated with prolonged total hospitalization compared to the emergency surgery group, whereas the lengths of the postoperative hospital stays were significantly shorter in SEMS group. These results are similar to findings by Yang et al<sup>8</sup> found that since bowel functions recover earlier in the SEMS group, their postoperative hospital stay is shorter. However, Arezzo et al,<sup>5</sup> reported longer total hospital stays in the SEMS group and Kim et al<sup>14</sup> who also reported a week's difference between the average hospital stay of the stent group and the surgery group.<sup>14</sup> The probable reason for inconsistent results is the lack of standardized protocols for inpatient assessment before and after stent placement, clinical cancer staging, and preoperative bowel preparation.

Five patients (20%) who were managed with SEMS insertion developed stent-related complications—perforation, obstruction, and migration—which contributed to prolonged hospital stays. The two stent-related perforations were managed with intensive care unit admission and urgent open exploration. Our perforation rate was 8.3%, which is double the international acceptable rate of 4.5%.<sup>4</sup> This is probably related to our learning curve experience. The obstruction and stent migration cases were managed with open exploration and had no significant postoperative consequences. These factors may have increased the total

hospital stay after colonic stent placement. Moreover, the European Society for Gastrointestinal Endoscopy recommends SEMS placement as a bridge to surgery in malignant colonic obstruction, not as a standard treatment.<sup>15</sup> The present study had limitations. It is retrospective and underpowered, and any significant differences between the two groups of the study could have been erroneously missed due to type 2 statisti-

cal errors. In conclusion, stent insertion was associated with a high rate of serious complications at our center, probably due to an initial learning curve experience.

#### Acknowledgment

*The authors are grateful to the Deanship of Scientific Research, King Saud University for funding through Vice Deanship of Scientific Research Chairs.*

## REFERENCES

1. Tejero E, Mainar A, Fernandez L, Tobío R, De Gregorio MA. New procedure for the treatment of colorectal neoplastic obstructions. *Diseases of the colon & rectum*. 1994;37(11):1158-9.
2. Kim EJ, Han SH, Kim KO, Chung J-W, Park DK, Kwon KA, et al. Stenting as a bridge to surgery for extra-colonic malignancy-induced colorectal obstruction: preliminary experience. *BMC gastroenterology*. 2020;20:1-7.
3. Watt AM, Faragher IG, Griffin TT, Rieger NA, Maddern GJ. Self-expanding metallic stents for relieving malignant colorectal obstruction: a systematic review. *Annals of surgery*. 2007;246(1):24.
4. Ye G-Y, Cui Z, Chen L, Zhong M. Colonic stenting vs. emergent surgery for acute left-sided malignant colonic obstruction: a systematic review and meta-analysis. *World journal of gastroenterology: WJG*. 2012;18(39):5608.
5. Arezzo A, Passera R, Secco GL, Verra M, Bonino MA, Targarona E, et al. Stent as bridge to surgery for left-sided malignant colonic obstruction reduces adverse events and stoma rate compared with emergency surgery: results of a systematic review and meta-analysis of randomized controlled trials. *Gastrointestinal endoscopy*. 2017;86(3):416-26.
6. Clavien PA, Barkun J, de Oliveira ML, Vauthey JN, Dindo D, Schulick RD, et al. The Clavien-Dindo classification of surgical complications: five-year experience. *Ann Surg*. 2009;250:187-196.
7. Law WL, Poon JT, Fan JK, Lo OS. Colorectal resection after stent insertion for obstructing cancer: comparison between open and laparoscopic approaches. *Surgical Laparoscopy Endoscopy & Percutaneous Techniques*. 2013;23(1):29-32.
8. Yang SY, Park YY, Han YD, Cho MS, Hur H, Min BS, et al. Oncologic outcomes of self-expandable metallic stent as a bridge to surgery and safety and feasibility of minimally invasive surgery for acute malignant colonic obstruction. *Annals of surgical oncology*. 2019;26(9):2787-96.
9. Yang C, Wexner SD, Safar B, Jobanputra S, Jin H, Li VK, et al. Conversion in laparoscopic surgery: does intraoperative complication influence outcome? *Surgical endoscopy*. 2009;23(11):2454.
10. Pirllet IA, Slim K, Kwiatkowski F, Michot F, Millat BL. Emergency preoperative stenting versus surgery for acute left-sided malignant colonic obstruction: a multicenter randomized controlled trial. *Surgical endoscopy*. 2011;25(6):1814-21.
11. Zhang Y, Shi J, Shi B, Song C-Y, Xie W-F, Chen Y-X. Self-expanding metallic stent as a bridge to surgery versus emergency surgery for obstructive colorectal cancer: a meta-analysis. *Surgical endoscopy*. 2012;26(1):110-9.
12. Quereshy F, Poon J, Law W. Long-term outcome of stenting as a bridge to surgery for acute left-sided malignant colonic obstruction. *Colorectal Disease*. 2014;16(10):788-93.
13. Gianotti L, Tamini N, Nespoli L, Rota M, Bolzonaro E, Frego R, et al. A prospective evaluation of short-term and long-term results from colonic stenting for palliation or as a bridge to elective operation versus immediate surgery for large-bowel obstruction. *Surgical endoscopy*. 2013;27(3):832-42.
14. Kim HJ, Huh JW, Kang WS, Kim CH, Lim SW, Joo YE, et al. Oncologic safety of stent as bridge to surgery compared to emergency radical surgery for left-sided colorectal cancer obstruction. *Surgical endoscopy*. 2013;27(9):3121-8.
15. Van Hooft JE, Van Halsema EE, Vanbiervliet G, Beets-Tan RG, DeWitt JM, Donnellan F, et al. Self-expandable metal stents for obstructing colonic and extracolonic cancer: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guidelines. *Endoscopy*. 2014;46(11):990-1053.