Short-Term outcomes of stents in obstructive rectal cancer: A systematic review and meta-analysis

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Abstract

**Background:** With acute obstruction due to rectal or recto-sigmoid cancer, the safety and success of deploying self-expandable metal stents has been controversial. The aim of this systematic review was to synthesize the existing evidence on the outcomes and complication rates of stent placement in these patients.

**Methods:** We performed a literature search of PubMed by using appropriate keywords, and manual reference screening of included articles was done. The article screening, data extraction, and quality assessment was done by four independent reviewers. A meta analysis was performed for the main outcome measures: technical and clinical success and complication rates.

**Results:** We identified 962 articles in the search. After applying inclusion and exclusion criteria, we included 32 articles in the meta-analysis. The pooled technical success rate across 26 studies that reported it was 97% [95% confidence interval (CI): 95%-99%] without evidence of significant heterogeneity ($I^2 = 0.0\%, P = 0.84$), and the clinical success rate across 26 studies that reported it was 69% (95% CI: 58%-79%) with evidence of significant heterogeneity ($I^2 = 81.7\%, P < 0.001$). The pooled overall complication rate across the 32 studies was 28% (95% CI: 20%-37%) with evidence of significant heterogeneity ($I^2 = 79.3\%, P < 0.001$).

**Conclusion:** The use of rectal stents in obstructing rectal or recto-sigmoid tumors seems to be technically feasible. A high rate of technical success, however, does not always translate into clinical success. A considerable complication rate is associated with this approach. Randomized controlled trials are needed to compare the outcomes of rectal stent placement with those of surgery.

**Keywords:** Complication, obstruction, rectal cancer, stent
INTRODUCTION

Colorectal cancer (CRC) has a heterogenous presentation as a result of the anatomical and functional differences between the right colon, the left colon, and the rectum. Because of these differences, the management approaches and outcomes vary. Intestinal obstruction in CRC commonly presents with lesions on the left side and in the rectosigmoid junction because of the smaller lumen size compared with the right colon and the fact that stool is well formed at this level.

Emergency surgery on obstructed colon cancer can be challenging, with significant morbidity of up to 49% and mortality rates of up to 16%. Moreover, surgery mostly involves creating a stoma, which has a negative impact on the patient's quality of life and can delay further oncological management. The introduction of self-expandable metallic stents (SEMS) has emerged as a bridge to surgery or palliative treatment for malignant colorectal obstruction. This approach has several advantages over emergency surgery. When used as a bridge to surgery, stenting allows the surgeon to operate on the patient in an elective setting after maximal optimization. It also allows the bowel to decompress and, on relief of the obstruction, to be prepared preoperatively. SEMS increases the chances of the procedure being performed laparoscopically instead of an open surgery, after the obstruction resolves and the bowel has returned to its normal diameter. Stenting thus allows full preoperative staging and treatment with neoadjuvant therapy if indicated.

The insertion of SEMS to treat obstructing rectal cancers is nonetheless problematic because of rectal irritation, which may lead to anal pain, tenesmus, incontinence, and stent migration and perforation. Available guidelines for stents focus mainly on colonic obstruction and lack specific recommendations on SEMS for the rectum. This absence of information can be attributed to the sparse data on rectal stents compared to that for colonic stents.

We aimed in this review to synthesize the existing evidence on the outcomes and complication rates of stent placement in patients who present with rectal or recto-sigmoid obstruction due to primary malignant tumors.

METHODS

The PRISMA guideline was followed in conducting this systematic review. The objectives, methods of analysis, inclusion criteria, and outcomes of primary interest were specified in advance and documented in a protocol registered at the National Committee of Biomedical Ethics (Reference No. 21-18). The protocol was registered and is available for review at PROSPERO/. The registration code is Crd42017069731.

Literature search strategy

We identified studies by searching the electronic database PubMed and by screening reference lists of the included articles, from January 2000 to July 2018. The database was searched by using Medical Subject Headings (MeSH) or their equivalent key words. We performed the search strategy by applying Boolean operators as follows: “rectal cancer” AND “colorectal obstruction” AND “stent.” Synonyms for each search aspect were also used. Study selection was initially based on the title and/or abstract, from which the full texts of relevant articles were further assessed. All potentially relevant studies were retrieved for review, and the references of the included studies were further screened to identify any additional potentially relevant studies.

Studies were included if they reported the rates of (1) technical success, defined as accurate SEMS placement with adequate stricture coverage; (2) clinical success, defined as decompression and relief of obstructive symptoms without further intervention during the hospital stay; and (3) complications, including perforation, tumor overgrowth, migration, severe pain, bleeding, and other complications that were reported to be caused by SEMS placement in the included studies, or relevant raw data that would allow the calculation of these outcomes of SEMS placement in patients who presented with rectal and/or recto-sigmoid obstruction due to a primary malignant tumor.

Four reviewers (HH, RA, SJ, and EA) performed the eligibility assessment for the records in an independent standardized manner. The retrieved articles were divided between two groups, and each article group was screened independently by two of the reviewers. Disparities between reviewers were resolved by discussion with a fifth reviewer (NT). Conference proceedings, reviews, case reports, and non-English articles were excluded.

Data extraction

We developed a data extraction form, pilot tested it on 47 randomly selected studies, and refined it accordingly. Four authors (HH, RA, SJ, and EA) independently extracted the data from the included studies. Two authors independently extracted the data from each half of the articles. Discrepancies between reviewers were discussed,
documented, and resolved by consensus. A fifth author (NT) arbitrated if no resolution was reached.

Information extracted from each study included the following: (1) first author name and year of publication; (2) study design; (3) characteristics of participants (including diagnosis, number of participants, age, gender, and site of obstruction); (4) intention of procedure (palliative or bridge to surgery); (5) study outcomes: technical success rate, clinical success rate, and any recorded complications; (6) need for reoperation and reintervention; (7) length of follow-up; and (8) overall disease-free survival.

Some of the potentially eligible articles had insufficient data, in which case their authors were contacted (291 authors in total); only 5.49% responded by providing sufficient data.

Assessment of study quality
Four reviewers (HH, RA, SJ, and EA) independently assessed the risk of bias in the included studies by using the methodological index for non-randomized studies (MINORS) criteria. Two reviewers independently assessed each half of the studies. Disparities between reviewers were resolved by discussion with a fifth reviewer (NT). MINORS is a validated 12-item instrument designed to assess the methodological quality of non-randomized studies, whether comparative or non-comparative. The 12 items include: the stated aim of the study, inclusion of consecutive patients, prospective collection of data, appropriateness of the end point to the study aim, unbiased evaluation of endpoints, appropriateness of the follow-up period to the major end point, loss to follow-up not exceeding 5%, prospective calculation of the sample size, and four more items specifically for comparative studies (the latter four items were not applicable to our included studies). The MINORS score ranges from 0 to 16.

Statistical analyses
Three outcomes were assessed: (i) technical success rate; (ii) clinical success rate; and (iii) complications rate, which included perforation, tumor overgrowth, migration, severe pain, bleeding, and other complications reported to be caused by SEMS placement in the included studies. The three outcomes were expressed as percentages. In the presence of heterogeneity, random effects models were used, whereas fixed effects were used in its absence. Forest plots were constructed for each outcome. For clinical success rate, summary estimates were presented for all studies combined and then stratified by study size. Studies comprising of a least 50 participants were considered large.

Heterogeneity was assessed with the index of heterogeneity, $I^2$, which is expressed as a percentage and quantifies the proportion of variation among the studies that is attributed to heterogeneity. The lower the number, the less the heterogeneity. All statistically significance tests were two sided, and analyses were conducted by using Stata 12.1 (StataCorp LP, College Station, Texas, USA).

RESULTS

Literature search and study selection
The initial search identified 962 publications, of which 404 studies were excluded based on the title and/or abstract, and 526 more were excluded based on a full-text review. Reasons for exclusion are shown in the flow chart in Figure 1. Thus, 32 studies matched our inclusion criteria and were included in the final analysis. Three studies were published in the United States,[19,21] four in Italy,[22-25] four in the United Kingdom,[26-28] seven in Korea,[13,19,30-33] one in Spain,[36] three in China,[37,39] two in Finland,[40,41] one in Canada,[42] one in Australia,[43] one in Portugal[44] one in South Africa,[45] one in Pakistan,[46] one in Turkey,[47] one in Norway[48] and one in Denmark.[49]

Characteristics of included studies
Descriptive statistics – including number of patients per study, population age, duration of follow-up, and quality assessment score – are reported in Table 1. The original articles included 2487 patients, who had a stent placed for either colonic or rectal obstruction. This systematic review included 811 patients of those 2487 stented patients who had a rectosigmoid or rectal obstruction. Eighteen of the studies were retrospective, as indicated by medical records,[13,19,20,25,26,31,34,37-39,41,44,46-49] and 14 were prospective.[22-24,27-30,32,33,35,36,40,45] Twenty-six studies reported technical and clinical success rates,[20-24,27-30,40,46,48,49] and 32 reported the complication rate.[13,19,49] All included studies were non-comparative. The studies were published between 2000 and 2018. The age of the patients included in the studies ranged from 18 to 97 years.

Quality of the included studies
The quality score of the included studies ranged from 7 to 14, of which 15 studies had a score of 75% or above.[21-24,26,27,30,32,33,35,40,41,43-45] Two studies did not mention an adequate follow-up period to the major endpoint,[37,38] and six studies did not report a loss to follow-up item.[28,31,38,43,44,49] Quality assessment scores are reported in Table 1.

Meta-analyses
The summary estimate of the technical success rate among the 26 studies[20-24,27-30,40,46,48,49] that reported this outcome was 97% [95% confidence interval (CI): 95%-99%] without evidence of significant heterogeneity. Six studies did not report the technical success rate[13,19,25,26,39,47] for patients
with rectal cancer separately [Figure 2]. Subgroup analysis by study quality and sample size did not reveal different results (data not shown).

The clinical success rate among the 26 studies that reported this outcome was 69% (95% CI: 58%-79%) with evidence of considerable heterogeneity ($I^2 = 82.0\%$, $P < 0.001$). Six studies did not report the clinical success rate separately for patients with rectal and rectosigmoid cancer. Heterogeneity remained after stratifying the studies by methodological quality. Studies with a score of 75% (12 out of 16) and higher were considered good quality and lower scores indicated poorer quality. The pooled estimate for the low-quality studies was 79% (95% CI: 70%-87%), $I^2 = 42.8\%$, $P = 0.06$, whereas for high-quality studies, it was 59% (95% CI: 40%-78%), $I^2 = 88.2\%$, $P < 0.001$ (data not shown). Subgroup analysis by sample size reduced heterogeneity. For large sample size studies (>50 patients), the summary estimate was 84% (95% CI: 79%-89%). [23,44,46] For small sample size studies (<50 patients), the summary estimate was 66% (95% CI: 53%-78%) [Figure 3]. The median clinical success rate was 84.3% (13%-100%).

The summary of the overall complication rate among the 32 studies was 28% (95% CI: 20%-37%), with evidence of considerable heterogeneity [Figure 4]. The results remained heterogenous despite stratifying the studies by methodological quality and sample size. The median complication rate was 27% (0%-100%).

Among 811 patients who underwent stenting for primary rectal cancer obstruction, stent reobstruction was the most common reason for clinical failure, occurring in 75 patients (10.50%) and reported in 18 studies. [13,19,21‑24,26‑30,39,41‑44,46,47] followed by stent migration in 67 patients (9.38%) reported in 20 studies. [13,19,21‑24,26‑30,33,34,36,39,43,44,46‑49] Severe persistent pain due to stent placement in 29 patients (4.06%) reported
in 9 studies,\textsuperscript{[13,22,23,26,35,40,41,46,47]} and perforation after stent placement in 21 patients (2.94\%) reported in 10 studies.\textsuperscript{[13,23,25,32,33,39,45,46,48,49]} Thirty-one patients (14.69\%) needed endoscopic reintervention as reported in 11 studies,\textsuperscript{[21,22,26‑28,30,35,36,39,44,48]} and 33 patients (8.31\%) needed surgery after stent failure, reported in 17 studies.\textsuperscript{[25,27,28,30,33,35,38,44,46,48]} There were 83 (53.20\%) stent placements for palliation among 11 studies that reported this outcome,\textsuperscript{[20,27,30,33‑38,40,48]} and 113 (43.29\%) stent replacements were intended as a bridge to surgery among 14 studies that reported this outcome.\textsuperscript{[9,20,27,28,30,33,34,36‑38,44,46,48]}

**DISCUSSION**

SEMS has been used as a bridge to surgery or for palliation in patients with malignant colorectal obstruction. In this review, we synthesized the evidence on the outcomes and complications of stent placement in patients who presented with rectal or recto-sigmoid obstruction due to primary malignant tumors. Despite the reported advantages of SEMS, such as shorter length of hospital stay, fewer postoperative complications, and lower stoma rates, controversy remains regarding its role in rectal and rectosigmoid obstruction.\textsuperscript{[50‑52]} Use of SEMS seems technically less effective for palliative purposes because of the risk of severe complications such as perforation, migration, and post-stent bacteremia associated with SEMS use in the long term.\textsuperscript{[53]} The pooled estimate of the clinical success rate of SEMS in previous studies was significantly lower than that for surgery (93.1\% vs. 99.8\%, \( P = 0.0009 \)), although the rate of total complications was similar between the two groups (34.0\% vs. 38.1\%, \( P = 0.60 \)).\textsuperscript{[9,53]}

Our systematic review and meta-analysis demonstrated that stents in rectal and recto-sigmoid primary tumors have a high technical success rate that does not always translate into clinical success. These findings are in accordance with a previous systematic review by Sebastian et al.\textsuperscript{[9]} that examined the efficacy and safety of SEMS in the setting of obstructed CRC in 1198 patients. These authors reported a median technical success rate for obstructed CRC of 94\% and a median clinical success rate of 91\%.\textsuperscript{[9]} Rectal and rectosigmoid stenting in our study thus compares unfavorably with these numbers; although the technical success rate in our review was very high at 97\%, the clinical success rate was only 69\%. The complication rates were similar for both Sebastian et al’s population and ours, with reobstruction rates of 7.3\% vs. 10.50\%, migration rates of 11.9\% vs. 9.38\%, and perforation rates of 3.7\% vs. 2.94\%, respectively. Among reported perforations in their study, 98\% occurred in stenting at the rectosigmoid junction, most likely related to its tortuosity.
A previous systematic review and meta-analysis compared the outcomes of stenting to treat obstruction of the left colon and rectum with the outcomes of emergent surgery. It showed significantly lower clinical success rate among the stenting group (52.5%) than that for the emergency surgery group (99%). However, the stenting group had a significantly higher primary anastomosis rate compared to that in the emergency surgery group (99% vs. 55%, respectively). In addition, the stenting group had a significantly lower stoma rate (45.3% vs. 62%). However, the rate of permanent stoma and anastomotic leakage was similar for both groups.

In addition to the technical and clinical success rates in SEMS, peri-procedure complications are an important aspect to consider. Our pooled overall complication rate was 28%. Complications included reobstruction, migration, pain, and perforation. It is important to recognize that this high complication rate may have been the result of bias against SEMS because patients who were not candidates for surgery due to malnutrition, poor overall condition, or the presence of contraindications to surgery would not be offered this procedure. They would have done poorly regardless of the type of intervention. A previously reported randomized control trial by Van Hooft et al. randomized patients with left-sided CRC obstruction into surgery and endoscopic treatment groups. In the endoscopic stent group, 8 of 10 patients had one or more stent-related complications vs. 1 of 8 who had postoperative complications in the surgical arm. A high rate of perforations (6 of 10) was noted after endoscopic stent placement that resulted in reoperation and/or mortality in three patients. Perforations are an especially important complication to assess, as they result in both septic complications and oncological outcomes by upstaging the tumor. Other reported adverse effects were stent migration, obstruction, pain, and diarrhea. This trial was prematurely closed, given these results.

To the best of our knowledge, this is the first systematic review and meta-analysis to specifically analyze the short-term outcomes of stenting for obstructive rectal and recto-sigmoid cancers and to summarize the evidence for technical and clinical success and complications. The
This study has several limitations. Our search could have been limited as we only searched PubMed and performed manual reference screening. We reviewed articles in English only. The low response rate from authors contacted to obtain detailed outcomes for rectal and rectosigmoid cancers was another limitation to our study, since some articles could not be included due to insufficient information. Lastly, our results showed high heterogeneity among the pooled estimates of clinical success and complication rates. Subgroup analysis by quality and size of study did not decrease the heterogeneity of the complication rates. Factors that could explain the significant heterogeneity are inclusion of studies that had very high or very low complication rates; variability of defining and reporting of complications; variation in the length of follow-up (maximum success will be achieved 48 hours after stent placement when it is fully deployed); variation of periprocedural adjuvant therapy such as the use of bevacizumab, as it was found to be associated with gastrointestinal perforation\(^{[44,45]}\); variation in the level of experience of the endoscopists and the volume and expertise of the center; and variation in treatment intent (palliative vs. curative). Some of these variables are difficult to control or define. We did not have access to the type of stents placed, which may have contributed to the heterogenous clinical outcomes (covered, not covered, or partially covered). Concerning the quality of the studies themselves, only 15 of the 32 had an acceptable score of 75% or higher per the MINORS criteria. Our systematic review is thus limited by the poor quality of some of the included studies.

**CONCLUSION**

SEMS as treatment for obstructive rectal and rectosigmoid tumors is technically feasible but does not always translate into clinical success. In addition, complication risks associated with this approach are considerable. Because the data are significantly heterogeneous, definitive conclusions cannot be made. Obstructing rectal tumors are a different entity from obstructing colonic tumors; thus, future prospective studies are needed to assess the efficacy and safety of SEMS in the setting of malignant rectal obstruction.

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**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Li F-Y, Lai M-D. Colorectal cancer, one entity or three. J Zhejiang Univ Sci B 2009;10:219-29.
2. Min CK, Kim HO, Lee D, Jung KU, Lee SR, Kim H, et al. Obstructive left colon cancer should be managed by using a subtotal colectomy instead of colonic stenting. Ann Coloproctol 2016;32:215-20.
3. Raahave D. Faecal retention: A common cause in functional bowel disorders, appendicitis and haemorrhoids— with medical and surgical therapy. Dan Med J 2015;62:B5031.
4. Trompetas V. Emergency management of malignant acute left-sided colonic obstruction. Ann R Coll Surg Engl 2008;90:181-6.
5. Tekkis PP, Kinsman R, Thompson MR, Stamatakis JD. The Association of Coloproctology of Great Britain and Ireland study of large bowel obstruction caused by colorectal cancer. Ann Surg 2004;240:76-81.
6. Meyer F, Marusch F, Koch A, Meyer L, Fuhrer S, Kocherling F, et al. Emergency operation in carcinomas of the left colon: Value of Hartmann's procedure. Tech Coloproctol 2004;8(Suppl 1):s226-9.
7. Perez D, Turgeano F, Calvo S, Tomas-Palacios JD, Fuemayor-Valera ML, Hernández Edel V, et al. Emergency subtotal colectomy as treatment of choice in obstructing carcinomas of the left colon. Colorectal Dis 1999;1:13-8.
8. Herrle F, Sandra-Petrescu F, Weiss C, Post S, Runkel N, Kienle P. Quality of life and timing of stoma closure in patients with rectal cancer undergoing low anterior resection with diverting stoma: A multicenter longitudinal observational study. Dis Colon Rectum 2016;59:281-90.
9. Sebastian S, Johnston S, Geoghegan T, Torreggiani W, Buckley M. Pooled analysis of the efficacy and safety of self-expanding metal...
stenting in malignant colorectal obstruction. Am J Gastroenterol 2004;99:2051-7.

10. Hinerbein M, Krause M, Moesta KT, Rau B, Schlag PM. Palliation of malignant rectal obstruction with self-expanding metal stents. Surgery 2005;137:42-7.

11. Van Hoot JF, 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 Guideline. Endoscopy 2014;46:1053.

12. Harrison ME, Anderson MA, Appalaneni V, Banerjee S, Ben-Menachem T, Cash BD, et al. The role of endoscopy in the management of patients with known and suspected colorectal obstruction and pseudo-obstruction. Gastrointest Endosc 2010;71:669-79.

13. Lee HJ, Hong SP, Cheon JH, Kim TI, Kim WH, Park SJ. Clinical Outcomes of self-expansible metal stents for malignant rectal obstruction. Dis Colon Rectum 2018;61:43-50.

14. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Med 2009;6:e1000097.

15. Slim K, Nini E, Forestier D, Kwiatkowski F, Panis Y, Chipponi J. Methodological index for non-randomized studies (minors): Development and validation of a new instrument. ANZ J Surg 2003;73:712-6.

16. Egger M, Davey-Smith G, Altman DG. Systematic Reviews in Health Care: Meta-Analysis in Context. John Wiley & Sons; London: 2008.

17. Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. Stat Med 2002;21:1539-58.

18. Xu H, Platt RW, Lao ZG, Wei S, Fraser WD. Exploring heterogeneity in meta-analyses: Needs, resources and challenges. Paediatr Perinat Epidemiol 2008;22:18-8.

19. Liberman H, Adams DR, Blatchford GJ, Ternent CA, Christensen MA, Thorson AG. Clinical use of the self-expanding metallic stent in the management of colorectal cancer. Am J Surg 2000;180:407-11; discussion 12.

20. Stefanidou D, Brown K, Nazario H, Trevino HH, Ferral H, Brady CE 3rd, et al. Safety and efficacy of metallic stents in the management of colorectal obstruction. JSLS 2005;9:454-9.

21. Nagula S, Ishii N, Nash C, Markowitz AJ, Schattner MA, Temple L, et al. Quality of life and symptom control after stent placement or surgical palliation of malignant colorectal obstruction. J Am Coll Surg 2010;210:45-53.

22. Crosta C, Trovato C, Fiori G, Ravizza D, Tamayo D, Zampino MG, et al. Metal stent placement in acute malignant colorectal obstruction. Dig Liver Dis 2006;38:341-6.

23. Gianotti L, Tamarini N, Nepo G, Gresta S, Ghiotto V, et al. A prospective evaluation of short-term and long-term results from colorectal stenting for palliation or as a bridge to elective operation versus immediate surgery for large-bowel obstruction. Surg Endosc 2013;27:832-42.

24. Lamazza A, Fiori E, Schillaci A, DeMasi E, Pontone S, Sterpetti A. Self-expandable metallic stents in patients with stage IV obstructing colorectal cancer. World J Surg 2012;36:2931-6.

25. Zhang H, Piccolo G, Cavallaro A, Pulvirenti E, Menzo EL, Cardì F, et al. A pilot study about the oncologic safety of colonic self-expandable metal stents (SEMS) in obstructive colon cancer: Is occlusion always better than “silent” perforation? Eur Rev Med Pharmacol Sci 2016;20:5242-8.

26. Aviv RI, Shyamalan G, Watkinson A, Tibballs J, Ogunbaye G. Radiological palliation of malignant colon obstruction. Clin Radiol 2002;57:347-51.

27. Syn WK, Patel M, Ahmed MM. Metallic stents in large bowel obstruction: Experience in a District General Hospital. Colorectal Dis 2005;7:22-6.

28. Baraza W, Lee F, Brown S, Hurlstone DP. Combination endo-radiological colorectal stenting: A prospective 5-year clinical evaluation. Colorectal Dis 2008;10:901-6.

29. Selinger CP, Ramesh J, Martin DF. Long-term success of colonic stent insertion is influenced by indication but not by length of stent or site of obstruction. Int J Colorectal Dis 2011;26:215-8.

30. Kang SG, Jung GS, Cho SG, Kim JG, Oh JH, Song HY, et al. The efficacy of metallic stent placement in the treatment of colorectal obstruction. Korean J Radiol 2002;7:39-86.

31. Yoon JY, Jung YS, Hong SP, Kim TI, Kim WH, Cheon JH. Clinical outcomes and risk factors for technical and clinical failures of self-expandable metal stent insertion for malignant colorectal obstruction. Gastrointest Endosc 2011;74:858-68.

32. Im JP, Kim SG, Kang HW, Kim JS, Jung HC, Song IS. Clinical outcomes and patency of self-expanding metal stents in patients with malignant colorectal obstruction: A prospective single center study. Int J Colorectal Dis 2008;23:789-94.

33. Chou SQH, Song H-Y, Kim JH, Park J-H, Fan Y, Lee H, et al. Dual-design expandable colorectal stent for a malignant colorectal obstruction: Preliminary prospective study using new 20-mm diameter stents. Korean J Radiol 2012;13:66-72.

34. Fan YB, Cheng YS, Chen NW, Xu HM, Yang Z, Wang Y, et al. Clinical application of self-expanding metallic stent in the management of acute left-sided colorectal malignant obstruction. World J Gastroenterol 2006;12:755-9.

35. Li C-Y, Guo S-B, Wang N-F. Decompression of acute left-sided malignant colorectal obstruction: Comparing transanal drainage tube with metallic stent. J Clin Gastroenterol 2014;48:e37-42.

36. Xu Y-S, Fu Y-F, Du H-T, Li D-C. Palliative stent insertion for acute malignant colorectal obstruction: Long-term patency and survival. Surg Laparosc Endosc Perutan Tech 2015;25:500-4.

37. Varpe P, Huhtinen H, Rantalä A, Salminen P, Sarparanta H, Grönroos J. Adaption of self-expanding metallic stents in the palliative treatment of obstructive colorectal cancer - look out for perforations! Surg Laparosc Endosc Perutan Tech 2008;18:353-6.

38. Huhtinen H, Varpe P, Karvonen J, Rantalä A, Grönroos JM. Late complications related to palliative stenting in patients with obstructing colorectal cancer. Minim Invasive Ther Allied Technol 2013;22:352-8.

39. Bielawska B, Hooley IC, Jalkin IV. Dual-design expandable self-expanding metal stents appear to be safe and effective for malignant colorectal obstruction with and without concurrent use of chemotherapy. Surg Endosc 2010;24:2814-21.

40. Chouhan H, Wong CX, Maharaj P, Lawrence MJ, Hunter A, Moore JW. Colorectal stenting for malignant obstruction: An 8-year clinical experience. ANZ J Surg 2012;82:408-11.

41. Canena J, Liberato M, Marques I, Rodrigues C, Lagos A, Patrocínio S, et al. Sustained relief of obstructive symptoms for the remaining life of patients following placement of an expandable metal stent for malignant colorectal obstruction. Rev Esp Enferm Dig 2012;8:418-25.

42. Moolza Z, Madiba TE. Trends in demographics and management of obstructing colorectal cancer. World J Surg 2014;38:2466-70.

43. Saeed KM, Zafar W, Masood MA, Khattak S, Syed AA, Yusuf MA. Self-expanding metallic stents (SEMS) in left-sided colorectal cancer—A cancer center experience. J Gastrointest Cancer 2016;47:69-74.

44. Bayraktar B, Ozemir IA, Kefeli U, Demiral G, Sagroglu J, Bayraktar O, et al. Colorectal stenting for palliation and as a bridge to surgery: A 5-year follow-up study. World J Gastroenterol 2015;21:3973-9.
48. Gleditsch D, Søreide OK, Nesbakken A. Managing malignant colorectal obstruction with self-expanding stents: A closer look at bowel perforations and failed procedures. J Gastrointest Surg 2016;20:1643-9.
49. Broholm M, Kobbløg M, Frostberg E, Jeppesen M, Gögenür I. Delay of surgery after stent placement for resectable malignant colorectal obstruction is associated with higher risk of recurrence. Int J Colorectal Dis 2017;32:513-6.
50. Ho K-S, Quah H-M, Lim J-F, Tang C-L, Eu K-W. Endoscopic stenting and elective surgery versus emergency surgery for left-sided malignant colonic obstruction: A prospective randomized trial. Int J Colorectal Dis 2012;27:355-62.
51. Allievi N, Ceresoli M, Fugazzola P, Montori G, Coccolini F, Ansaloni L. Endoscopic stenting as bridge to surgery versus emergency resection for left-sided malignant colorectal obstruction: An updated meta-analysis. Int J Surg Oncol 2017;2017:2863272.
52. Crocechi R, Farinella E, Trastulli S, Desiderio J, Listorti C, Boselli C, et al. Safety and efficacy of endoscopic colonic stenting as a bridge to surgery in the management of intestinal obstruction due to left colon and rectal cancer: A systematic review and meta-analysis. Surg Oncol 2013;22:14-21.
53. Zhao XD, Cai BB, Cao RS, Shi RH. Palliative treatment for incurable malignant colorectal obstructions: A meta-analysis. World J Gastroenterol 2013;19:5565-74.
54. Van Hooft JE, Fockens P, Marinelli AW, Timmer R, Van Berkel AM, Bossuyt PM, et al. Early closure of a multicenter randomized clinical trial of endoscopic stenting versus surgery for stage IV left-sided colorectal cancer. Endoscopy 2008;40:184-91.
55. Hurwitz H, Fehrenbacher L, Novotny W, Cartwright T, Hainsworth J, Heim W, et al. Bevacizumab plus irinotecan, fluorouracil, and leucovorin for metastatic colorectal cancer. N Engl J Med 2004;350:2335-42.