

How to decide on stent insertion or surgery in colorectal obstruction?

Assad Zahid, Christopher John Young

Assad Zahid, Christopher John Young, Department of Colorectal Surgery, Royal Prince Alfred Hospital, Camperdown, Sydney, NSW 2050, Australia

Assad Zahid, Christopher John Young, Discipline of Surgery, University of Sydney, Sydney, NSW 2006, Australia

Christopher John Young, RPAH Medical Centre, Newtown, Sydney, NSW 2042, Australia

Author contributions: All authors equally contributed to this paper with conception and design of the study, literature review and analysis, drafting and critical revision and editing, and final approval of the final version.

Conflict-of-interest statement: There is no conflict of interest associated with any of the senior author or other coauthors contributed their efforts in this manuscript.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

Correspondence to: Christopher John Young, MBBS, MS, FRACS, FACS, Clinical Associate Professor, RPAH Medical Centre, Suite 415/100 Carillon Ave, Newtown, Sydney, NSW 2110, Australia. cyoungnsw@aol.com
Telephone: +61-2-95153204
Fax: +61-2-95153222

Received: June 30, 2015
Peer-review started: July 5, 2015
First decision: October 13, 2015
Revised: November 6, 2015
Accepted: December 1, 2015
Article in press: December 2, 2015
Published online: January 27, 2016

Abstract

Colorectal cancer is one of the most common cancers in western society and malignant obstruction of the colon accounts for 8%-29% of all large bowel obstructions. Conventional treatment of these patients with malignant obstruction requiring urgent surgery is associated with a greater physiological insult on already nutritionally replete patients. Of late the utility of colonic stents has offered an option in the management of these patients in both the palliative and bridge to surgery setting. This has been the subject of many reviews which highlight its efficacy, particularly in reducing ostomy rates, allowing quicker return to oral diet, minimising extended post-operative recovery as well as some quality of life benefits. The uncertainty in managing patients with malignant colonic obstructions has lead to a more cautious use of stenting technology as community equipoise exists. Decision making analysis has demonstrated that surgeons' favored the use of stents in the palliative setting preferentially when compared to the curative setting where surgery was preferred. We aim to review the literature regarding the use of stent or surgery in colorectal obstruction, and then provide a discourse with regards to the approach in synthesising the data and applying it when deciding the appropriate application of stent or surgery in colorectal obstruction.

Key words: Self-expanding metallic stent; Stenting; Surgery; Colorectal cancer; Large bowel obstruction; Radiology

© **The Author(s) 2016.** Published by Baishideng Publishing Group Inc. All rights reserved.

Core tip: Despite the accumulation of data on stent insertion, the choice of stent or surgery as the most appropriate modality in the management of colorectal obstruction presents a constant decision dilemma. When cure is possible we want that, but with minimal

morbidity. In a group of patients who are prone to higher rates of morbidity and mortality, this can be problematic and full of uncertainty. This review takes an approach to review the primary and secondary outcomes established in the literature regarding the use of stent or surgery in colorectal obstruction, and then create discourse and a structured approach in regards to synthesising the data and applying it when deciding the appropriate application of stent or surgery in colorectal obstruction.

Zahid A, Young CJ. How to decide on stent insertion or surgery in colorectal obstruction? *World J Gastrointest Surg* 2016; 8(1): 84-89 Available from: URL: <http://www.wjgnet.com/1948-9366/full/v8/i1/84.htm> DOI: <http://dx.doi.org/10.4240/wjgs.v8.i1.84>

INTRODUCTION

Despite the accumulation of data on stent insertion, the choice of stent or surgery as the most appropriate modality in the management of colorectal obstruction presents a constant decision dilemma. When cure is possible we want that, but with minimal morbidity. In a group of patients who are prone to higher rates of morbidity and mortality, this can be problematic and full of uncertainty.

This review takes an approach to review the primary and secondary outcomes established in the literature regarding the use of stent or surgery in colorectal obstruction, and then create discourse and a structured approach in regards to synthesising the data and applying it when deciding the appropriate application of stent or surgery in colorectal obstruction.

Colorectal cancer is one of the most common cancers in western society and malignant obstruction of the colon accounts for 8%-29% of all large bowel obstructions^[1]. Other causes of large bowel obstruction include uterine, ovarian, gastric, breast, bladder and kidney malignancies^[2]. Conventional treatment of these patients with malignant obstruction requiring urgent surgery is associated with a greater physiological insult on already nutritionally replete patients. This is associated with mortality in 15%-34% of patients and morbidity in 32%-64% of patients^[3]. Of late the utility of colonic stents has offered an option in the management of these patients. The first being used by Dohmoto *et al*^[4] in 1991. Tejero *et al*^[5] described the use of colonic stents as a "bridge to surgery" in 1994. This has been the subject of many reviews which highlight its efficacy, particularly in reducing ostomy rates, allowing quicker return to oral diet, minimising extended post-operative stay and some quality of life (QoL) benefits^[6]. Xinopoulos *et al*^[7] demonstrated that self-expanding metallic stent (SEMS) placement represents an alternative approach to colostomy for patients with inoperable malignant colonic strictures. The uncertainty in managing patients with malignant

colonic obstructions has lead to a more cautious use of stenting technology as community equipoise exists^[8].

PATIENT AND DISEASE FACTORS

Regarding the location of obstructing colonic malignancy, Fiori *et al*^[9] in 2004 reported that 63.6% of obstructing malignancies occur in the rectum and 36.3% in the rectosigmoid/sigmoid colon. Sankararajah *et al*^[10] in 2005 observed 37% in the rectosigmoid, 21% in the sigmoid colon, 16% at the splenic flexure, 16% in the descending colon, 5% in the rectum and 5% in the ascending colon. van Hooft *et al*^[11] in 2008 observed 76% obstruction in the rectosigmoid and 24% obstruction in the descending colon. With the majority of obstructing pathology being on the left side, this makes these lesions amenable to endoscopic intervention. Sankararajah *et al*^[10] demonstrated malignant stricture length to be in the range of 3-7 cm meaning that all these lesions are within "stentable" range. Fiori *et al*^[9] and van Hooft *et al*^[11] collected data on patient ASA level with all patients included in their trials being ASA 1 to 3. The majority of the patients were in the ASA 2 category.

MORBIDITY OF SURGERY V STENT

While decision making with regards to the utility of stents in patients with metastatic disease may be easier for the treating clinician, this decision is more difficult to make for patients with local disease. A recent randomised controlled trial (RCT) by Young *et al*^[6] reported that in a population of patients with incurable metastatic large bowel obstruction, stent use was associated with faster return to diet, decreased stoma rates, reduced post-procedure stay, and some QoL benefits.

The decision with regards using a stent in patients with non-metastatic malignant bowel obstruction is one that is fraught with indecision due to the theoretical risk of perforation converting a once potentially curable disease to incurable^[12,13]. However this risk needs to be balanced with multiple other factors, principally being the patients pre-existing morbidities and the need for emergent surgical intervention. In this day, with highly trained endoscopists, the more imminent risk of perforation is much lower in some centres than the reported 4%.

Efficacy

The efficacy of SEMSs as a tool in the treatment of malignant colonic obstruction has been demonstrated well over the past few years. Many randomised control trials have supported their use and hence should be considered a valid option in the treatment of this condition (Table 1).

The 2011 review by Sagar *et al*^[14] reported an clinical relief of obstruction in the colonic stenting group to be approximately 0.66 d compared to 3.55 d in the emergency surgery group, with an overall success rate of 86%. In Ho's review in 2012, the placement of

Table 1 Summary of the studies included in this review

Ref.	Centres and aim	No. of patients (stenting/surgery)	Stenting morbidity	Surgery morbidity	Stenting mortality	Surgery mortality	Stenting efficacy
Fiori <i>et al</i> ^[9]	Single centre, palliation	11/11	0	1/11 (9%)	0	0	100%
Xinopoulos <i>et al</i> ^[27]	Single centre, palliation	15/15	0	0	0	0	93%
van Hooft <i>et al</i> ^[11]	Multicentre, palliation	11/10	11/11 (100%)	5/10 (50%)	3/11 (27%)	0	82%
Sankararajah <i>et al</i> ^[10]	Single centre	9/9	2/9 (22%)	6/9 (67%)	1/9 (11%)	1/9 (11%)	78%
Cheung <i>et al</i> ^[23]	Single centre, bridge to surgery	24/24	2/24 (8%)	17/24 (71%)	0	0	83%
van Hooft <i>et al</i> ^[24]	Multicentre, bridge to surgery	47/51	25/47 (53%)	23/51 (41%)	9/47 (19%)	9/51 (18%)	70%
Ho <i>et al</i> ^[15]	Single centre, bridge to surgery	20/19	7/20 (35%)	11/19 (35%)	0	3/19 (16%)	70%
Young <i>et al</i> ^[6]	Multicentre, palliative	26/26	10/26 (38%)	14/26 (54%)	0	0	79%

self expanding metallic stents took a median time of 35 min (range, 20-80 min). Seventy percent patients (14/20) had been stented successfully. Following stent placement, they resumed a diet after approximately day 2 and were discharged about day 4. Six out of 20 patients failed stenting with the main cause being the inability to pass the guide wire across the stenotic cancer (4/6 cases)^[15]. This technical success was also noted in the review by Khot *et al*^[16]. It may be overcome with the use of a pediatric nasogastroscope^[17].

Both Tan *et al*^[18] and Zhang *et al*^[19] reviews demonstrated that a higher primary anastomosis rate and lower morbidity rate was achieved in the group receiving colonic stents.

In the study by Ho *et al*^[15] stented patients were sent home significantly sooner than in the emergency surgery groups, with medial length of stays at 6 d vs 8 d respectively ($P = 0.028$). Furthermore, they demonstrated significantly better outcomes for the stenting group that went on to have elective surgery compared to the group randomized to have emergency surgery^[14].

A recent metaanalysis by Zhao *et al*^[20] emphasized that there is limited data on the long term survival of patients with malignant left sided colonic obstruction when comparing emergency surgery with semi-elective use of stents. With limited data, recommendation was made for more studies on the topic^[20].

BLOCKAGE

Blockage of stents principally affects patients who have long term stent insertion in the palliative setting. In the review by Khot *et al*^[16], the overall, reobstruction occurred in 52 of 525 (10%) cases with only three patients in the "bridge to surgery" group having reobstruction. The reasons of reobstruction in these patients included tumour in-growth in 32 (62%), stent migration in seven (13%) and faecal impaction in 13 (25%)^[16]. These issues with obstruction of the stent can be managed expectantly with surveillance being tailored to the patient's condition. In general, patients who are having the stent as a bridge to surgery would very rarely experience obstruction. Patients with palliative stent insertion who are not candidates for surgery would present the main group with tumor related blockage and this may be managed expectantly with re-stenting of the

lesion.

STOMA RATES

A major advantage of colonic stent placement is the reduction of stoma formation rates^[5,6,9,11,21]. This represents a significant improvement in the patient outcomes with relation to physical recovery and overall QoL issues. In the meta-analysis by Cennamo *et al*^[22], the permanent stoma creation rate was 38/152 (25%) in the stent group and 78/162 (48.1%) in the surgical group; the pooled analysis showed a significantly higher rate in the surgical group^[20]. In the RCT by Young *et al*^[6], none of the 19/26 patients in the stent group who were successfully stented required a stoma while 24/26 in the surgery group required a stoma to be fashioned ($P < 0.001$).

PERFORATION RATES

The decision of using a stent in patients with non-metastatic malignant bowel obstruction is one that is fraught with indecision due to the theoretical risk of perforation converting a once potentially curable disease to incurable. However this risk needs to be balanced with multiple other factors, principally being the patients pre-existing morbidities and the need for emergent surgical interventions. In four trials, no stent related perforation was noted (Young *et al*^[6] 2015, Cheung *et al*^[23] 2009; Fiori *et al*^[9] 2004; Sankararajah *et al*^[10] 2005). In two of the RCTs by Khot *et al*^[16] 2011 and van Hooft *et al*^[24], a perforation rate of 4% was noted. Khot *et al*^[16] states that this rate was significantly associated with balloon pre-dilatation. With Van Hooft's study the large number of centres^[24] involved in the study may not have allowed a standardisation in the technique and also local expertise may vary considering that some centres contributed one patient over the two year period.

DEATH

In malignant obstruction of the colon, emergency surgery is associated with a high mortality rate of 10%-30%, when compared to < 5% rate in elective surgery for colorectal cancer^[25,26]. Three meta-analyses^[14,18,19],

Table 2 Surgeons' treatment preferences in different clinical scenarios (Suen *et al*^[8])

Clinical scenarios	Level of clinical certainty			Evidence of community equipoise?
	Surgery (%)	Undecided (%)	Stent (%)	
1 70yo; partial obstruction; metastatic cancer; ASA score 4	8	12	80	N
2 70yo; complete obstruction; metastatic cancer; ASA 4	9	8	82	N
3 50yo; partial obstruction; metastatic cancer; ASA 4	15	10	75	N
4 50yo; complete obstruction; metastatic cancer; ASA 4	12	8	80	N
5 70yo; partial obstruction; metastatic cancer; ASA 1	51	19	30	Y
6 70yo; complete obstruction; metastatic cancer; ASA 1	40	13	47	Y
7 50yo; partial obstruction; metastatic cancer; ASA 1	60	17	23	Y
8 50yo; complete obstruction; metastatic cancer; ASA 1	51	14	35	Y
9 70yo; partial obstruction; curable cancer; ASA 4	66	15	19	Y
10 70yo; complete obstruction; curable cancer; ASA 4	41	13	46	Y
11 50yo; partial obstruction; curable cancer; ASA 4	73	10	17	N
12 50yo; complete obstruction; curable cancer; ASA 4	50	11	39	Y
13 70yo; partial obstruction; curable cancer; ASA 1	96	4	0	N
14 70yo; complete obstruction; curable cancer; ASA 1	79	12	9	N
15 50yo; partial obstruction; curable cancer; ASA 1	96	4	0	N
16 50yo; complete obstruction; curable cancer; ASA 1	87	9	4	N

did not show any advantage in terms of post-operative mortality between the emergency surgery and stenting groups. In the recent RCT by Young *et al*^[6], similar mortality figures were noted in both groups, noting that this patient population was palliative. A review of the United Kingdom National Audit showed that patients undergoing surgery for left-sided colonic obstruction had an operative mortality rate of 12.9%^[27]. The mortality rate with stenting being a lot lower at 1%, giving evidence that it is a safe method to decompress a patient as a bridge to surgery^[16].

COST

The cost of stents utility needs to be weighed up against many factors. They may represent an expensive option in isolation, however overall they represent a cost-effective option in the treatment of malignant obstruction of the colon. A study from the United Kingdom demonstrated the cost of a palliative stent was fifty percent less than surgical decompression and that the expense of 'bridge to surgery was reduced by twelve percent with compared to a two stage procedure^[28]. In the review by Fiori *et al*^[9], the median hospital stay was 2.6 d for stent group and the median hospital stay was 8.1 d for the stoma group.

Other factors such as QoL, faster return to normal bowel function and significantly less physiological insult make stenting a much more cost-effective option. Further, the additional costs of outpatient stoma care should also not be forgotten^[16].

QOL

Increasing evidence has been published with regards to the QoL of patients undergoing stents and surgical intervention for the management of malignant bowel obstruction. In the study by van Hooft *et al*^[24] (2011), primary outcome of global health status was recorded and no significant difference was noted between the two groups. More recently, Young *et al*^[6] (2015) observed

that 15/26 (58%) patients in the stent group patients were recorded as having an increased QoL from baseline to one week compared to 7/26 (27%) of the surgery group ($P = 0.02$). The surgery group had significantly lowered QoL compared to the stent group from baseline to 1 and 2 wk ($P < 0.001$ and $P < 0.012$), and from baseline to 12 mo ($P = 0.01$) in favor of the stent group, while both reported reduced QoL^[6]. There were no significant differences in whether the patient had an increased or decreased QoL at any other time point.

DECISIONS

The treatment of patients with senting technology is one that has traditionally being fraught with concern by the treating clinician. A recent study by Suen *et al*^[8] demonstrated that there would be limitations in conducting a future randomised controlled trial to assess the use of colonic stenting especially in the curative setting. Surgeons' favored the use of stents in the palliative setting preferentially when compared to the curative setting where surgery was preferred (Table 2).

In the management of physiologically poor patients (ASA > 3) with complete bowel obstruction, SEMS is the preferred initial intervention of choice. This allows the patient to be physiologically optimised for subsequent interventions and also increases the chance of a one-stage resection. The morbidity of emergency surgery can be as high as 51% with an associated mortality rate of 16%^[29]. With the greatest concern of colonic perforation being reported at 4% in previous trials, and modern day trials are quoting this at 0% with increasingly experienced interventionalists and safe methodology^[6]. This low rate of perforation and the benefits of stenting with lower stoma formation rates, lower perioperative morbidity and quicker recovery/return to community should make SEMS a valid tool in the management of malignant complete bowel obstruction^[23].

In the fit patient with curable disease, surgery is more often preferred as the intervention of choice due

to the improved physiologic parameters aiding in a better outcome and potential for one stage resection.

Considering the myriad of clinical scenarios and variables, the overall judgement, stenting technology offers an alternate tool to the clinician in the management of large bowel obstruction, with safe and effective outcomes.

The present body of evidence regarding stent insertion demonstrates its role, but to more clearly define its use in areas of uncertainty and community equipoise would require large multi-centre RCT's. Such trials may be necessary, but will be hard to complete with the difficulties of recruiting patients to trials where treating clinicians still hold conservative views as to the merits of stent or surgery.

REFERENCES

- 1 **Deans GT**, Krukowski ZH, Irwin ST. Malignant obstruction of the left colon. *Br J Surg* 1994; **81**: 1270-1276 [PMID: 7953385 DOI: 10.1002/bjs.1800810905]
- 2 **Lee YM**, Law WL, Chu KW, Poon RT. Emergency surgery for obstructing colorectal cancers: a comparison between right-sided and left-sided lesions. *J Am Coll Surg* 2001; **192**: 719-725 [PMID: 11400965 DOI: 10.1016/S1072-7515(01)00833-X]
- 3 **Smothers L**, Hynan L, Fleming J, Turnage R, Simmang C, Anthony T. Emergency surgery for colon carcinoma. *Dis Colon Rectum* 2003; **46**: 24-30 [PMID: 12544518 DOI: 10.1007/s10350-004-6492-6]
- 4 **Dohmoto M**, Hünnerbein M, Schlag PM. Application of rectal stents for palliation of obstructing rectosigmoid cancer. *Surg Endosc* 1997; **11**: 758-761 [PMID: 9214327]
- 5 **Tejero E**, Mainar A, Fernández L, Tobío R, De Gregorio MA. New procedure for the treatment of colorectal neoplastic obstructions. *Dis Colon Rectum* 1994; **37**: 1158-1159 [PMID: 7956588]
- 6 **Young CJ**, De-Loyde KJ, Young JM, Solomon MJ, Chew EH, Byrne CM, Salkeld G, Faragher IG. Improving Quality of Life for People with Incurable Large-Bowel Obstruction: Randomized Control Trial of Colonic Stent Insertion. *Dis Colon Rectum* 2015; **58**: 838-849 [PMID: 26252845 DOI: 10.1097/DCR.0000000000000431]
- 7 **Xinopoulos D**, Dimitroulopoulos D, Theodosopoulos T, Tsamakidis K, Bitsakou G, Plataniotis G, Gontikakis M, Kontis M, Paraskevas I, Vassilopoulos P, Paraskevas E. Stenting or stoma creation for patients with inoperable malignant colonic obstructions? Results of a study and cost-effectiveness analysis. *Surg Endosc* 2004; **18**: 421-426 [PMID: 14735348]
- 8 **Suen MK**, Zahid A, Young JM, Rodwell L, Solomon MJ, Young CJ. How to decide to undertake a randomized, controlled trial of stent or surgery in colorectal obstruction. *Surgery* 2015; **157**: 1137-1141 [PMID: 25796417 DOI: 10.1016/j.surg.2015.01.022]
- 9 **Fiori E**, Lamazza A, De Cesare A, Bononi M, Volpino P, Schillaci A, Cavallaro A, Cangemi V. Palliative management of malignant rectosigmoidal obstruction. Colostomy vs. endoscopic stenting. A randomized prospective trial. *Anticancer Res* 2004; **24**: 265-268 [PMID: 15015606]
- 10 **Sankararajah D**, Forshaw MJ, Parker MC. Multicentre prospective randomised controlled trial of pre-operative endoluminal stenting vs surgery in large bowel obstruction - interim analysis of short term outcomes. *Colorectal Dis* 2005; **7** (Suppl 1): 45-143
- 11 **van Hooft JE**, Fockens P, Marinelli AW, Timmer R, van Berkel AM, Bossuyt PM, Bemelman WA. Early closure of a multicenter randomized clinical trial of endoscopic stenting versus surgery for stage IV left-sided colorectal cancer. *Endoscopy* 2008; **40**: 184-191 [PMID: 18322873]
- 12 **Kyllönen LE**. Obstruction and perforation complicating colorectal carcinoma. An epidemiologic and clinical study with special reference to incidence and survival. *Acta Chir Scand* 1987; **153**: 607-614 [PMID: 3434101]
- 13 **Young CJ**, Solomon MJ. Acute malignant colorectal obstruction and self-expandable metallic stents. *ANZ J Surg* 2002; **72**: 851 [PMID: 12485215]
- 14 **Sagar J**. Colorectal stents for the management of malignant colonic obstructions. *Cochrane Database Syst Rev* 2011; **(11)**: CD007378 [PMID: 22071835 DOI: 10.1002/14651858.cd007378.pub2]
- 15 **Ho KS**, Quah HM, Lim JF, Tang CL, Eu KW. Endoscopic stenting and elective surgery versus emergency surgery for left-sided malignant colonic obstruction: a prospective randomized trial. *Int J Colorectal Dis* 2012; **27**: 355-362 [PMID: 22033810 DOI: 10.1007/s00384-011-1331-4]
- 16 **Khot UP**, Lang AW, Murali K, Parker MC. Systematic review of the efficacy and safety of colorectal stents. *Br J Surg* 2002; **89**: 1096-1102 [PMID: 12190673]
- 17 **Lamazza A**, Fiori E, Schillaci A, Sterpetti AV. A new technique for placement of a self-expanding metallic stent (SEMS) in patients with colon rectal obstruction: a prospective study of 43 patients. *Surg Endosc* 2013; **27**: 1045-1048 [PMID: 23052503 DOI: 10.1007/s00464-012-2522-y]
- 18 **Tan CJ**, Dasari BV, Gardiner K. Systematic review and meta-analysis of randomized clinical trials of self-expanding metallic stents as a bridge to surgery versus emergency surgery for malignant left-sided large bowel obstruction. *Br J Surg* 2012; **99**: 469-476 [PMID: 22261931 DOI: 10.1002/bjs.8689]
- 19 **Zhang Y**, Shi J, Shi B, Song CY, Xie WF, Chen YX. Self-expanding metallic stent as a bridge to surgery versus emergency surgery for obstructive colorectal cancer: a meta-analysis. *Surg Endosc* 2012; **26**: 110-119 [PMID: 21789642 DOI: 10.1007/s00464-011-1835-6]
- 20 **Zhao X**, Liu B, Zhao E, Wang J, Cai M, Xia Z, Xia Q, Shuai X, Tao K, Wang G, Cai K. The safety and efficiency of surgery with colonic stents in left-sided malignant colonic obstruction: a meta-analysis. *Gastroenterol Res Pract* 2014; **2014**: 407325 [PMID: 24959174 DOI: 10.1155/2014/407325]
- 21 **Law WL**, Choi HK, Chu KW. Comparison of stenting with emergency surgery as palliative treatment for obstructing primary left-sided colorectal cancer. *Br J Surg* 2003; **90**: 1429-1433 [PMID: 14598426 DOI: 10.1002/bjs.4311]
- 22 **Cennamo V**, Luigiano C, Coccolini F, Fabbri C, Bassi M, De Caro G, Ceroni L, Maimone A, Ravelli P, Ansaloni L. Meta-analysis of randomized trials comparing endoscopic stenting and surgical decompression for colorectal cancer obstruction. *Int J Colorectal Dis* 2013; **28**: 855-863 [PMID: 23151813 DOI: 10.1007/s00384-012-1599-z]
- 23 **Cheung HY**, Chung CC, Tsang WW, Wong JC, Yau KK, Li MK. Endolaparoscopic approach vs conventional open surgery in the treatment of obstructing left-sided colon cancer: a randomized controlled trial. *Arch Surg* 2009; **144**: 1127-1132 [PMID: 20026830 DOI: 10.1001/archsurg.2009.216]
- 24 **van Hooft JE**, Bemelman WA, Oldenburg B, Marinelli AW, Lutke Holzik MF, Grubben MJ, Sprangers MA, Dijkgraaf MG, Fockens P. Colonic stenting versus emergency surgery for acute left-sided malignant colonic obstruction: a multicentre randomised trial. *Lancet Oncol* 2011; **12**: 344-352 [PMID: 21398178 DOI: 10.1016/S1470-2045(11)70035-3]
- 25 **Smith JJ**, Cornish J, Tekkis P, Thompson MR. The National Bowel Cancer Audit Project 2007: quality improvement and open reporting. Association of Coloproctology of Great Britain and Ireland, London, 2007
- 26 **Hennekinne-Mucci S**, Tuech JJ, Bréhant O, Lermite E, Bergamaschi R, Pessaux P, Arnaud JP. Emergency subtotal/total colectomy in the management of obstructed left colon carcinoma. *Int J Colorectal Dis* 2006; **21**: 538-541 [PMID: 16228180 DOI: 10.1007/s00384-005-0048-7]
- 27 **Stamatakis J**, Thompson M, Chave H. National Audit of Bowel Obstruction due to Colorectal Cancer, April 1998-March 1999. London: Association of Coloproctology of Great Britain and Ireland, 2000

- 28 **Osman HS**, Rashid HI, Sathananthan N, Parker MC. The cost effectiveness of self-expanding metal stents in the management of malignant left-sided large bowel obstruction. *Colorectal Dis* 2000; **2**: 233-237 [PMID: 23578083 DOI: 10.1046/j.1463-1318.2000.00140.x]
- 29 **Seah DW**, Ibrahim S, Tay KH. Hartmann procedure: is it still relevant today? *ANZ J Surg* 2005; **75**: 436-440 [PMID: 15943733 DOI: 10.1111/j.1445-2197.2005.03367.x]

P- Reviewer: Cai KL, Fiori E **S- Editor:** Ji FF
L- Editor: A **E- Editor:** Liu SQ





Published by **Baishideng Publishing Group Inc**

8226 Regency Drive, Pleasanton, CA 94588, USA

Telephone: +1-925-223-8242

Fax: +1-925-223-8243

E-mail: bpgoffice@wjgnet.com

Help Desk: <http://www.wjgnet.com/esps/helpdesk.aspx>

<http://www.wjgnet.com>

