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EDITORIAL

Colonic Stenting in the Management of Acute Left-sided Malignant Colonic Obstruction is Oncologically Safe?

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ABSTRACT

The management of patients presenting with acute large bowel obstruction caused by left sided colorectal cancer is still debated. Colonic stenting (CS) allows to convert an urgent situation in an elective one. Lately conflicting results were published about this technique used as bridge to surgery in comparison with the emergency surgery in terms of oncologic safety and recurrence rate. Actually self expandable metallic stents (SEMS) are not "allowed" to treat potentially curable patients. Data reported in literature show that colonic stenting improves primary anastomosis rate with a low stoma creation in comparison with emergency surgery, enhancing patients' quality of life, without differences in terms of mortality and morbidity rate. According to available data, at one year follow up time, the recurrence rate is higher in patients treated with stent, with no statistical difference in terms of disease free survival and overall survival. Endoscopist's experience, type of colic obstruction (partial or total), type of stent, insertion technique and timing of surgery are fundamental to reach CS technical and clinical success. Oncologic (un)-safety of colonic stenting has to be still investigated and confirmed by medium and long term follow up of large prospective studies and randomized controlled trials comparing SEMS as bridge to surgery and ES. CS can be strongly considered with palliative intent in patients with advanced neoplastic disease, to avoid stoma and health care costs related to stoma.

Key words: Colonic stent; Self Expandable Metallic Stent; Obstructive left colon cancer; Emergency surgery; Oncologic outcome

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INTRODUCTION

Approximately 10-30% of patients affected by colorectal cancer (CRC) presents with acute large bowel obstruction (ALBO) requiring urgent decompression in western countries. ALBO in about 70% of case is caused by left sided lesions and is often associated with increasing age, more advanced disease and considerably increased hospital morbidity and mortality[1].

There is not still consensus about the emergency management of the obstructed left colon cancer. Treatment options are resection of the obstructing tumor with primary anastomosis, proximal diversion, and insertion of a self-expandable metal stents (SEMS) as bridge to surgery (BTS)[1-2].

Emergency surgery (ES) for ALBO is associated with a significant risk of mortality and morbidity and with a high percentage of stoma creation (either temporary or permanent)[2].

Dohmoto and Tejero were the first to describe the use of SEMS to treat CRC obstruction[3-4]. Since then, several studies demonstrated that endoscopic stenting, followed by elective surgery in the optimal timing, within 5-7 days[5-6], increases the primary anastomosis rate with low stoma creation in comparison with ES, in patients with obstructive left sided lesion, without differences in terms of mortality and morbidity rate[7-10].

SEMS placement in emergency, if there are no signs of perforated tumor, allows time for preoperative evaluation, for improving patient's medical condition, and facilitating bowel decompression.

Colonic stenting (CS) with palliative intent is well indicated in patients with advanced, inoperable, disease and decreases high health care costs of stomas[11-12].

For patients with obstructive non-palliative left-sided colonic cancer, SEMS placement remains controversial because of the risk, which has to be still investigated of peritoneal carcinomatosis. Maruthachalam reported that endoscopic insertion of colonic stents results in increased levels of CK20 mRNA in the peripheral circulation[13]. Malgras showed an increased metastatic process and shorter survival time in a mouse model of colonic cancer treated with SEMS[14]. Besides in the last decade many studies have been published, including randomized controlled trials (RCTs) and systematic reviews, with conflicting results comparing SEMS as BTS and emergency surgery in terms of safety, morbidity, disease free survival (DFS), recurrence rate and overall survival (OS)[15-20].

Actually surgeons are not allowed to consider CS as BTS for young and potentially curable patients. Consequently surgical procedures involving the creation of a diverting or permanent stomas are increasing and this trend seems to increase with age of patients affected, decreasing their quality of life[21-22].

EMERGENCY SURGEON'S POINT OF VIEW

ALBO presents a challenge to any surgeon. Distended unprepared bowel, patient's dehydration, advanced disease and frequent need for surgery out of hours, often at night, are all factors which predispose to complications.

The surgical management of ALBO is still debated and includes: (1) Primary resection and Anastomosis: associated with on-table irrigation or manual decompression of the colon (one stage procedure): it prevents the confection of a loop colostomy but presents the risk of anastomotic leakage; (2) Hartmann's procedure (two stage surgery): it allows the treatment of both obstruction and cancer and prevents anastomotic leakage but needs a second operation to reverse the colostomy; (3) Three stage procedure: (de-compressive colostomy-colic resection-colostomy's closure); (4) Subtotal or total colectomy with/without primary anastomosis; it is indicated in case of diastatic colon perforation or synchronous right colonic cancer; (5) Temporary or definitive loop colostomy/ileostomy: in case of important bowel dilatation proximal to obstruction, advanced neoplastic disease or peritoneal carcinomatosis, because of the high risk of anastomotic leakage[1-2].

The 'ideal' operation is the one that would be chosen in the elective setting. The immediate colic resection with primary anastomosis represents the gold standard in patients with low risk, performing either a typical resection with wash-out, or a subtotal colectomy; a temporary de-functioning colostomy or ileostomy could be proposed to patients with an intermediate anesthetic risk; in high-risk cases, advanced obstruction, simultaneous colonic perforation, metastatic or locally advanced disease, Hartmann's operation should be preferred, as safer surgical procedure; colonic stents represent the best option when skills are available[2].

CS as BTS seems to provide a good therapeutic option to convert an emergency clinical situation into a more elective one.

INTERNATIONAL GUIDELINES RECOMMENDATIONS ABOUT SEMS

The World Society of Emergency Surgeons (WSES) stated that colonic stents represent a valuable option both for palliation and as a bridge to elective surgery to treat patients presenting with ALBO and no signs of perforations. High clinical and technical expertise is mandatory to obtain good results. CS should be preferred to colostomy for palliation in patients not treated with bevacizumab-based therapy, avoiding high health care cost related to stoma[2,11,12,23].

The European Society of Gastrointestinal Endoscopy (ESGE) does not recommend SEMS placement as a standard treatment of symptomatic malignant left bowel obstruction; it can be considered for patients with potentially curable obstructing left-sided colonic cancer at high risk of postoperative mortality (American Society of Anesthesiologists Physical Status ≥ III and/or age > 70 years) as an alternative to emergency surgery; it is recommended as the preferred treatment for palliation, except in patients treated or considered for treatment with anti-angiogenic drugs such as bevacizumab[24].

The Eastern Association for the Surgery of Trauma (EAST) recommends CS (if available) as initial therapy for malignant left colon obstruction, because stent use was associated with decreased mortality and morbidity rates[25].

The Korean Society of Gastrointestinal Endoscopy recommends CS as BTS in order to avoid high morbidity related to ES, above all in patients with un-resectable CRC, because SEMS placement can relieve symptoms, improve quality of life and allow chemotherapy and/ or radiotherapy for palliation[26].

RISK OF PERFORATION AFTER SEMS INSERTION

Tumor perforation after SEMS placement represents the most feared complication. Free perforation occurs in 3.8% to 6.9% of patients treated [27] resulting in seeding of neoplastic cells in the abdominal cavity (peritoneal carcinomatosis). Almost 70% of colon perforations occurs in the first week after stenting and it could have a negative effect on long term survival, especially in patients whose disease is potentially curable. Perforation rate ranged from 0 to 83%; the overall risk of perforation was about 5%, which is a relatively low risk, but the mortality rate of patients with perforations was 16%[28].

CS technical and clinical success are dependent on Endoscopist's experience: Geraghty reported that technical success and good outcome for the emergency management of ALBO by SEMS insertion did not vary by indication or site of obstruction but it is higher for experienced operators who had performed more than 10 procedures, using the through-the-scope (TTS) endoscopy technique[29].

Giannotti evaluating prospectively short and long term results from CS concluded that the interpretation of CS benefits may be ascribed to the experience of the endoscopist and the relatively low rate of complete colonic obstructions[30].

Mehmood reported that colonic stent insertion for obstructing colorectal malignancies can be performed by an endoscopist without radiologist support if adequately trained[31].

Type of colic obstruction (partial or complete): Boyle et Al affirmed that CS is more likely to be successful in shorter, malignant strictures with less angulation, distal to the obstruction[32].

Van Halsema identified as risk factors for perforation, benign etiology of the stricture, and chemotherapy with bevacizumab [27,32,33].

Type of stent: Selection of the appropriate stent is very important for outcomes, considering material, design, diameter, length, radial force, flexibility, foreshortening ratio, and delivery system but there is no evidence to indicate which stent type is superior.

Cheung and Al recently conducted a multi center, randomized, prospective, comparative study aimed to compare the clinical efficacy and complication rates of the D-type colonic uncovered stent (Taewoong medical Co., Gimpo, South Korea) with those of the Wallflex colonic uncovered stent (Boston Scientific Corp., Natick, MA, USA); both stents were uncovered with different radial and axial force, to reduce the excessive pressure on the ends, which contact with the normal mucosa of the colon and may result in the increased risk of perforation. Perforation occurred for 5/58 patients treated with colonic stent. 4 with the Wallflex stent and one with D-type stent without statistically significant difference[34].

Van Halsema with a meta-analysis involving 4086 patients revealed an overall perforation rate of 7.4% and noted that of the 9 most frequently used stent types, the WallFlex, the Comvi, and the Niti-S D-type have a higher perforation rate (> 10%). A lower perforation rate (< 5%) was found for the Hanarostent and the Niti-S covered stent[27].

Timing of surgery: The appropriate time for surgery after SEMS insertion as BTS has yet to be clarified. Sufficient expansion of the stent followed by reversal of the ischemia of the dilated proximal bowel and bowel cleansing requires enough time after SEMS insertion. Theoretically, surgery may be delayed for at least 1 week or longer after SEMS insertion to minimize the risk of stoma formation and postoperative complications, such as anastomotic leak, abscess, and wound problems. However, with a longer delay in the surgery, the frequency of stent-related complications may increase. Therefore, in general, surgical colonic resection is recommended on the 5th to 10th day after SEMS insertion[10].

The clinical and pathological effect on evolution of neoplastic disease of silent micro-perforation induced by SEMS has to be investigated.

Surely, the enforced radial dilatation induced by SEMS suggests the possibility of increased risk of perforation and tumor manipulation that can induce dissemination of cancer cells into the peritoneal cavity, surrounding lymphatic vessels and bloodstream, but negative long-term oncological outcomes of SEMS insertion have to be proven and are still debated.

ONCOLOGIC (UN)SAFETY OF SEMS: WHAT CAN BE FOUND IN LITERATURE?

Matsuda showed with his meta-analytic study including 1136 patients of whom 432 (38%) underwent CS as BTS and 704 (62%) underwent ES that OS, DFS and recurrence did not differ significantly between the CS as BTS and ES groups[34].

Kavanagh conducted an observational comparative study to evaluate medium term oncological outcomes of CS as BTS and ES with an intention to treat analysis. Data showed no difference in cancer specific and all cause mortality between both groups; there were 3 cancer related deaths in the CS group and 4 in ES group. Median follow up (months) in CS and ES group was 27.4 (range 1-81) and 26[35]. Disease recurrence occurred in 4 patients in the CS group and 6 patients in the ES group; sites of recurrence in the CS were: local/peritoneal in two patients, liver in two patients; both local recurrences occurred in patients who had undergone R1 resections. In the ES group there were 1 local/liver, 2 peritoneal, and 3 liver; the local recurrence occurred in a single patient who had a R1 resection. Kavanagh reported the histological evidence of clinically silent tumor micro perforations in 3 patients in the CS group (13%) in comparison with 2 (7%) tumor micro perforations in the ES group and this suggested that it is occasionally present in the absence of stent deployment[35].

Gorissen reported that SEMS was associated with an increased local recurrence rate in the younger patients aged 75 years or less. In the younger patients, a significantly higher local recurrence rate was observed following SEMS compared with ES at the end of the follow up (32% *vs* 8 %; $p = 0.038$). Of 20 local recurrences, 12 were diffusely peritoneal, 5 were at the large bowel anastomosis/side wall, 2 were ovarian and 1 was on the small bowel[36].

Sloothaak reported data about disease recurrence (DR), DFS, disease specific survival (DSS) and OS about 58 patients involved in the Dutch Stent in 2 trial[20-16]. Median follow up was 4 and 41 months in the ES and CS groups respectively. Loco-regional or distant disease recurrence developed in 9/32 patients in the ES group and 13/26 in the CS group. DFS was worst after a stent-related perforation.The OS rate was 50% for patients with a stent related perforation and was worse than the rate of 62% in patients without stent-related perforation[20-16].

Sabbagh retrospectively analyzed data from 48 patients in the SEMS group and 39 in the surgery-only group, using a propensity score and reported worse OS and DFS of patients with ALBO with SEMS insertion compared with ES. In the overall population, OS ($P = 0.001$) and 5-year overall survival ($P = 0.0003$) were significantly lower in the SEMS group than in the surgery-only group, and 5-year cancer-specific mortality was significantly higher in the SEMS group ($P = 0.02$). Five-year DFS, the recurrence rate, and the mean time to recurrence were better in the surgery-only group (not significant). For patients with no metastases or perforations at hospital admission, *OS* ($P = 0.003$) and 5-year overall survival (30% *vs* 67%, respectively, $P = 0.001$) were significantly lower in the SEMS group than in the surgery-only group. The same authors explained these data by analyzing pathological specimens from the CS- and the surgery-only groups in a case-matched analysis (with the groups matched for the T stage). A total of 84 patients were included in the study (50 in the CS group). Twenty-five patients in the CS group were matched with 25 patients of the surgery-only group. Tumor ulceration ($p = 0.0001$), peri-tumor ulceration ($p = 0.0001$), perineural invasion ($p = 0.008$), and lymph node invasion ($p = 0.005$) were significantly more frequent in the CS group. In a multivariate analysis of the CS group, T4 status and tumor size were significant risk factors for microscopic perforation, perineural invasion, and lymph node invasion[37-38].

Then Knight et al decided to carried out a retrospective cohort study to determine if preoperative stenting adversely affects long-term survival by comparing a group of patients having preoperative stenting (group A) with a group of patients having elective surgery for Dukes' B and C cancer excluding mid and low rectal tumors (group B) in a single centre. The 30-day mortality rate for groups A

and B was 6.7 % (one patient) and 5.7% (five patients), respectively. The 5-year survival rate was 60 % and 58 %, respectively, with a p value of 0.96. Knight concluded that patients undergoing SEMS as a "bridge to surgery" have the same long-term survival with those undergoing elective surgery[39].

Park analyzed retrospectively data from 67 stented patients underwent SEMS placement as BTS and 35 patients treated by ES to compare surgical and oncologic outcomes of the groups.The stent group had a higher laparoscopic resection rate (67.2 *vs* 31.4 %, p = 0.001) with a lower conversion rate (4.3 *vs* 35.3 %, p = 0.003). The rates of local recurrence and distant metastasis, recurrence-free, and OS were not significantly different between the two groups[40].

Also Kim carried out a retrospective analysis of data from 43 patients underwent radical resection after preoperative stent insertion (stent group) and 48 underwent emergency surgery with curative intent (surgery group) to compare short- and long-term outcomes between the two groups. The 5-year disease-free survival and 5-year survival rates were not significantly different between the stent and surgery groups[41].

CONCLUSIONS

CS improves primary anastomosis rate with a low stoma creation in comparison with ES and is a therapeutical option to take in consideration, when skills are available, to treat patients unfit for surgery, with palliative intent.

We think that preoperative SEMS placement gives surgeon the opportunity to convert an emergency situation in an elective one and to perform laparoscopy, increasing primary anastomosis and consequently decreasing health care costs related to permanent/ temporary stoma, thereby enhancing patients' quality of life.

Recently published data showed that at one year follow up, recurrence rate is higher in patients treated with stent compared with patients submitted to ES without statistical difference in terms of DFS and OS.

Considering these oncological outcomes, surgery is the only treatment that we can offer to patients presenting with malignant colorectal obstruction, potentially curable, but CS remains an interesting option to ES when available with good results.

Oncologic (un)-safety of colonic stenting has to be still investigated and confirmed by medium and long term follow up of large prospective studies and randomized controlled trials comparing SEMS and ES.

CS can be strongly considered in the treatment of patients with advanced neoplastic disease with palliative intent, to avoid stoma and health care costs related to stoma.

REFERENCES

1. De Simone B, Catena F. Emergency Surgery for Colorectal Cancer in Patients Aged Over 90 Years: Review of the Recent Literature. *Journal of Tumor* 2015; **4(1)**: 349-353
2. Ansaloni L, Andersson RE, Bazzoli F, Catena F, Cennamo V, Di Saverio S, Fuccio L, Jeekel H, Leppäniemi A, Moore E, Pinna AD, Pisano M, Repici A, Sugarbaker PH, Tuech JJ. Guidelines in the management of obstructing cancer of the left colon: consensus conference of the world society of emergency surgery (WSES) and peritoneum and surgery (PnS) society. *World J Emerg Surg*. 2010 Dec 28; **5**: 29. [DOI: 10.1186/1749-7922-5-29]
3. Dohmoto M, Hünerbein M, Schlag PM.Application of rectal stents for palliation of obstructing rectosigmoid cancer. *Surg Endosc*. 1997 Jul; **11(7)**: 758-61. [PMID: 9214327]
4. Tejero E, Fernández-Lobato R, Mainar A, Montes C, Pinto I, Fernández L, Jorge E, Lozano R.Initial results of a new procedure for treatment of malignant obstruction of the left colon. *Dis Colon Rectum*. 1997 Apr; **40(4)**: 432-6, [PMID: 9106691]
5. Abdussamet Bozkurt M1, Gonenc M, Kapan S, Kocatasş A, Temizgönül B, Alis H. Colonic stent as bridge to surgery in patients with obstructive left-sided colon cancer. *JSLS*. 2014 Oct-Dec; **18(4)**. pii: e2014.00161. [DOI: 10.4293/JSLS.2014.00161]
6. Sirikurnpiboon S, Awapittaya B, Jivapaisarnpong P, Rattanachuek T, Wannaprasert J, Panpimarnmas S.Bridging metallic stent placement in acute obstructed left sided malignant colorectal cancer: optimal time for surgery. *J Med Assoc Thai*. 2014 Nov; 97 Suppl 11: S81-6. [PMID: 25509700]
7. Huang X, Lv B, Zhang S, Meng L.Preoperative colonic stents versus emergency surgery for acute left-sided malignant colonic obstruction: a meta-analysis. *J Gastrointest Surg*. 2014 Mar; **18(3)**: 584-91. [DOI: 10.1007/s11605-013-2344-9]. Epub 2013 Oct 30.
8. 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 obstructivecolorectal cancer: a meta-analysis. *Surg Endosc*. 2012 Jan; **26(1)**: 110-9. [DOI: 10.1007/s00464-011-1835-6]. Epub 2011 Jul 26. Review.
9. Cirocchi R, Farinella E, Trastulli S, Desiderio J, Listorti C, Boselli C, Parisi A, Noya G, Sagar J.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 Mar; **22(1)**: 14-21. [DOI: 10.1016/j.suronc.2012.10.003]. Epub 2012 Nov 24. Review.
10. De Ceglie A, Filiberti R, Baron TH, Ceppi M, Conio M. A meta-analysis of endoscopic stenting as bridge to surgery versus emergency surgery for left-sided colorectal cancer obstruction. *Crit Rev Oncol Hematol*. 2013 Nov; **88(2)**: 387-403. [DOI: 10.1016/j.critrevonc.2013.06.006]. Epub 2013 Jul 8. Review.
11. Xinopoulos D, Dimitroulopoulos D, Theodosopoulos T et al. Stenting or stoma creation for patients with inoperable malignant colonic obstructions? Results of a study and cost-effectiveness analysis. *Surgical Endoscopy and other Interventional techniques* 2004, **18(3)**: p.421-426, [PMID: 14735348]; [DOI: 10.1007/s00464-003-8109-x]
12. Targownik LE, Spiegel BM, Sack J, et Al. Colonic stent vs emergency surgery for management of acute left sided malignant colonic obstruction: a decision analysis. *Gastrointestinal Endoscopy* 2004, **60(6)**: p.865-874. [PMID: 15604999]
13. Maruthachalam K, Lash GE, Shenton BK, Horgan AF. Tumour cell dissemination following endoscopic stent insertion. *Br J Surg*. 2007 Sep; **94(9)**: 1151-4. [PMID: 17541987]; [DOI: 10.1002/bjs.5790]
14. Malgras B, BrulléL, Lo Dico R, El Marjou F, Robine S, Therwath A, Pocard M.Insertion of a Stent in Obstructive Colon Cancer Can Induce a Metastatic Process in an Experimental Murine Model. *Ann Surg Oncol*. 2015 Dec; **22 Suppl 3**: 1475-80. [DOI: 10.1245/s10434-015-4588-y]. Epub 2015 May 9.
15. van Hooft JE, Fockens P, Marinelli AW, Timmer R, van Berkel AM, Bossuyt PM, Bemelman WA; Dutch Colorectal Stent Group.Early closure of a multicenter randomized clinical trial of endoscopic stenting versus surgery for stage IV left-sided colorectal cancer. *Endoscopy*. 2008 Mar; **40(3)**: 184-91. [DOI: 10.1055/s-2007-995426]
16. van Hooft JE, Bemelman WA, Oldenburg B, Marinelli AW, Lutke Holzik MF, Grubben MJ, Sprangers MA, Dijkgraaf MG, Fockens P; collaborative Dutch Stent-In study group.Colonic stenting versus emergency surgery for acute left-sided malignant colonic obstruction: a multicentre randomised trial. *Lancet Oncol*. 2011 Apr; **12(4)**: 344-52. [DOI: 10.1016/S1470-2045(11)70035-3]
17. 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 Mar; **27(3)**: 355-62. [DOI: 10.1007/s00384-011-1331-4]. Epub 2011 Oct 28.

18. Alcántara M, Serra-Aracil X, Falcó J, Mora L, Bombardó J, Navarro S.Prospective, controlled, randomized study of intraoperative colonic lavage versus stent placement in obstructive left-sided colonic cancer. *World J Surg*. 2011 Aug; **35(8)**: 1904-10. [DOI: 10.1007/s00268-011-1139-y]
19. Pirlet 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. *Surg Endosc*. 2011 Jun; **25(6)**: 1814-21. [DOI: 10.1007/s00464-010-1471-6]. Epub 2010 Dec 18.
20. Sloothaak DA, van den Berg MW, Dijkgraaf MG, Fockens P, Tanis PJ, van Hooft JE, Bemelman WA; collaborative Dutch Stent-In study group.Oncological outcome of malignant colonic obstruction in the Dutch Stent-In 2 trial. *Br J Surg*. 2014 Dec; **101(13)**: 1751-7. [DOI: 10.1002/bjs.9645]. Epub 2014 Oct 9.
21. Anaraki F, Vafaie M, Behboo R, Maghsoodi N, Esmaeilpour S, Safaee A.Quality of life outcomes in patients living with stoma. *Indian J Palliat Care*. 2012 Sep; **18(3)**: 176-80. [DOI: 10.4103/0973-1075.105687].
22. Wong SK, Young PY1, Widder S1, Khadaroo RG2; Acute Care and Emergency Surgery (ACES) Group of the University of Alberta, Canada. A descriptive survey study on the effect of age on quality of life following stoma surgery. *Ostomy Wound Manage*. 2013 Dec; **59(12)**: 16-23.[PMID: 24334361]
23. Cennamo V, Fuccio L, Mutri V, Minardi ME, Eusebi LH, Ceroni L, Laterza L, Ansaloni L, Pinna AD, Salfi N, Martoni AA, Bazzoli F. Does stent placement for advanced colon cancer increase the risk of perforation during bevacizumab-based therapy? *Clin Gastroenterol Hepatol*. 2009 Nov; **7(11)**: 1174-6. [DOI: 10.1016/j.cgh.2009.07.015]. Epub 2009 Jul 22.
24. van Hooft JE, van Halsema EE, Vanbiervliet G, Beets-Tan RG, DeWitt JM, Donnellan F, Dumonceau JM, Glynne-Jones RG, Hassan C, Jiménez-Perez J, Meisner S, Muthusamy VR, Parker MC, Regimbeau JM, Sabbagh C, Sagar J, Tanis PJ, Vandervoort J, Webster GJ, Manes G, Barthet MA, Repici A; European Society of Gastrointestinal Endoscopy. Self-expandable metal stents for obstructing colonic and extracolonic cancer: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline. *Endoscopy*. 2014 Nov; **46(11)**: 990-1053. [DOI: 10.1055/s-0034-1390700]. Epub 2014 Oct 17.
25. Ferrada P, Patel MB, Poylin V, Bruns BR, Leichtle SW, Wydo S, Sultan S, Haut ER, Robinson B. Surgery or stenting for colonic obstruction: A practice management guideline from the Eastern Association for the Surgery of Trauma. *J Trauma Acute Care Surg*. 2016 Apr; **80(4)**: 659-64. [DOI: 10.1097/TA.0000000000000966].
26. Lee KJ, Kim SW, Kim TI, Lee JH, Lee BI, Keum B, Cheung DY, Yang CH; Stent Study Group of the Korean Society of Gastrointestinal Endoscopy. Evidence-based recommendations on colorectal stenting: a report from the stent study group of the korean society of gastrointestinal endoscopy. *Clin Endosc*. 2013 Jul; **46(4)**: 355-67. [DOI: 10.5946/ce.2013.46.4.355]. Epub 2013 Jul 31.
27. van Halsema EE, van Hooft JE, Small AJ, Baron TH, García-Cano J, Cheon JH, Lee MS, Kwon SH, Mucci-Hennekinne S, Fockens P, Dijkgraaf MG, Repici A.Perforation in colorectal stenting: a meta-analysis and a search for risk factors. *Gastrointest Endosc*. 2014 Jun; **79(6)**: 970-82.e7; quiz 983.e2, 983.e5. [DOI: 10.1016/j.gie.2013.11.038]. Epub 2014 Mar 18. Review.
28. Kim EJ, Kim YJ.Stents for colorectal obstruction: Past, present, and future. *World J Gastroenterol*. 2016 Jan 14; **22(2)**: 842-52. [DOI: 10.3748/wjg.v22.i2.842]. Review.
29. Geraghty J1, Sarkar S, Cox T, Lal S, Willert R, Ramesh J, Bodger K, Carlson GL Management of large bowel obstruction with self-expanding metal stents. A multicentre retrospective study of factors determining outcome. *Colorectal Dis*. 2014 Jun; **16(6)**: 476-83. [DOI: 10.1111/codi.12582]
30. Gianotti L, Tamini N, Nespoli L, Rota M, Bolzonaro E, Frego R, Redaelli A, Antolini L, Ardito A, Nespoli A, Dinelli M. 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. *Surg Endosc*. 2013 Mar; **27(3)**: 832-42. [DOI: 10.1007/s00464-012-2520-0]. Epub 2012 Oct 6.
31. Mehmood RK1, Parker J1, Kirkbride P1, Ahmed S1, Akbar F1, Qasem E1, Zeeshan M1, Jehangir E1. Outcomes after stenting for malignant large bowel obstruction without radiologist support. *World J Gastroenterol*. 2014 May 28; **20(20)**: 6309-13. [DOI: 10.3748/wjg.v20.i20.6309]
32. Boyle DJ, Thorn C, Saini A, Elton C, Atkin GK, Mitchell IC, Lotzof K, Marcus A Predictive factors for successful colonic stenting in acute large-bowel obstruction: a 15-year cohort analysis. *Dis Colon Rectum*. 2015 Mar; **58(3)**: 358-62. [DOI: 10.1097/DCR.0000000000000243]. [PMID: 25664716]
33. Imbulgoda A, MacLean A, Heine J, Drolet S, Vickers MM. Colonic perforation with intraluminal stents and bevacizumab in advanced colorectal cancer: retrospective case series and literature review. *Can J Surg*. 2015 Jun; **58(3)**: 167-71. [PMID: 25799132]; [PMCID: PMC4447509]
34. Matsuda A, Miyashita M, Matsumoto S, Matsutani T, Sakurazawa N, Takahashi G, Kishi T, Uchida E. Comparison of long-term outcomes of colonic stent as "bridge to surgery" and emergency surgery for malignant large-bowel obstruction: a meta-analysis. *Ann Surg Oncol*. 2015 Feb; **22(2)**: 497-504. [DOI: 10.1245/s10434-014-3997-7]. Epub 2014 Aug 14.
35. Kavanagh DO, Nolan B, Judge C, Hyland JM, Mulcahy HE, O'Connell PR, Winter DC, Doherty GA. A comparative study of short- and medium-term outcomes comparing emergent surgery and stenting as a bridge to surgery in patients with acute malignant colonic obstruction. *Dis Colon Rectum*. 2013 Apr; **56(4)**: 433-40. [DOI: 10.1097/DCR.0b013e3182760506]
36. Gorissen KJ1, Tuynman JB, Fryer E, Wang L, Uberoi R, Jones OM, Cunningham C, Lindsey I.Local recurrence after stenting for obstructing left-sided colonic cancer. *Br J Surg*. 2013 Dec; **100(13)**: 1805-9. [DOI: 10.1002/bjs.9297]
37. Sabbagh C, Browet F, Diouf M, Cosse C, Brehant O, Bartoli E, Mauvais F, Chauffert B, Dupas JL, Nguyen-Khac E, Regimbeau JM.Is stenting as "a bridge to surgery" an oncologically safe strategy for the management of acute, left-sided, malignant, colonic obstruction? A comparative study with a propensity score analysis. *Ann Surg*. 2013 Jul; **258(1)**: 107-15. [DOI: 10.1097/SLA.0b013e31827e30ce]
38. Sabbagh C, Chatelain D, Trouillet N, Mauvais F, Bendjaballah S, Browet F, Regimbeau JM.Does use of a metallic colon stent as a bridge to surgery modify the pathology data in patients with colonic obstruction? A case-matched study. *Surg Endosc*. 2013 Oct; **27(10)**: 3622-31. [DOI: 10.1007/s00464-013-2934-3]. Epub 2013 Apr 10.
39. Knight AL, Trompetas V, Saunders MP, Anderson HJ.Does stenting of left-sided colorectal cancer as a "bridge to surgery" adversely affect oncological outcomes? A comparison with non-obstructing elective left-sided colonic resections. *Int J Colorectal Dis*. 2012 Nov; **27(11)**: 1509-14. [DOI: 10.1007/s00384-012-1513-8]. Epub 2012 Jun 9.
40. Park SJ, Lee KY, Kwon SH, Lee SH. Stenting as a Bridge to Surgery for Obstructive Colon Cancer: Does It Have Surgical Merit or Oncologic Demerit? *Ann Surg Oncol*. 2016 Mar; **23(3)**: 842-8. [DOI: 10.1245/s10434-015-4897-1]. Epub 2015 Dec 14.
41. Kim HJ, Huh JW, Kang WS, Kim CH, Lim SW, Joo YE, Kim HR, Kim YJ. Oncologic safety of stent as bridge to surgery compared to emergency radical surgery for left-sided colorectal cancer obstruction. *Surg Endosc*. 2013 Sep; **27(9)**: 3121-8. [DOI:

10.1007/s00464-013-2865-z]. Epub 2013 Feb 23.

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