

Colonic stent placement as a bridge to surgery in patients with left-sided malignant large bowel obstruction. An observational study

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SUMMARY: Colonic stent placement as a bridge to surgery in patients with left-sided malignant large bowel obstruction. An observational study.

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Background. Acute left-sided malignant colonic obstruction is common in elderly patients, in which emergency surgery is related with high morbidity and mortality rates, and often necessitates a two-step resection. Although the use of self-expanding metallic stents (SEMS) in elderly patients has not been adequately described yet, there are almost two international important trials which are still in progress, the stenting technique is established to be, by the international literature, an useful treatment with low morbidity and mortality. It's also a bridge to surgery, since the insertion of a SEMS can decompress the obstruction, making bowel and patient preparation possible and facilitating single-stage surgical resection. Palliative stenting can improve quality of life when compared to surgery in patients with metastasis or high co-morbidity.

The aim of this study is to analyze mortality, avoidance of stoma, short- and long-term survival in patient with malignant left-sided large bowel obstruction who underwent to stent placement in our Emergency Surgery Unit, which is operative since November 2010 in our city Hospital in Ferrara.

Patients and methods. Between November 2010 and December 2012 a total of 15 patients with acute left-sided malignant large bowel obstruction suitable for colonic stent application were admitted to

Emergency Surgery Unit. Among these patients, 9 underwent to self-expanding metallic stent placement (group A), the other (group B) 6 patient underwent to emergency surgery.

In this observational not-randomized study we analyzed the efficacy and safety of SEMS placement for patients either as a bridge to surgery or as a palliation, beside the short term and long term outcomes, versus those patients operated straight.

Results. Self-expanding metallic stents were successfully implanted in 9 of the 15 patients with acute left-sided malignant large bowel obstruction. No acute procedure-related complication was observed. All the patients in group A kept the stent in place for an average of 7,7 days, then everyone underwent to surgery. A large bowel resection with one-time recanalization was performed in 8 of the 9 patients. None Hartmann resection was necessary. Only one underwent again to surgery because of a dehiscence, a stoma was necessary.

Between the other 6 patients in group B who underwent directly to surgery, In one case was necessary an Hartmann resection, another one incurred in dehiscence of the anastomosis that required reoperation with stoma creation.

Conclusions. Placement of SEMS seems to be an useful alternative to emergent surgery in the management of acute left-sided bowel obstruction, both as a bridge to surgery and as a palliative procedure. SEMS can provide an effective and safe therapeutic option compared to emergency surgery, most of all in elderly patients, with a lower mortality rate, a significantly higher rate of primary anastomosis and the avoidance of stoma.

However, to fully determine their role for these indications, more data and more high level evidence is required.

KEY WORDS: Colorectal cancer - Large bowel obstruction - Stent placement - Bridge to surgery.

Introduction

Colorectal cancer is among the most common malignant disease, with a global incidence of 1 million new cases per year, ranking fourth in frequency in men and

third in women, with mortality of about 529,000 deaths (1).

There are over 300,000 new cases of colorectal cancers diagnosed annually in the western countries, of which 150,000 die each year (2).

In particular Colorectal cancer (CRC) is the most common cancer in Europe with a mortality rate of almost 50%. In 2008, there were an estimated 436,000 new cases of CRC and 212,000 deaths (3).

In the United States currently, one in 3 women and one in 2 men in the will develop cancer in his or her lifetime. Increases in the number of individuals diagnosed

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with cancer each year, due in large part to aging and growth of the population, as well as improving survival rates, have led to an ever-increasing number of cancer survivors (4).

The prognosis of patients with CRC is largely influenced by the clinical and pathological stage at the time of diagnosis (3).

It has been estimated that 7-29% of patients with colorectal cancer present with near or complete bowel obstruction (1, 2, 5, 6) and patients presenting with obstruction tend to have more advanced disease, since several studies have shown that bowel obstruction negatively influences the outcome of affected patients who survive the postoperative period, when compared to those without obstruction (2). In fact acute colonic obstruction that leads to emergency surgery is frequently followed by severe complications such as dehiscence of the anastomosis, surgical site infection, venous thrombosis and so on (7).

Large bowel obstruction constitutes an acute surgical emergency in 85% of cases (5, 8, 9). High morbidity and mortality rates have been reported following primary resection and anastomosis in emergency conditions, moreover curative resection is not feasible in up to 30% of patients who present with malignant colonic obstruction due to extensive local tumor infiltration, distant metastasis and severe comorbidity (2). Since up to three-quarters of colonic tumors are situated in the left colon (5, 6, 10), conventional therapies for relieving a malignant colorectal obstruction include surgical resection or Hartmann procedure and loop colostomy (1, 6).

Resection is ideally carried out as a single stage-procedure, with anastomosis to restore bowel continuity (1), but especially elderly patients with multiple comorbidity who undergo to emergency surgery often necessitate a two-step resection (11).

A significant proportion of patients (up to 50%) receiving a staged procedure never undergo reversal of the colostomy (1, 6, 9, 12). Studies have shown that the reversal of Hartmann's Procedure alone has a morbidity rate of 20% and mortality of 1-6% (13). In the emergency setting, surgery carries a high mortality rate from 3% to 45% compared to 0,9%-6% in elective surgery for CRC (7), high morbidity (45-50%) risk with increased prevalence of intensive care stay, infections and complications related to stomas (1, 2, 6), and preoperative study of the patient is not possible (7), including also increased anesthetic risk because of inadequate time to optimize patient before operation (14).

Furthermore, even after adjustment for the TNM stage, survival rate is significantly lower after emergency surgery compared with elective procedures (7).

Worldwide the population is aging, with an ever increasing number of people developing cancer. This means that the number of elderly cancer patients requiring treat-

ment is increasing, in fact in Western countries, more than 60% of new cancer cases and 70% of cancer deaths occur in people over the age of 65 years (15).

In 1991 Dohmoto et al. first described the use of self-expanding metallic stents (SEMS) (5, 6, 16-18), and pioneered in the performing the first stent insertion for palliation in a malignant rectal obstruction, and a few years later Tejero et al. were the first to report two cases of colonic stenting before elective surgery (12). Since then the technique has been widely applied in the management of acute left-sided bowel obstruction. Thereafter, a number of studies have shown that stent placement before elective surgery is a relatively simple and safe alternative to conventional surgical management of malignant obstruction of the left colon (6).

The use of SEMS has been described in two main settings: first, SEMS may be used to palliate symptoms of bowel obstruction in patients with metastatic cancer or those unfit for major surgery, thus avoiding the requirement for a stoma. Second, the use of SEMS has been advocated as a "bridge to surgery", permitting a period of "optimization" of the patients' general medical condition, improving their nutritional state and facilitating surgery on an elective basis (5), on a properly assessed patient with prepared bowel, and possibly lower peri-operative complications and improved survival (14).

Supporters of use of SEMS as a bridge to surgery cite elective single-stage colonic resection providing major advantage by avoiding the need for a stoma. In both settings, successful deployment of SEMS result in decompression of the colon, so avoiding emergency operation in a sick patient with associated morbidity and mortality.

However, the use of SEMS is becoming popular, there are no randomized trials to substantiate these claims and few published data on stent-associated morbidity (5), since there are two big ongoing trials in Holland and Sweden, at the moment stenting as a bridge to surgery seems to be an effective and safe option to emergency surgical resection for the treatment for malignant colorectal obstruction (14).

Instead a recent statement position by the Association of Coloproctology of Great Britain and Ireland underlined that colorectal stenting is the single procedure that makes the biggest difference in the management of acute left-sided colonic obstruction either for palliation or as a bridge to surgery (12).

In the last Consensus Conference of the World Society of Emergency Surgery (WSES) and Peritoneum and Surgery Society (PnS), which took place in Bologna in July 2011, were summarized guide lines for treatment of left-sided colonic stenosing tumor:

- Primary resection and one-stage anastomosis with manual colonic decompression (segmental resection, total or sub-total colectomy in those cases with con-

temporary diastatic perforation of the right bowel and/or synchronous neoplasms);

- Hartmann resection with left stoma (in those cases with high risk for dehiscence of the anastomosis);
- SEMS placement for palliation or decompression as bridge to surgery (18).

Colorectal stenting is a relatively low-risk procedure with a mortality rate of less than 1% (10).

However stenting practice does have potential complications including perforation, stent migration, hemorrhage and re-obstruction (6, 8, 17).

The complications are mainly divided in early (within 30 days from the stent placement) and delayed (after 30 days). The early ones include essentially perforation and bleeding. The late ones are due to tumor ingrowth, with consequent re-obstruction, and migration of the device, rarely perforation (10, 18).

Perforation is the most serious consequence associated with stent placement. It may occur early at the time of placement related to balloon predilatation, excessive manipulation of the guidewire, rapid expansion of the stent or a closed loop obstruction with subsequent cecal distension from excessive air insufflation. Perforation may also occur as a late complication resulting from stent erosion through the bowel wall or chemotherapy.

Migration occurs in among 10% of cases, of which in 26% within 3 days from insertion. Stent typically migrate distally and usually pass spontaneously through the anus. The use of covered stent, pre-stenting dilation and small diameter increase the risk of migration. Partial migration can be managed by placement of a second overlapping stent.

The review by Watt et al. reported a re-obstruction rate of 12%, occurring from 48 hours to 480 days. It usually occurs when stents are placed for palliation, and the main cause in tumor ingrowth, less common causes includes stent migration, tumor overgrowth and fecal impaction (17).

Overall perforation can lead tumor dissemination, changing a potentially treatable cancer to incurable (8). In theory SEMS insertion is an endoscopic procedure that could have deleterious effects on both tumor development and metastasis, and thus the effect of SEMS on the long-term outcome of those patients whose disease is potentially curable is still unclear (6).

Devices

The early experience of colorectal stent placement involved use of stents initially designed for other locations (esophagus and tracheo-bronchial site) (10). More recently, dedicated colonic stents have been manufactured because of the increasing recognition of their role in the preoperative and palliative management of colorectal can-

cer (17). The first prototype nitinol stent specifically designed for colonic lesion was created in 1988, then developed and tested in a prospective trial by the Leuven group (10, 19) SEMS are made of a stainless steel, Elgiloy, an alloy of cobalt, nickel, chromium or Nitinol strut matrix, capable of exerting high radial forces (17) and may be uncovered or covered with polyurethane, polyethylene or silicone coating to resist tumor invasion and tissue ingrowth (12). Nowadays the most of the SEMS are made of Nitinol, an alloy of nickel and titanium, which increases stent's flexibility, necessary feature to expand uniformly very angulated stenosis, without apply an excessive radial force. Moreover it has the property of maintaining an elastic memory of its shape at a given temperature (20).

Both covered and uncovered stents have advantages and disadvantages. Uncovered stents have a lower risk for migration, but there can be tumor invasion within the metallic meshes, with the result of a re-occlusion. Vice versa the covered stents can prevent tumor ingrowth, but they hold higher risk for migration (18).

The diameter is between 20 and 25 mm, larger diameter helps to prevent fecal occlusion and some stents have a proximal flare, of 25-30 mm, to prevent migration (17).

Indications for colorectal stent placement should be defined after a thorough evaluation of baseline clinical and radiological data, with a multidisciplinary team of radiologists, surgeons and endoscopists (10). A computed tomography (CT) scan is prior to stent placement to rule out a perforation, to assess the degree of obstruction and the stage of disease (17), as well as detection of any extraluminal spread or metastasis of the disease (10).

Once evaluation is completed the main indications for colonic stenting in malignant colorectal obstruction are:

- 1) preoperative colonic decompression before colonic resection (the so called bridge to surgery);
- 2) palliation of obstructing tumors not suitable for curative surgical resection (10);
- 3) aged patients;
- 4) poor general conditions and severe cardiopulmonary diseases associated (21).

Absolute contraindications to colorectal stenting are:

- 1) perforation documented with free intraperitoneal gas;
- 2) very distal rectal lesions with a healthy margin of tissue less than 3-4 cm from the anal sphincter;
- 3) peritoneal carcinomatosis (10)

(Relative contraindications are uncorrectable coagulopathy and prolonged bleeding).

In conclusion, according to data available at this moment, the SEMS acts as a "bridge to surgery" by allowing conversion of an emergency procedure to a semi-elective one, permitting improvement of the physiological state of the patient and a better staging of the disease (16).

Patients and methods

In 2010 began the activity of the Emergency Surgery Unit at St. Anna Hospital of Ferrara. In a two-year period from November 2010 and December 2012, were admitted to our department 15 patients with diagnosis of left-sided bowel obstruction of neoplastic origin, with the necessary requirements *to be candidates* for endoscopic placement of self-expandable metallic stent.

We conducted a non-randomized observational study evaluating the clinical, pathological aspects and clinical outcome after surgical colonic stent placement as a “bridge to surgery” and/or colectomy for cancer in one-shot in emergency regime.

The present study examines our experience among two groups of patients: a selected group of 9 patients (group A) underwent to single-step surgical resection, after solving the acute phase of the occlusive disease by endoscopic placement of SEMS through the neoplastic stenosis; group B consists of 6 patients who underwent surgery in emergency, without stent insertion, for various reasons, including the difficulties in planning and organizing procedures for endoscopic placement of SEMS in urgency for public holidays or at night, and sometimes the lack of ready availability of self-expandable stents within the hospital.

Although these patients also satisfied the conditions required and were suitable for colonic stent placement, in reason of the critical clinical condition it was not possible waiting until the first useful day or until the delivery of the prosthesis required, so it was necessary proceed straight to surgery.

Results

In our study, nine patients in group A underwent to SEMS placement, 8 men (88.9%) and one woman (11.1%), aged between 68 and 88 years old, with a mean age of 73.8 years at the time of diagnosis of bowel obstruction.

In all patients the diagnosis was made with instrumental exams (plain abdominal X-ray and CT abdomen with and without contrast), which highlighted the neoplastic cause of the occlusion, the specific colic location and the presence of extra-intestinal dissemination [at the time of diagnosis 2 patients (20%) had multiple liver metastases].

Presenting symptoms included constipation for more than 72 hours (on average between 3 and 7 days in one case of worsening constipation 3 months) in 7 of 9 patients (77.7%).

One patient (11%) was channeled with liquid stool and another patient (11%) had paradoxal canalization after evacuating enema.

Abdominal pain and distension were observed in all patients.

Four patients reported vomiting (44.4%), one nausea. Other symptoms included anorexia for a few weeks in 4 patients (44.4%), associated in 3 cases (33.3%) with weight loss between 3 and 10 kg in a period from 1 week to 3 months. Two patients presented anemia (22.2%), one patient fever (11%) and one ascites. These clinical manifestations are likely due to the evolution of neoplastic disease.

The site of occlusion was more frequently observed at the sigma-rectum junction in 3 patients (33.3%), in 2 patients in the descending colon, at the passage of the left colon with sigma in 2 cases and sigma in the remaining 2 cases.

Stent placement by endoscopy was performed the same day of admission at the Department of Emergency Surgery in 2 patients, 6 patients the day after and one patient after 4 days of hospitalization.

None immediate or short-term stent placing procedure-related complication was recorded.

In one case migration of the endoprosthesis occurred during positioning, readily replaced by the Endoscopist who was performing the procedure.

In all patients the bowel movements were immediate, or within 24 hours.

All patients were then submitted to X-ray control 24-36 hours after the stent placement to check for the complete opening of the prosthesis and its correct positioning straddle the stenosis (Fig. 1).

All the patients maintained the stent in place between 4 and 10 days, with a mean of 7.4 days elapsed between the device positioning and surgery.

All the 9 patients underwent to laparotomic surgery (Fig. 2), in which it was possible to perform a colonic resection with single-time recanalization in 8 cases out of 9. No case required an Hartmann resection. Any mortality or postoperative morbidity was recorded.

The most frequent surgical procedure was a left hemicolectomy, performed in 6 cases (66.6%).

In two patients we performed an anterior resection of the rectum, in one patient a total colectomy with terminal ileostomy packaging, since the entire large bowel mucosa appeared ischemic and the cecum was perforated. The surgical procedures took between 160 and 250 minutes, with an average of 178 minutes, quite comparable to the same timings performed in election (Fig. 3).

One of the nine patients underwent surgery presented intraoperative complications (cardiac arrest in previous acute myocardial infarction).

Among the short-term complications in one case occurred dehiscence of the anastomosis in the ninth postoperative day, which required re-intervention with colostomy packaging.

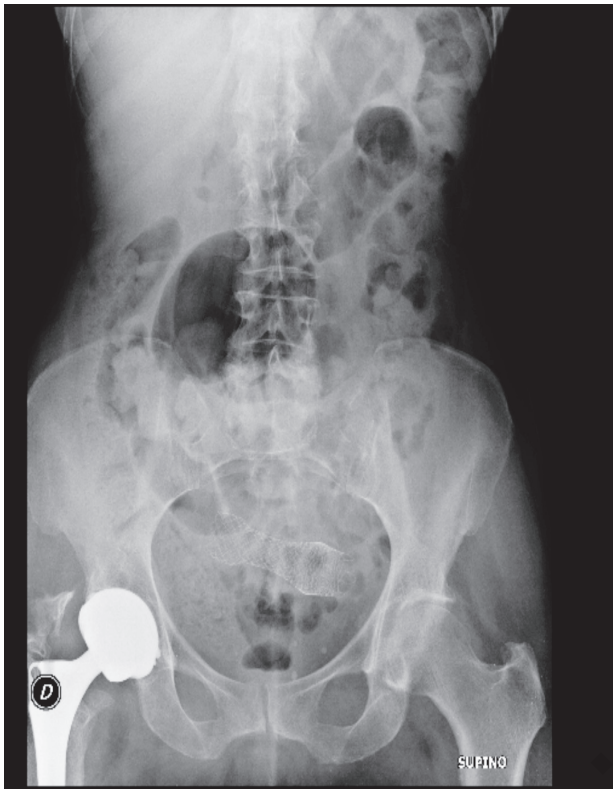


Fig. 1 - X-ray control 24-36 hours after stent placement.

Two patients reported mild anemia treated with transfusion therapy, a patient reported an episode of melena and two patients pyrexia between the second and third postoperative day.

Two patients required a short period of observation at the Intensive Care for stabilization and hemodynamic monitoring.

The post-operative evacuation occurred for the nine patients between the second and the thirteenth day (on average in 5.4 day). Beside canalization, the patients re-started feeding between third and tenth postoperative days, in average five days after surgery.

The average hospital stay was 22.7 days.

At the end of the therapeutic way 8 of 9 patients went back to their own home, a single patient went in a long-term care hospital.

Pathology of the surgical specimens showed that four patient had a cancer staging T3 No, one of these already had liver metastasis at the time of occlusion; the other patient with metastasis had an histological staging T3 N1. Between the other patients one had a T3 N2, one T4 No, two T4a with respectively N1 and N2.

As long-term complications 1 patient was hospitalized again after 15 months for the upturn of the neoplastic disease elsewhere.

The 6 patients in group B, underwent to surgery in emergency, the main cause of failure of metallic stent



Fig. 2 - Colonic obstruction.

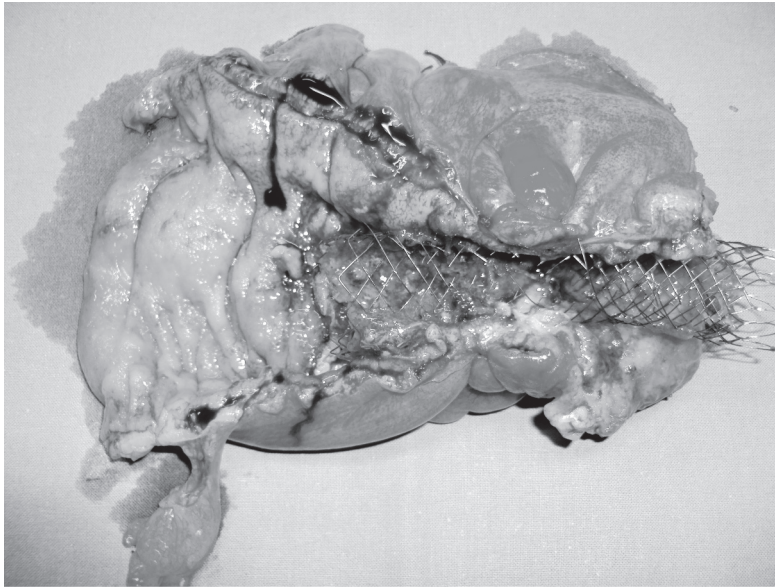


Fig. 3 - Surgical specimen.

placement was their access to the hospital, and then at the Department of Emergency Surgery, during public holidays or at night; for this reason it wasn't possible performing the endoscopic procedure, neither waiting until the next working day because of the critical clinical condition of the patients.

These patients were six men and one woman, aged between 62 and 84 years (mean 72), who presented with an occlusive cancer of the descending colon, similar to the patients in group A. In these patients the diagnosis was made as well through instrumental tests such as plain abdominal X-ray and CT abdomen with and without contrast medium.

All the patients underwent emergency surgery: sigmoidectomy was performed in 3 cases and left hemicolectomy in 2 cases, all with immediate restoration of intestinal continuity. In one case it was necessary to perform an Hartmann resection. In one case occurred intestinal anastomotic dehiscence, in the sixth post-operative day, which required re-intervention and colostomy packaging (as the patient in group A).

In group B, the postoperative bowel movements were observed between the third and ninth day (on average 5.8 day), the re-feeding on average in the sixth day; results are quite similar to those for patients belonging to group A.

The average hospital stay was 11.5 days (lower than patients who underwent colonic stenting and deferred surgery).

Four of the 6 patients went back home, 2 went to long-term care.

At the moment there is no news of further admissions relevant to the clinical-surgical basis.

In conclusion, our experience, although limited to

nine cases, demonstrates the effectiveness of self-expandable colonic stent placement in acute neoplastic left-sided large bowel occlusions, in line with data reported by various Authors in the international literature.

In our study, in none of the patients underwent surgery after stent placement was necessary to perform an Hartmann resection, whereas between patients operated straight in emergency was performed in one case.

The most serious complication, the anastomotic dehiscence, was observed equally in both groups of patients (then required packaging of colostomy).

The method of positioning metallic endoprotheses, burdened with a low complication rate, is a valid alternative to the emergency surgery, which involves high risk of colostomy. It also gives the surgeon the opportunity to study the patient and stabilize the general clinical conditions in order to perform, where permitted by the disease's stage, a bowel resection with primary anastomosis in conditions close to the election. It also offers the possibility to choose for a definitive palliative treatment in case of advanced malignancy, allowing the patient a better quality of life in the absence of stoma.

Despite the results are quite similar in two groups, the risk of an Hartmann procedure in not-stented group is higher, and exposes the surgeon to a more difficult operation in the attempt to avoid, however, the stoma.

Conclusions

Over the past 20 years, SEMS have become a prime example of the possibility of intervening on the basis of acute malignant bowel obstruction, especially in the left colon, effectively particularly in emergency situations that

require immediate surgery, timeless to study the patient in detail. With the introduction and increasing use of SEMS in the management of clinical-surgical acute phase, it is possible to avoid, where conditions allow it, to perform surgery in emergency, which, as recognized by the international literature, could lead to serious sequelae for the patient, with a high incidence of mortality and morbidity. Especially in elderly patients with clinical conditions or precarious, the use of SEMS for palliation in advanced lesions, or for decompressive purposes in resectable lesions waiting for repair under semi-elective treatment, very often avoids the necessity of operating in two stages, which often hesitate in the permanence of a definitive colostomy.

The use of SEMS in the acute phase allows for a rapid and effective decompression of the intestine, allowing medical staff to stabilize the patient's clinical conditions, often critical in the acute phase of the bowel ob-

struction, to study in detail the general framework by clinical and instrumental tests, in order to perform surgery under conditions very close to election. These better operative conditions dramatically reduces the mortality/morbidity and perioperative complications, especially allowing the surgeon to run a single time surgical resection and immediate recanalization avoiding, in most cases the packaging of a colostomy. In this way it aims to achieve a better surgical outcome with faster recovery of patient autonomy, even in the elderly, with a better quality of life in the absence of stoma.

This is our hope with regard to the multicentric ongoing trials future results.

Disclosure

The authors declare that they have no conflict of interest.

References

1. Soren Meisner, Ferran Gonzalez-Huix, et al. Self-expandable metal stents for relieving malignant colorectal obstruction: short term safety and efficacy within 30 days of stent procedure in 447 patients. *Gastrointestinal Endoscopy*. 2011;74(4).
2. Shaji S, Johnston S, et al. Pooled Analysis of the Efficacy and Safety of Self-Expanding Metal Stenting in Malignant Colorectal obstruction. *Am J of Gastroenterol*. 2004;99:2051-2057.
3. Stegeman I, de Wijkerslooth TR, Mallant-Hent RC, et al. Implementation of population screening for colorectal cancer by repeated Fecal Immunochemical Test (FIT): third round. *BMC Gastroenterol*. 2012;12:73.
4. Siegel R, DeSantis C, et al. Cancer Treatment and Survivorship Statistics, 2012. *Cancer J Clin*. 2012;62:220-24.
5. Mackay CD, Craig W, et al. Self-expanding metallic stents for large bowel obstruction. *British J of Surgery*. 2011;98:1625-1629.
6. Yi Zhang, Jian Shi, et al. Self-expanding metallic stent as a bridge to surgery versus emergency surgery for obstructive colorectal cancer: a meta-analysis. *Surg Endosc*. 26 July 2011.
7. Olmi S, Scaini A, et al. Acute colonic obstruction: endoscopic stenting and laparoscopic resection. *Surg Endosc*. 2007;21:2100-2104.
8. Blake P, Delicata R, et al. Large bowel obstruction due to colorectal carcinoma can be safely treated by colonic stent insertion - case series from UK district general hospital. *Colorectal Dis*. 2012 Mar 24.
9. Jiménez-Peréz J, et al. Colonic Stenting as a Bridge to surgery in Malignant Large-Bowel Obstruction: a report from two large Multinational Registries. *The Am J of Gastroenterology*. 2011;106:2174-2180.
10. Repici A, de Paula Pessoa Ferreira D. Expandable metal stents for malignant colorectal strictures. *Gastrointest Endoscopi Clin N Am*. 2011;21:511-533.
11. Tilney HS, Lovegrove RE, et al. Comparison of colonic stenting and open surgery for malignant large bowel obstruction. *Surg Endosc*. 2007;21(2):225-33. Epub 2006 Dec 9.
12. Katsanos K, Sabharwal T, Adam A. Stenting of the lower Gastrointestinal tract: Current status. *Cardiovasc Intervent Radiol*. 2011;34:462-473.
13. Thornell A, et al. Treatment of acute diverticulitis laparoscopic lavage vs. resection (DILALA): study protocol for a randomised controlled trial. *Trials*. 2011;12:186.
14. Kok-Sun Ho, et al. Endoscopic stenting and elective surgery versus emergency surgery for left-sided malignant colonic obstruction: a prospective randomized trial. *Int J Colorectal Dis*. Oct 2011.
15. Ming-Gao Guo, Yi Feng, et al. Comparison of Self-Expanding Metal Stents and Urgent Surgery for left-sided malignant colonic Obstruction in elderly patients. *Dig Dis Sci*. 27 March 2011. DOI 10.1007/s 10620-011-1648-4.
16. Foo CC, Poon JTC, Law WL. Self-expanding metallic stent for acute left-sided large bowel obstruction: a review of 130 patients. *The Association of Coloproctology of GB and Ireland*. 2011;13:519-554.
17. Donnellan F, Moosavi S, Byrne MF. Colonic stenting in 2011. *Minerva Gastroenterol Dietol*. 2011;57:193-204.
18. Tommasi C, Naspetti R. Cosa fare se il paziente presenta una stenosi maligna complessa del colon? *Giorn Ital End Dig*. 2011;34:221-224.
19. Tack J, Gevers AM, Rutgeerts P. Self-expandable metallic stents in the palliation of rectosigmoidal carcinoma: a follow-up study. *Gastrointest Endosc*. 1998;48:267-271.
20. Repici A, de Paula Pessoa Ferreira D, Carlino A. Le protesi coloretali. *Giorn Ital End Dig*. 2010;33:127-133.
21. Montini F, Cinquesanti L, et al. L'impiego di protesi autoespandibili nel trattamento delle occlusioni neoplastiche del colon sinistro: la nostra esperienza. *Ann Ital Chir*. 2007;78:217-219.