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Original article

Palliation of inoperable malignant colonic obstruction. Comparison and cost effectiveness analysis between stent placement and stoma creation

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SUMMARY

Aim: Comparison of efficacy, safety and cost of palliative endoscopic treatment with auto-expanding metal stents with the stoma creation in the management of patients with inoperable malignant colonic obstructions. Method: Thirty patients with inoperable (metastases, hemodynamic or pulmonary instability) malignant partial obstruction in the left colon due to colorectal or ovarian cancer were included in the study. Fifteen were randomized to undergo palliative metallic colonic stent placement and 15 to undergo stoma creation. The efficacy and safety of each method was compared and cost-effectiveness analysis was performed, including the cost of post-interventional care. Results: Stents were placed successfully in 14 of 15 patients. In one case with obstruction of a tortuous rectosigmoid flexure, colon stenting was not possible. The patient was excluded from the study. During follow up, a moderate nonocclusive ingrowth of tumor into the stent lumen was observed in 6 patients, who were treated with introspective laser application. The performed cost-effectiveness analysis showed that although the stoma creation procedure was less expensive, the total average difference in cost between the two methods was 6.9% (132 Euros). Conclusions: Self-expanding metallic stent placement is a palliative method, alternative to colostomy, for patients with inoperable malignant colonic strictures, which additionally provides a better quality of life without the psychological repercussions of a colostomy and appears to be cost-effective.

Key words: Self-expanding metal stents, Inoperable malignant colonic obstructions, Cost-effectiveness analysis, Colostomy

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INTRODUCTION

Colorectal cancer (CRC) is an extremely common malignant condition with high incidence and mortality rates. According to the World Health Organization, worldwide there are more than 800,000 newly diagnosed cases of CRC with an overall mortality of more than 500,000 each year.[1]

In 10% to 20% of all cases, partial colonic obstruction will develop and complete obstruction occurs in an additional 8 to 29%.[2,3]

In 75% of cases, the neoplasm are located in the left side of the colon and the rectosigmoid region, areas that are easily reached by endoscopy.[4]

The management of patients with colonic obstructions is, in general, a surgical procedure in two stages. Colostomy, the first stage of this approach, provides immediate relief of obstruction. The second stage, in patients with resectable tumors, includes the resection of the neoplastic lesion.

Unfortunately, at the time of diagnosis CRC causing obstruction tends to be at an advanced stage. Only 50% of patients are candidates for curative surgery.[5] The vast majority have Dukes C lesions, 40% have Dukes D disease and many have direct extension into other

structures.[6] The median survival with advanced disease is measurable in months.[7] The poor general medical condition (severe comorbidity, dehydration, electrolyte imbalance) and the advanced age of this group of patients create a population with a very high operative risk, and adversely influence prognosis.[8,9] For patients who are not candidates for resection, a permanent stoma may be the only therapeutic option.

On the other hand, several endoscopic techniques, alternatives to colostomy, that do not involve surgery have been described for these cases, such as bougienage, scope or balloon dilation, electrocoagulation, photodynamic therapy, laser pthotocoagulation and stenting.[10-15]

Most of these methods are applicable only to distal rectal tumors, each one of them may require repeating to maintain luminal patency, and their efficacy rates range between 56 and 72%.[16]

The overall experience of colorectal stenting is still limited, less than 600 metal endoprostheses had been placed worldwide by 2002, but high rates of safety and effectiveness were reported (85% and 90% respectively).[17,18] Although it is not a new technique, stenting has rarely been performed as a palliation, perhaps because of its relatively high cost.[19,20]

MATERIAL AND METHODS

Patients

Thirty patients, 16 men and 14 women (mean age 72.4 years, range 64 to 87 years) with partial inoperable malignant colonic obstruction, admitted to the Department of Gastroenterology and the First Department of Surgical Oncology, "Saint Savvas" Cancer Hospital, Athens, Greece, from March 1998 to April 2002, and after giving informed consent, were included in the study. The study protocol was approved by the hospital ethics committee.

In all cases the malignancy was confirmed histologically. The etiology of stenoses was colorectal adenocarcinoma (24 patients) and ovarian cancer (6 patients). The site of obstruction was in the rectosigmoid (18 patients) and sigmoid colon (12 patients). The length of stenoses was revealed endoscopically or with barium enema examination and ranged between 3 and 6 cm (mean 4.2 cm). All patients had greater than 70% colonic narrowing and none had evidence of perforation or fistula. In all cases the tumor was considered non-resectable: 19 patients had confirmed multiple metastases in the liver, lungs, bones and brain and 11 were unable to undergo surgery due to serious hemodynamic or pulmonary instability.

Fifteen patients (9 men and 6 women) were randomized in a 1:1 ratio and a double-blind manner to undergo metallic colonic stent placement and 15 (7 men, 8 women) to undergo colostomy.

In all cases, stent placement or colostomy were considered the definitive palliative treatment of colonic obstruction.

Technique

a) Stenting: No oral bowel preparation was performed to avoid exacerbation of the intestinal obstruction. All patients were given colonic cleansing. Sedatives (Midazolam) and analgesics (Pethidine) were administered intravenously and no general anesthesia was required. Vital signs were monitored by means of continuous pulse oximetry and blood pressure measurement every 5 minutes.

Barium enema examination revealed the precise location and the morphology of the colonic obstruction in 6 cases. In the other 9 patients, the distal part of the stenosis was located endoscopically [CF-T 1401 (4.2 mm diameter working channel) Olympus America, Melville, NY]. Via the working channel of the endoscope, with the use of an endoscopic retrograde cholangiopancreatography (ERCP) catheter, water-soluble contrast material (lopromide) was injected to provide visualization of the distal and proximal end of the stenosis.

In all cases, dilation with Savary-Gillard dilators was performed over a stiff-angled metallic guidewire and the stenosis were dilated to 20 mm under image intensifier control.

After dilation, with the guidewire in place, the endoscope was reinserted beside it to the distal margin of the lesion. The lesion's length was defined endoscopically and the upper and lower margins were marked under fluoroscopic guidance with external radiopaque markers. Through the working channel of the coloscope and over the guidewire a compressed uncovered metallic endoprosthesis delivery system (Wallstent, Microvasive, Boston Scientific, length 8 cm, diameter 20 to 22 mm) was introduced and passed beyond the lesion. Under fluoroscopic and endoscopic control, the stent was then deployed with the patient in supine position (Figure 1).

Plain abdominal films were obtained a few minutes after placement, to assess decompression.

b) Colostomy: A non-functional stoma was created

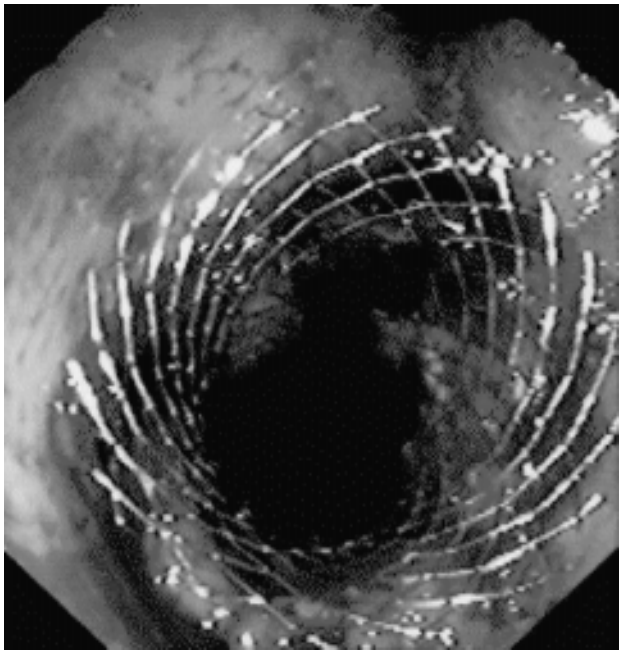

Figure 1. Stenting of a malignant stricture in the rectosigmoid area. Frontal view.

under general anesthesia through a midline incision. In all cases it was an end sigmoid colostomy proximal to the stenosis and mucous technique fistula of the distal colon.

Statistical analysis

Summary statistics of baseline characterization are given as mean values. Survival distribution curves are compared by Log-Rank test. Level of statistical significance is set at 0.05.

Cost analysis

A cost analysis was performed comparing the total costs generated for stent placement procedure versus the total costs generated for stoma creation.

The cost of each palliative procedure and the additional post-interventional cost were calculated, taking into account the following elements:

1. The personnel costs: were calculated as the cost of working hours for each person (physicians, radiology technicians, nurses, assistant personnel).
2. The cost of materials used during and after each procedure: stents, contrast liquids, drugs, single use stoma bugs, paste, etc. The cost of a stent was 1,617 Euros. The daily cost of stoma bugs and paste (4 Euros) was multiplied by the mean number of survival days for patients who underwent stoma creation.
3. The cost for each coloscopic and barium enema examination and for each laser session were 73.52, 44.11 and 29.41 Euros respectively, including the personnel cost, calculated on a working hour basis.
4. The housing and overheads for the procedures and the outpatient examinations, costs based on the number of square meters required to investigate, to operate and to stent a debridden patient and including the cost of furniture, cleaning, telephone and services of various overhead departments.
5. The total hospital iration stay during each procedure multiplied by the daily rate of 132,62 Euros.

Costs were derived from the database of the Greek National Health Care System and from the currently applicable prices of stents, contrast materials, bugs and drugs.

RESULTS

In 14 of 15 patients, auto-expanding metal stents were placed successfully (technical success rate 93.3%) (Figure 2). There were no serious complications relating to the procedure. Nine of 15 patients (60%) developed minor bleeding and pain, resolved with analgesics, during the stent placement.

In one patient with obstruction in a tortuous recto-

Figure 2. Radiologic view of the stented colon.

sigmoid flexure colon, due to CRC, stenting was not possible because the guidewire could not be passed through the lesion, either radiologically or endoscopically. That patient underwent palliative stoma formation two days later (and was excluded from the study).

In all other cases, the final stent position was controlled endoscopically after 24 hours and the patients were kept under medical observation for 2 days.

Endoscopic inspections were carried out every 8 weeks. Eight patients remained free of colonic obstruction until their death 6-18 (mean 11) weeks after stent placement. A moderate non-oclusive ingrowth of tumor into the stent lumen was documented in the remaining 6 patients. They were treated with introspective application of Diomed laser for a total of 16 sessions, with an interval of 8 weeks between each session. These patients died of progressive disease without clinical signs or endoscopic findings of recurrent obstruction 22-56 (mean 36) weeks after endoprosthesis placement.

After 44 weeks of follow up and introspective application of laser, one stent was expelled to the anal side of the lesion, without complication.

The stoma creation procedure was performed successfully and without serious complications. A mild leucocytosis with fever was noted in 2 patients (13.33%).

The total hospital stay after each procedure was 28 days for patients who underwent stenting and 60 days for patients who underwent stoma creation.

Statistical analysis revealed no significant difference in the cumulative survival between the two groups (p=NS). The median survival time was 21.4 weeks for patients who underwent stent placement and 20.9 weeks for patients who underwent stoma creation (Figure 3).

Cost analysis results

The average total cost of the stent placement procedure was similar to that of the stoma creation procedure: 2,224 and 2,092 Euros respectively, including also the post-interventional cost for each. Although stent placement may appear to be an expensive palliative treatment modality for inoperable malignant colonic obstructions, compared with colostomy, the total average difference in cost between the two methods was calculated to be 132 Euros (6.9%) (Figure 4).

Reasons for this marginal average difference of 6.9% were mainly the shorter hospitalization time of stented patients and the overall simplicity of the method (fewer medical and assistant personnel, no need for an operation room, avoidance of anesthetic, analgesic and antibiotic medications).

The frequent colonoscopic examinations of patients following after stent placement, due to protocol rules, were an additional cost that increased the total average cost of the method.

Comparing only the average cost of materials for each procedure, the difference was much higher (36.63%). The mean cost of materials was 1,717 Euros for the stent placement and 1,088 Euros for the stoma creation procedure.

DISCUSSION

Over the last decade, several investigators have described the use of autoexpandable metallic endoprosthesis in treating patients with malignant and

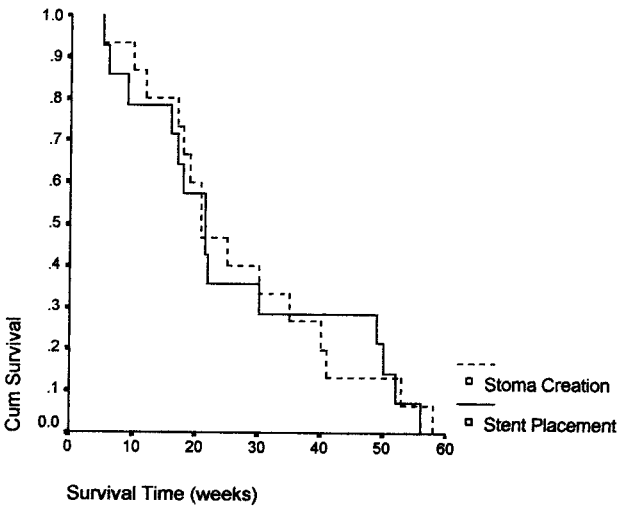

Figure 3. Survival time in weeks of stenting and stoma group.

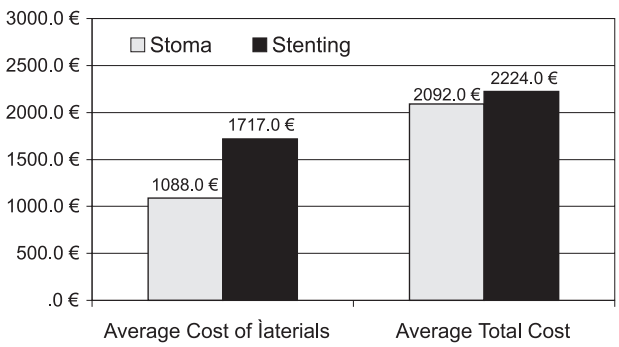

Figure 4. Average cost of materials for each procedure (left column) and the average total cost (right column).

occasionally benign rectosigmoid strictures.[18,21-25] Stents have been used, mainly, in cases of acute colonic obstruction due to resectable malignant tumors, as a bridge to one-stage elective surgery, providing time for a complete evaluation and mechanical bowel preparation with technical and clinical success rates ranging from 63% to 100% and 84% to 100% respectively.[17,21,26-28] In these patients stenting also allow fluid replacement therapy, thus improving the general status immediately, avoiding the discomfort caused by (temporary or permanent) colostomy and impoving the overall quality of life.

Two techniques have been described for colorectal stenting, radiological and endoscopic-fluoroscopic, with similar effectiveness and comparable risks.[17]

Metallic endoprosthesis can also provide palliative relief of colonic strictures in patients with unresectable tumors, avoiding a risky surgical procedure without demonstrated benefits.[12,19,28-32] For these patients, stenting is considered to be the palliation treatment of choice.[26] Other therapeutic options, such as chemotherapy, are not affected by this procedure. The overall technical success rate of stent placement in these cases is 90.3%.[17]

However, due to its high cost and the short life expectancy of these patients, endoprosthesis implantation is adversely influenced and limited in a selective population with particular indications.[24] Thus, stoma creation seems to be the only reasonable and unavoidable palliative option, even though it entails serious disadvantages, such as substantial morbidity and an obvious decrease in quality of life, with major psychologic repercussions.[21]

The aim of the present study was to perform a cost-effectiveness analysis, comparing stenting with the stoma creation procedure in patients with inoperable malignant colonic obstructions. The effectiveness of both methods was similar, 93.3% and 100% respectively.

Major complications, such as perforation (reported incidence rate 5.4%), prosthesis migration (reported incidence rate 10.4%) or massive bleeding, were not observed.[18,20] In many cases, these complication are associated with the dilation procedure before stent placement. Other possible reasons for the high complication rates reported above, in our opinion, are the limited experience in stenting procedures, the proximal site of some lesions and the type of stent, which in several studies were not designed and approved for use in the colon.[20,27]

Nine of our patients who underwent endoprosthesis placement developed minor bleeding and pain, resolved with analgesics.

Endoprosthesis diameter is an additional important factor that must be considered, especially in palliative placement, because it may increase the risk of stent dysfunction due to stool impaction or mucosal prolapse. Using large diameter stents, 20 to 22 mm, and administering mild laxatives, none of our patients developed these complications.

Obstruction due to tumor invasion is also a common complication which can be resolved by laser ablation or the insertion of a second stent, especially when the tumor is overgrowing the proximal or distal margin of the stent.[17,20] Repeated colonoscopic examinations during the follow up period, with interval time 6-8 weeks, are necessary to avoid this complication. In our study group, the mean time of partial reobstruction was 8 weeks with the first laser session performed 10-12 weeks after endoprosthesis placement. It is a safe, effective, minimally invasive and inexpensive technique that can be applied on an outpatient basis.

Theoretically, the use of covered metallic stents may avoid the risk of tumor ingrowth through the stent lumen. However, all of the currently available types of covered stents have two to three-fold greater diameter delivery systems than the uncovered (18-32 Fr vs 9 Fr), making their passage through the scope working channel difficult and also appear to become dislocated more frequently. Thus, their use is still limited. No significant difference in survival between the two groups was noted. All patients died due to their progressive disease, free of signs and symptoms of reobstruction. As was expected, the survival rates were not influenced by the kind of the procedure.

Preoperative stent placement is a cost effective procedure for patients with acute colonic obstruction due to resectable tumors. Binkert et al, based on economic data of the Swiss semiprivate health system, reported an average benefit of 19.7% comparing the cost of the method with that of one surgical intervention.[33] Although the commercial price of a metallic endoprosthesis is high and appeares prohibitive for use in cases of inoperable malignant colonic obstructions, according to our results, the overall cost of the procedure, including the cost of postinterventional care, is similar to that of colostomy, because it avoids surgery and even hospitalization, with a total average difference of 6.9% (132 Euros).

In summary, our results suggest that auto-expanding metallic stent placement is a palliative alternative to colostomy for patients with inoperable malignant colonic strictures, which, additionally, provides a better quality of life without the psychological repercussions of a

permanent colostomy, and appears to be cost-effective.

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