Bridging Metallic Stent Placement in Acute Obstructed Left Sided Malignant Colorectal Cancer: Optimal Time for Surgery

Siripong Sirikurnpiboon MD*, Burin Awapittaya MD*,
Paiboon Jivapaisarnpong MD*, Thawee Rattanachu-ek MD*,
Jerasak Wannaprasert MD*, Sukij Panpimarnmas MD*

** Department of Surgery, Rajavithi Hospital, College of Medicine, Rangsit University, Bangkok, Thailand*

Background: *Colonic stenting is now the preferred treatment either for palliation or as a bridge to surgery for obstructed colorectal cancer. It reduces complications from emergency surgery and the need for colostomy formation. However, stent perforation can lead to peritoneal tumor spillage, a higher rate of infection and changing the risk of a potentially curable disease to an incurable one. Therefore, it is important to study the optimum time for operation after stent insertion.*

Material and Method: *From January 2006 to January 2012, 30 cases of acute left-sided malignant colorectal obstruction were managed by expandable metallic stent (SEMS) as a bridge to surgery. In all, 19 males and 11 females with mean age of 60.07±12.19 years (range 40-80 years) were included in the study. The obstructed locations were 1 case at the transverse colon, 6 cases at the descending colon, 13 cases at the sigmoid colon, 5 cases at the upper third at the rectum and 5 cases involving the middle third of the rectum.*

Results: *The perforation of SEMS was founded in 11 cases (36.67%). The mean bridging time before operation in the nonperforated group was 5.54 (±1.29) days shorter than in the perforated group, 10.54 (±4.82) days ($p<0.001$). All of the subjects in the perforated group reported clinical lower abdominal pain without sign of peritonitis, developed in an average 4.5 days (3-7 days).*

Conclusion: *The optimum bridging time for surgery should be within 5 days.*

Keywords: *Colonic stent, Colorectal cancer, Obstruction*

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Acute colonic obstruction is a potentially lethal condition, and is accompanied by several serious complications such as electrolyte imbalance, bowel gangrene and perforation. In 8-29% of cases, the cause for colonic obstruction was due to a malignant lesion of the colon and rectum[1]. In the past, left sided colorectal cancer was treated with staged operation: either two- or three-stage operation was performed, but this produced a high rate of morbidity and mortality. Hence, one-stage operation was introduced to reduce the length of hospital stay and provide beneficial oncologic outcomes. This possibly reduced morbidities and mortalities by on table lavage or subtotal/total colectomy; but also had high morbidities. In 1981, Dohmoto et al[2] presented a method that produced favorable outcomes in palliative treatment of left sided malignancies of colonic obstruction with the placement of self-expandable metallic stents (SEMS). Thereafter, many other reports showed significant benefits of SEMS in relieving colonic obstruction followed by definite cancer surgery (as a bridge of surgery). Targownik et al[3] reported a 23% reduction in mortality rate with the use of SEMS as a bridge to surgery. Martinez-Santos et al[4] demonstrated that patients with SEMS required 58.5% less need for further surgery when compared with those undergoing emergency surgery. While these numbers are promising, as a bridge to surgery; several reports of stent perforation occurred before the planned definite cancer surgery. This perforation can result in peritoneal tumor spillage, a higher rate of infection and changing the risk of a potential curable disease to an incurable one. As a result, the author intended to determine the optimum time to perform operation following stent insertion and also to identify the effect of varied time of surgery.

Correspondence to:
Sirikurnpiboon S, Department of Surgery, Rajavithi Hospital, 2 Phayathai Road, Ratchathewi, Bangkok 10400 Thailand.
Phone: 0-2354-8108 ext. 3140
E-mail: laizan99@hotmail.com

Material and Method

A prospective study was conducted on enrolled patients who presented with malignant left-sided colonic obstruction from January 2006 to January 2012 (six-year period). The diagnosis of malignant left-sided colonic obstruction was a presumptive diagnosis based on clinical evaluation, radiologic and endoscopic examination including pathologic report and excluded colorectal cancer with other underlying bowel disease (IBD, diverticular disease). The SEMS was performed by colonoscopic technique under fluoroscopic guidance without preballoon dilation. Following SEMS insertion, the patients were monitored for vital signs and abdominal plain film in both supine and upright positions on days 1 and 3. Abnormalities such as fluid and electrolyte imbalance and underlying disease were also corrected. The operation was performed when the patients were at clinical stable and suitable to undergo surgery. The study was approved by the Ethics Committee Rajavithi Hospital.

The data collected for analysis covered three periods: preoperative, perioperative and postoperative. The preoperative period took into account the patient's age, sex, underlying disease, previous treatment (neo-adjuvant therapy), type of SEMS used (25 mm, Wallflex, Boston Scientific, USA, or Ultraflex Boston Scientific, USA), clinical appearance after insertion of the SEMS, duration time, time of bridge to surgery and abdominal signs and symptoms. The perioperative period data included gross pathology of the tumor, the type of operation performed, surgical staging, amount of blood loss and the characteristics of the bowel wall over stent. The postoperative period data included postoperative complications, pathologic staging, hospital stay and clinical status when followed-up after 12 months.

Statistical analysis

Chi-square or Fisher's exact test was used to compare factors of perforation. Unpaired t-test or Mann-Whitney U test was used to compare basic characteristics of the patients such as age and underlying diseases in both groups.

Results

During the period of study, a total of 47 patients with colorectal obstruction from colorectal cancer were enrolled; of which 11 were excluded (four patients with Oglivie's syndrome, four patients were referred cases that were referred back by the hospital system, one with clinical failure, one with underlying ulcerative colitis and one who lost in follow-up). Of the remaining 36 patients, 6 were treated with palliative treatment; leaving only 30 patients as candidates to study 'bridge to surgery'. Within the palliation group, one of the patients developed bowel perforation at one month after stent placement and required emergency surgery (Hartmann's procedure). The stent insertion was technically successful in all patients and the clinical success rate was at 97%.

The bridging to surgery group consisted of 30 patients: 19 males and 11 females with an average age of 60.07 years (range 40 to 80 years). The site of obstruction comprised 1 case at the transverse colon, 6 cases at the descending colon, 13 cases at the sigmoid colon, 5 cases the upper rectum and 5 cases at the middle rectum. The average time for each stent placement was about 20 minutes (range 15 to 35 minutes). Perforations were noted in 11 patients (36.67%).

In the perforation group (Fig. 1) consisting of 11 patients (36.67%), the average duration of the colorectal obstruction was 8.18 days (range 2 to 14 days), mean time following admission for SEMS placement was 18.55 hours (range 8to 48 hours) and the mean time after SEMS placement before surgery was 10.54 days (range 6 to 18 days). All of these cases, except one, developed pelvic pain on average of 4.5 days (range 3 to 7 days). 2 patients developed generalized peritonitis on days 9 and 10 after stent placement, and the perforation occurred over the upper rectum in one patient and middle rectum in the other. The other nine developed a phlegmon, found intra-operatively. One of the patients developed surgical wound infection, one acquired postoperative pneumonia and four needed protective ileostomy for low anterior resection. However, no mortality was noted. In the perforation group, no pathological stage

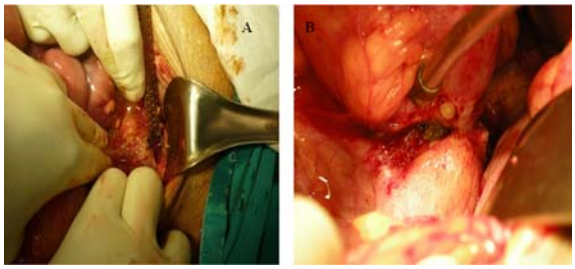

Fig. 1 Perforation site. A) The perforation site at upper rectum after removing phlegmon. B) The perforation site at immediate generalize peritoneal exploration.

Table 1. Baseline characteristics of patients between perforation and nonperforation groups

Characteristic	Perforation		*p*-value
	No (n = 19)	Yes (n = 11)	
Age (years)	60.55±9.84	60.4±4.54	0.985
Sex			0.919
Male	9 (64.3%)	5 (35.7%)	
Female	10 (62.5%)	6 (37.5%)	
Position			0.002*
Transverse colon + descending colon	7 (36.8%)	0 (0.0)	
Sigmoid colon	10 (52.6%)	3 (27.3%)	
Upper rectum	2 (10.6%)	3 (27.3%)	
Middle rectum	0 (0.0)	5 (45.4%)	
Comorbid disease	12 (63.2%)	6 (54.6%)	0.104
Stent type			0.900
Ultraflex	2 (10.5%)	1 (9.1%)	
Wallflex	17 (89.5%)	10 (90.9%)	
Pathologic stage			1.000
1	0 (0.0)	0 (0.0)	
2	3 (15.8%)	2 (18.2%)	
3	13 (68.4%)	8 (72.7%)	
4	3 (15.8%)	1 (9.1%)	
Tumor morphology			1.000
Annular	15 (78.9%)	2 (18.2%)	
Ulcerative	4 (21.1%)	9 (81.8%)	
Polypoid	0 (0.0)	0 (0.0)	
Infiltrative	0 (0.0)	0 (0.0)	

Values were represented as mean ± SD and number (%)

Table 2. Factors associated with perforation

Characteristic	Perforation		RR (95%CI)	*p*-value
	Yes	No		
Timing duration of colorectal obstruction (days)	8.18±3.95	2.95±1.47		<0.001*
≤4 day (n = 13)	1 (5.9%)	12 (94.1%)	Ref	0.007*
>4 day (n = 17)	10 (76.9%)	7 (23.1%)	2.24 (1.24-4.04)	
Timing following admission to SEMS placement (hours)				
Mean ± SD	18.55±12.17	6±1.37		<0.001*
Median (min-max)	16 (8-48)	6 (2-8)		
<8 hr (n = 11)	0	11 (100.0)	Ref	0.002*
>8 hr (n = 19)	11 (57.9)	8 (42.1)	2.38 (1.40-4.02)	
Timing after SEMS to surgery (day)	10.54±4.82	5.5±1.29		<0.001*
<7 days (n = 17)	1 (9.1)	16 (90.9)	Ref	<0.001*
≥7 days (n = 13)	10 (84.2)	3 (15.8)	4.08 (1.50-11.08)	

Table 3. Comparative morbidity and length of hospital stay

	Perforation		*p*-value
	Yes (n = 11)	No (n = 19)	
Hospital stay (days), median (min-max)	30 (20-45)	17 (14-28)	<0.001*
Overall morbidity (n, %)			0.001*
Yes	8 (80.0%)	2 (20.0%)	
No	3 (27.3%)	17 (89.5%)	
Ileostomy			0.047*
Yes	4 (80.0%)	1 (20.0%)	
No	7 (28.0%)	18 (72.0%)	
Major wound infection			0.126
Yes	2 (100.0%)	0 (0.0%)	
No	9 (32.1%)	19 (67.2%)	
Pneumonia			0.537
Yes	2 (66.7%)	1 (33.3%)	
No	9 (33.3%)	18 (66.7%)	

Values are represented as number (%) or median range

1 was found. Annular and ulcerative tumor morphology were mostly found, and polypoid and infiltrative were not observed.

In the nonperforation group, 19 cases (63.33%), the average duration of colorectal obstruction was found to be 2.95 days (range 1 to 6 days), average time following admission for SEMS placement was 6 hours (range 2 to 8 hours), and the average time to surgery after stent placement was 5.54 days (range 3 to 18 days). One case developed postoperative pneumonia and one case needed protective ileostomy for low anterior resection. No mortality was noted.

In the present study, the factors associated with perforation included tumor location and three time frame groups, The risk ratio at 95%CI were 2.24 (1.24-4.04, $p = 0.007$) , 2.38 (1.4-4.02 $p<0.001$) and 4.08 (1.5-11.08, $p<0.001$). In subgroup analysis, tumor location and timing to SEMS placement were not statistically significant ($p = 0.285$, $p = 0.180$ respectively). More data is required for further analysis.

Discussion

In the past, the management of colorectal cancer with obstruction was performed by three-stage operation later reduced to two-stage operation and then eventually one-stage with subtotal colectomy or table lavage. Finally, the placement of SEMS for bridge to surgery was introduced and is currently the preferred management. It converted emergency surgeries to elective surgeries allowing the surgeon more time to prepare and correct the patient's co-morbidities, abnormal conditions and clear the obstructed bowel of fecal material[5-7]. Because the operations were now being performed on more prepared patients, it reduced morbidity, mortality, length of hospital stay[8] and need for stoma formation; it also improved oncologic outcomes (early curative resection).

Although the SEMS placement showed good result with definition palliation procedures and served as a bridge to surgery, it has drawbacks including bowel perforation requiring emergency operation, increased risk from anesthesia, longer operative time and increased postoperative complications. The perforations are believed to be due to certain insertion techniques such as balloon dilation[9,10] before stent insertion, expandable strength of the stent, thinning of the bowel wall from tumor erosion or ischemia over tumor after placement of stent and from previous received neo-adjuvant chemotherapy[11,12]. In the present study, we found the period of time to be a risk factor for perforation after SEMS placement, especially multivariate analysis showed prolonged symptoms of obstruction until admission ($p = 0.180$). The possible explanation is strangulation at the bowel wall in prolonged obstruction[13]. The perforation rates reported were 3.8 to 6.67%[14-16] and could occur as early as the third day after stent placement. According to Fernandez-Esparrach et al[17] most of these cases required emergency operations with high morbidity, high mortality and stoma formation. In the present study, the increased morbidity in perforated cases was due to wound infection, pneumonia, longer hospital stay and

need for protective ileostomy.

To reduce serious complication such as perforation, definite curative surgery was performed at the proper time. Lacy et al[14] suggested an optimal window of three days after placement of stent. However, in reality, preparing a patient within three days was a difficult task. Saida et al[18] reported a mean time of 6.3 days after stent placement to perform operation without increased in risk of complications. In this study, we suggest bridging time should be within five days because the expansion process of SEMS continues over 24 to 48 hours after placement and then the material is incorporated into the tumor by pressure necrosis and becomes deeply incorporated into the ''normal'' bowel wall[19]. Duration of obstruction and time to surgery after stent placement were also a risk factor for perforation. The other factor such as age, sex, location of tumor, comorbidity, type of stent inserted, pathologic state and tumor morphology were insignificant.

Morino M et al[20] showed that the clinical presentation of bowel perforation was abdominal pain. According to the present study, the authors came up with similar results, evidenced by the pelvic pain developed in 10 of 11 patients within an average of 4.5 days (range 3-7 days).

Conclusion

The risk factors of bowel perforation included the duration of obstructive symptom and the time taken to reach surgical management. The optimum bridging time should be within five days after stent placement. In cases which present a longer duration of obstructive symptoms (more than four days), surgical management should be made as soon as possible.

Potential conflicts of interest

None.

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ระยะเวลาที่เหมาะสมสำหรับการผ่าตัดภายหลังการรักษาภาวะลำไส้ใหญ่ด้านซ้ายอุดตันจากมะเร็งด้วยการใส่ท่อเหล็กถ่างขยาย

สิริพงศ์ สิริกุลพิบูลย์, ไพบูลย์ จิวะไพศาลพงศ์, บุรินทร์ อาวพิทยา, จีระศักดิ์ วรรณประเสริฐ, ทวี รัตนชูเอก, สุกิจ พันธ์พิมานมาศ

ภูมิหลัง: *การใส่ท่อเหล็กเพื่อถ่างขยายลำไส้อุดตันที่เกิดจากมะเร็งนั้นเป็นที่ยอมรับกันอย่างกว้างขวาง ทั้งในด้านการรักษาแบบประคับประคองในมะเร็งระยะสุดท้ายและการรักษาในภาวะฉุกเฉินเพื่อที่จะสามารถเตรียมผู้ป่วยให้พร้อม เพื่อที่จะทำการผ่าตัดรักษาในระยะต่อไปโดยให้ผลดีในการที่สามารถลดภาวะแทรกซ้อนที่เกิดจากการผ่าตัดในภาวะฉุกเฉินและลดการสร้างทวารเทียมลงได้อย่างมีนัยสำคัญ แต่อย่างไรก็ดีตัวท่อเหล็กถ่างขยายนั้นก็สามารถทำให้เกิดการแตกทะลุของลำไส้ได้ ซึ่งจะยังผลเสียไปสู่ตัวผู้ป่วยได้เช่น การมีมะเร็งกระจายออกไปยังช่องท้อง เพิ่มโอกาสการติดเชื้อเป็นต้น ดังนั้นการศึกษานี้จึงมุ่งเน้นหาช่วงเวลาที่เหมาะสมที่สุดสำหรับการผ่าตัดภายหลังที่มีการใส่ท่อเหล็กถ่างขยายไปแล้ว*

วัสดุและวิธีการ: *คณะผู้นิพนธ์ได้รวบรวมประวัติผู้ป่วยที่เข้ารับการรักษาด้วยภาวะอุดตันจากมะเร็งลำไส้ใหญ่และทวารหนัก ในโรงพยาบาลราชวิถีโดยเริ่มตั้งแต่ เดือนมกราคม พ.ศ. 2549 ถึง เดือนมกราคม พ.ศ. 2555 โดยได้จำนวนผู้ป่วยทั้งสิ้น 30 ราย ที่ทำการรักษาในภาวะฉุกเฉิน ด้วยการใส่ท่อเหล็กถ่างขยายลำไส้ โดยแบ่งเป็นเพศชาย 19 ราย และเพศหญิง 11 ราย อายุเฉลี่ย 60.07 ปี (40-80 ปี) ตำแหน่งที่พบมีการอุดตันได้แก่ transverse colon 1 ราย descending colon 6 ราย sigmoid colon 13 ราย upper rectum 5 ราย และใน middle rectum 5 ราย*

ผลการศึกษา: *การแตกทะลุที่เกิดจากท่อถ่างขยายลำไส้พบ 11 ราย คิดเป็นร้อยละ 36.67 โดยพบว่ากลุ่มที่ไม่มีการแตกทะลุมีระยะเวลาที่เตรียมผู้ป่วยเพื่อไปผ่าตัดอยู่ที่ 5.54 วัน และในกลุ่มที่พบมีการแตกทะลุนั้น มีระยะเวลาที่เตรียมการเพื่อไปผ่าตัดนั้นอยู่ที่ 10.54 วันและในกลุ่มที่มีการแตกทะลุนี้พบว่าจะมีอาการปวดบริเวณอุ้งเชิงกราน โดยที่ไม่มีการแสดงการอักเสบของเยื่อบุช่องท้องและอาการปวดที่อุ้งเชิงกรานนี้โดยส่วนใหญ่จะเกิดที่ 4.5 วัน (3-7 วัน)*

สรุป: *ระยะเวลาที่เหมาะสมสำหรับการผ่าตัดภายหลังการใส่ท่อเหล็กถ่างขยาย ในภาวะลำไส้ใหญ่อุดตันจากมะเร็งนั้นควรทำภายใน 5 วัน โดยเฉพาะกลุ่มผู้ป่วยที่เข้ารับการรักษาช้า*