

Temporary partially-covered metal stent insertion in benign esophageal stricture

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Abstract

AIM: To study the therapeutic efficacy of temporary partially-covered metal stent insertion on benign esophageal stricture.

METHODS: Temporary partially-covered metal stent was inserted in 83 patients with benign esophageal stricture. All the patients had various dysphagia scores.

RESULTS: Insertion of 85 temporary partially-covered metal stents was performed successfully in 83 patients with benign esophageal stricture and dysphagia was effectively remitted in all the 83 cases. The dysphagia score was 3.20 ± 0.63 (mean \pm SD) and 0.68 ± 0.31 before and after stent insertion, and 0.86 ± 0.48 after stent removal. The mean diameter of the strictured esophageal lumen was 3.37 ± 1.23 mm and 25.77 ± 3.89 mm before and after stent insertion, and 16.15 ± 2.96 mm after stent removal. Follow-up time was from 1 week to 96 months (mean 54.26 ± 12.75 months). The complications were chest pain ($n=37$) after stent insertion, and bleeding ($n=12$) and reflux ($n=13$) after stent removal.

CONCLUSION: Temporary partially-covered metal stent insertion is one of the best methods for treatment of benign esophageal stricture.

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INTRODUCTION

Benign esophageal stricture is a common complication in esophageal diseases. Balloon catheter dilation under X-ray was previously the most common treatment for benign esophageal stricture. Its short-term curative efficacy is good, but it does not last long. The development in stenting techniques has led to the increased application of stents in benign esophageal stricture. However, because of the relatively high incidence of complications and the difficulty of handling those

complications, it is preferable to use stents with discretion. Here we report our experiences in using temporary partially-covered metal stent insertion in 83 patients with benign esophageal stricture.

MATERIALS AND METHODS

Materials

Eighty-three patients (48 males, 35 females, age 18-82 years) came to our clinic due to dysphagia. A dysphagia score was assessed by the quality of swallowing^[1,2]. Grade 0 is for normal swallowing, grade 1 for swallowing most solid food, grade 2 for swallowing semisolids, grade 3 for swallowing liquid food only, and grade 4 for complete dysphagia. The dysphagia score of the 83 patients was 3.20 ± 0.63 (mean \pm SD), and the causes of stricture were achalasia of cardia ($n=70$), anastomotic stenosis ($n=5$), sclerotic stricture due to ingestion of corrosive agents ($n=3$) and simple sclerosis stricture after radiation therapy for esophageal carcinoma ($n=5$). The diagnoses were made by an upper gastrointestinal contrast examination using barium-meal radiography and gastroscopic assessment. The mean diameter of the strictured esophageal lumen was 3.37 ± 1.23 mm in the 83 patients with partially-covered metal stent insertion.

Methods

The preparation before stent insertion involved ensuring an empty stomach for at least 4 hours, testing of the bleeding and clotting times, and intramuscular injection of ataractics before interventional procedure. The stent made from nitinol (a nonmagnetic Ni-Ti alloy) by Chinese manufacturers (Zhiye Medical Instruments Corporation, Changzhou, China, and Youyan Yijin Advanced Materials Co.Ltd, Beijing, China) has a length of 4-12 cm and a diameter of 16-30 cm. Its surface is covered with silica gel. The savy conical silica-gel dilator has a diameter of 0.5-2 cm, and contrast medium.

The patients were placed in a sitting position or lying on the side during the stent-placement operation, and false teeth were removed and dental pads were placed. A 260-cm-long exchange guidewire was inserted into the stomach. Along with the guidewire, the nitinol stent was installed in the propeller. After the propeller was pushed to the stricture segment, the mantle annular tube was retracted, after which the stent would automatically expand. After stent expansion, barium-meal radiography was routinely used to examine the stent position and the dilated stricture. Three to seven days after stent deployment, 500-1 000 ml of ice-cold water was poured into the side hole of a gastroscope. A protractor was then used to loosen the stent from its surroundings and was then connected to the stent orifice. The stent orifice shrank when we contracted the protractor, and then the stent was removed along with the gastroscope. After that, a gastroscope was again inserted to examine bleeding and mucosa tearing membranes. The patients were allowed to consume cold food for the first 2 days after interventional procedure, and resumed a normal diet afterwards. Within 1 week, barium-meal examination was used to observe the intraluminal patency and swallowing function.

one-month, 6-months, and 1-year follow-ups were recommended.

RESULTS

We inserted 85 temporary partially-covered metal stents in 83 patients with esophageal stricture, which were removed 3-7 days later. The placement and removal of stents were successful in 100 % of cases. Immediately after placing the stent, we performed an esophageal contrast examination, which confirmed good stricture patency. The mean diameter of the esophageal lumen was 25.77 ± 3.89 mm after stent insertion, and 16.15 ± 2.96 mm after stent removal. The dysphagia score was 0.68 ± 0.31 after stent insertion, and 0.86 ± 0.48 after stent removal. The mean follow-up time was 54.26 ± 12.75 months (range 1 week-96 months). The complications immediately after stent insertion were chest pain (37 cases). After stent removal, 12 cases had a small amount of bleeding and 13 had reflux. All these complications were managed effectively. Temporary partially-covered metal stent insertion and removal were obviously effective on the esophageal stricture and dysphagia.

DISCUSSION

The short-term effect of balloon dilation on esophageal benign stricture was good, but its mid-term and long-term curative effect was not ideal. In 1990 Domschke *et al*^[1] first reported an expandable stent used in malignant esophageal strictures. Since then different types of stent have been developed and applied to the gastrointestinal system^[2]. In 1993 Cwikiel *et al*^[3] reported the application of silica-gel-covered stent in benign esophageal strictures. The covering of the stent was found to be effective against recurrence of esophageal stricture^[4-39]. Because covered stents would migrate, they have not been widely used for some time. However, patients with uncovered stents exhibited more complications such as reflux, stricture recurrence (hyperplasia of granulation tissue), and pain. There is no effective way to manage these complications, which impacts on the long-term curative effect. The worse thing for cases was that another surgical operation was sometimes required to resect the stricture section and the stent placed previously. In order to solve these problems, we used temporary partially-covered metal stent insertion in benign esophageal stricture^[40]. The follow-up time was approximately 8 years. The curative effect was long-lasting, dysphagia was clearly palliated, and complications were reduced and easy to manage. Temporary partially-covered metal stent insertion was effective on benign esophageal stricture. Our follow-up investigations revealed that the mid-term and long-term curative effect of temporary stent insertion was better than that of balloon dilation and permanently uncovered or antireflux covered or partially-covered metal stent^[41-48]. Our results demonstrated that it was unnecessary to perform graded diameter increment in such stents, unlike when dilating the balloon catheter. Its necessity could be decided based on the follow-up data. After stent insertion, the complications of pain and reflux due to dilating the esophageal stricture by the stent were mainly caused by the chronic tissue tearing of the layer of esophageal muscle and the damage to the original anatomy of the stomach cardia. The stent continued to expand until it reached to body temperature. Since this took 16-24 hours, the tearing of the esophageal muscle tissue was relatively regular and comparatively less scar tissue was formed. Therefore, the recurrence of stricture was low, unlike in balloon dilation which caused acute and irregular tearing on the layer of esophageal muscle, and a corresponding high recurrence of stricture. This is one reason why the method of temporary partially-covered

metal stent insertion in benign esophageal stricture is better than that of balloon dilation. We used uncovered stents in patients with benign esophageal strictures in order to reduce the occurrence rate of stent migration. After stent placement, dilation was excellent and dysphagia disappeared, thus achieving the goal of treatment. However, it was accompanied by new problems such as gastroesophageal reflux and recurrence of stricture (hyperplasia of granulation tissue). The reflux could be treated with drugs, but this took a long time. Recurrence of stricture could be reduced by heat cauterization under gastroscope, but it could easily recur. When we used antireflux covered stent, complications of gastroesophageal reflux and hyperplasia of granulation tissue were not found, but many unexpected results occurred. Comparative studies and experimental research are recommended to further explore the recurrence mechanisms. Further research and development of new stents that are biodegraded by esophageal organism within 2 months after insertion would improve their curative effect, and provide a new therapeutic method for benign esophageal stricture^[49]. With further developments in molecular biology, application of gene therapy in the treatment of benign esophageal stricture is expected.

REFERENCES

- 1 **Domschke W**, Foerster EC, Matek W, Rodl W. Self-expanding mesh stent for esophageal cancer stenosis. *Endoscopy* 1990; **22**: 134-136
- 2 **Song HY**, Choi KC, Kwon HC, Yang DH, Cho BH, Lee ST. Esophageal strictures: treatment with a new design of modified Gianturco stent, Work in progress. *Radiology* 1992; **184**: 729-734
- 3 **Cwikiel W**, Willen R, Stridbeck H, Lillo-Gil R, von Holstein CS. Self-expanding stent in the treatment of benign esophageal strictures: experimental study in pigs and presentation of clinical cases. *Radiology* 1993; **187**: 667-671
- 4 **Song HY**, Do YS, Han YM, Sung KB, Choi EK, Sohn KH, Kim HR, Kim SH, Min YI. Covered, expandable esophageal metallic stent tubes: experiences in 119 patients. *Radiology* 1994; **193**: 689-695
- 5 **Foster DR**. Use of a Strecker oesophageal stent in the treatment of benign oesophageal stricture. *Australas Radiol* 1995; **39**: 399-400
- 6 **Strecker EP**, Boos I, Vetter S, Strohm M, Domschke S. Nitinol esophageal stents: new designs and clinical indications. *Cardiovasc Intervent Radiol* 1996; **19**: 15-20
- 7 **Vanderburgh L**, Ho CS. Nonvascular stents. *Prog Cardiovasc Dis* 1996; **39**: 187-200
- 8 **Moore DW**, Ilves R. Treatment of esophageal obstruction with covered, self-expanding esophageal Wallstents. *Ann Thorac Surg* 1996; **62**: 963-967
- 9 **Heindel W**, Gossmann A, Fischbach R, Michel O, Lackner K. Treatment of a ruptured anastomotic esophageal stricture following bougienage with a Dacron-covered nitinol stent. *Cardiovasc Intervent Radiol* 1996; **19**: 431-434
- 10 **Fry SW**, Fleischer DE. Management of a refractory benign esophageal stricture with a new biodegradable stent. *Gastrointest Endosc* 1997; **45**: 179-182
- 11 **Song HY**, Park SI, Do YS, Yoon HK, Sung KB, Sohn KH, Min YI. Expandable metallic stent placement in patients with benign esophageal strictures: results of long-term follow-up. *Radiology* 1997; **203**: 131-136
- 12 **Song HY**, Park SI, Jung HY, Kim SB, Kim JH, Huh SJ, Kim TH, Kim YK, Park S, Yoon HK, Sung KB, Min YI. Benign and malignant esophageal strictures: treatment with a polyurethane-covered retrievable expandable metallic stent. *Radiology* 1997; **203**: 747-752
- 13 **Foster DR**. Self-expandable oesophageal stents in the management of benign peptic oesophageal strictures in the elderly. *Br J Clin Pract* 1997; **51**: 199
- 14 **Tan BS**, Kennedy C, Morgan R, Owen W, Adam A. Using uncovered metallic endoprotheses to treat recurrent benign esophageal strictures. *Am J Roentgenol* 1997; **169**: 1281-1284

- 15 **Hramiec JE**, O' Shea MA, Quinlan RM. Expandable metallic esophageal stents in benign disease: a cause for concern. *Surg Laparosc Endosc* 1998; **8**: 40-43
- 16 **Miller LS**, Jackson W, McCray W, Chung CY. Benign nonpeptic esophageal strictures. Diagnosis and treatment. *Gastrointest Endosc Clin N Am* 1998; **8**: 329-355
- 17 **Sheikh RA**, Trudeau WL. Expandable metallic stent placement in patients with benign esophageal strictures: results of long-term follow-up. *Gastrointest Endosc* 1998; **48**: 227-229
- 18 **Wengrower D**, Fiorini A, Valero J, Waldbaum C, Chopita N, Landoni N, Judchack S, Goldin E. EsophaCoil: long-term results in 81 patients. *Gastrointest Endosc* 1998; **48**: 376-382
- 19 **Cowling MG**, Adam A. Radiological management of oesophageal strictures. *Hosp Med* 1998; **59**: 693-697
- 20 **Kang SG**, Song HY, Lim MK, Yoon HK, Goo DE, Sung KB. Esophageal rupture during balloon dilation of strictures of benign or malignant causes: prevalence and clinical importance. *Radiology* 1998; **209**: 741-746
- 21 **Monda LA**. Diagnosis and treatment of esophageal strictures. *Radiol Technol* 1999; **70**: 361-372
- 22 **Vakil N**, Gross U, Bethge N. Human tissue responses to metal stents. *Gastrointest Endosc Clin N Am* 1999; **9**: 359-365
- 23 **Sandha GS**, Marcon NE. Expandable metal stents for benign esophageal obstruction. *Gastrointest Endosc Clin N Am* 1999; **9**: 437-446
- 24 **Boulis NM**, Armstrong WS, Chandler WF, Orringer MB. Epidural abscess: a delayed complication of esophageal stenting for benign stricture. *Ann Thorac Surg* 1999; **68**: 568-570
- 25 **Pajarinen J**, Ristkari SK, Mokka RE. A report of three cases with an oesophageal perforation treated with a coated self-expanding stent. *Ann Chir Gynaecol* 1999; **88**: 332-334
- 26 **Cowling MG**. Stenting in the oesophagus. *Hosp Med* 2000; **61**: 33-36
- 27 **Fiorini A**, Fleischer D, Valero J, Israeli E, Wengrower D, Goldin E. Self-expandable metal coil stents in the treatment of benign esophageal strictures refractory to conventional therapy: a case series. *Gastrointest Endosc* 2000; **52**: 259-262
- 28 **Chen JS**, Luh SP, Lee F, Tsai CI, Lee JM, Lee YC. Use of esophagectomy to treat recurrent hyperplastic tissue obstruction caused by multiple metallic stent insertion for corrosive stricture. *Endoscopy* 2000; **32**: 542-545
- 29 **Macdonald S**, Edwards RD, Moss JG. Patient tolerance of cervical esophageal metallic stents. *J Vasc Interv Radiol* 2000; **11**: 891-898
- 30 **Lee JG**, Hsu R, Leung JW. Are self-expanding metal mesh stents useful in the treatment of benign esophageal stenoses and fistulas? An experience of four cases. *Am J Gastroenterol* 2000; **95**: 1920-1925
- 31 **Song HY**, Jung HY, Park SI, Kim SB, Lee DH, Kang SG, Il Min Y. Covered retrievable expandable nitinol stents in patients with benign esophageal strictures: initial experience. *Radiology* 2000; **217**: 551-557
- 32 **Cordero JA Jr**, Moores DW. Self-expanding esophageal metallic stents in the treatment of esophageal obstruction. *Am Surg* 2000; **66**: 956-959
- 33 **Morgan R**, Adam A. Use of metallic stents and balloons in the esophagus and gastrointestinal tract. *J Vasc Interv Radiol* 2001; **12**: 283-297
- 34 **Ackroyd R**, Watson DI, Devitt PG, Jamieson GG. Expandable metallic stents should not be used in the treatment of benign esophageal strictures. *J Gastroenterol Hepatol* 2001; **16**: 484-487
- 35 **Catnach S**, Barrison I. Self-expanding metal stents for the treatment of benign esophageal strictures. *Gastrointest Endosc* 2001; **54**: 140
- 36 **McManus K**, Khan I, McGuigan J. Self-expanding oesophageal stents: strategies for re-intervention. *Endoscopy* 2001; **33**: 601-604
- 37 **Power C**, Rynne M, O' Gorman T, Maguire D, McAnena OJ. An unusual complication following intubation of a benign oesophageal stricture. *Endoscopy* 2001; **33**: 642
- 38 **Lee SH**. The role of oesophageal stenting in the non-surgical management of oesophageal strictures. *Br J Radiol* 2001; **74**: 891-900
- 39 **Dormann AJ**, Deppe H, Wigglinghaus B. Self-expanding metallic stents for continuous dilatation of benign stenoses in gastrointestinal tract - first results of long-term follow-up in interim stent application in pyloric and colonic obstructions. *Z Gastroenterol* 2001; **39**: 957-960
- 40 **Chen WX**, Cheng YS, Yang RJ, Li MH, Zhuang QX, Chen NW, Xu JR, Shang KZ. Interventional therapy of achalasia with temporary metal internal stent dilatation and its intermediate and long term follow-up. *Shijie Huaren Xiaohua Zazhi* 2000; **8**: 896-899
- 41 **Moses FM**, Wong RK. Stents for Esophageal Disease. *Curr Treat Options Gastroenterol* 2002; **5**: 63-71
- 42 **Wang YG**, Tio TL, Soehendra N. Endoscopic dilation of esophageal stricture without fluoroscopy is safe and effective. *World J Gastroenterol* 2002; **8**: 766-768
- 43 **Profili S**, Meloni GB, Feo CF, Pischedda A, Bozzo C, Ginesu GC, Canalis GC. Self-expandable metal stents in the management of cervical oesophageal and/or hypopharyngeal strictures. *Clin Radiol* 2002; **57**: 1028-1033
- 44 **Therasse E**, Oliva VL, Lafontaine E, Perreault P, Giroux MF, Soulez G. Balloon dilation and stent placement for esophageal lesions: indications, methods, and results. *Radiographics* 2003; **23**: 89-105
- 45 **Petruzzello L**, Costamagna G. Stenting in esophageal strictures. *Dig Dis* 2002; **20**: 154-166
- 46 **Cheng YS**, Yang RJ, Li MH, Shang KZ, Chen WX, Chen NW, Chu YD, Zhuang QX. Interventional procedure for benign or malignant stricture or obstruction of upper gastrointestinal tract. *Shijie Huaren Xiaohua Zazhi* 2000; **8**: 1354-1360
- 47 **Chen WX**, Cheng YS, Yang RJ, Li MH, Shang KZ, Zhuang QX, Chen NW. Metal stent dilation in the treatment of benign esophageal stricture by interventional procedure: a follow-up study. *Shijie Huaren Xiaohua Zazhi* 2002; **10**: 333-336
- 48 **Cheng YS**, Shang KZ. Interventional therapy in dysphagia. *Shijie Huaren Xiaohua Zazhi* 2002; **10**: 1312-1314
- 49 **Fry SW**, Fleischer DE. Management of a refractory benign esophageal stricture with a new biodegradable stent. *Gastrointest Endosc* 1997; **45**: 179-182

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