Randomized controlled trial to investigate the effect of metal clips on early migration during stent implantation for malignant esophageal stricture

Changxiong Wang, MD
Cui Lou, MD

Accepted for publication
May 12, 2015

Correspondence to:

C. Wang or C. Lui
Digestive Endoscopy Center
Lishui People's Hospital
Lishui 323000
Zhejiang, China
wangchenbo2006@163.com
lou_cui@126.com

DOI: 10.1503/cjs.002615

Background: The rate of stent migration, especially in the short term after implantation, is high in the treatment process. We sought to explore an effective method for preventing early migration after stent implantation for malignant esophageal stricture and to provide the basis for clinical treatment.

Methods: We conducted a prospective, open-label, parallel-assignment randomized controlled trial with patients undergoing stent implantation for malignant esophageal stricture. The proximal segments of stents in the treatment group were fixed with 2 metal clips during the perioperative period of esophageal stent implantation, while no treatment was used in the control group. All patients underwent radiography at 3 and 7 days and 1 and 3 months after placement to assess the stent migration.

Results: There were 83 patients in our study. Demographic characteristics were similar between the groups. There was no stent migration observed in the treatment group within 2 weeks of the operation, while stent migration was observed in 6 of 41 (14.6%) cases in the control group, occurring at 3 and 7 days after placement. There were no perioperative complications.

Conclusion: Perioperative fixation of the proximal segments of stents with metal clips is effective in preventing early stent migration.

Contexte : Le taux de migration des endoprothèses est élevé, surtout peu de temps après leur pose, au cours du processus thérapeutique. Nous avons voulu trouver une méthode efficace pour prévenir la migration précoce des endoprothèses peu après leur pose pour la sténose œsophagienne d'origine maligne et établir la base du traitement clinique.

Méthodes : Nous avons réalisé un essai prospectif ouvert randomisé et contrôlé selon une affectation parallèle auprès de patients soumis à la pose d'une endoprothèse pour une sténose œsophagienne d'origine maligne. Les segments proximaux des endoprothèses dans le groupe traité ont été fixés à l'aide de 2 agrafes métalliques durant la période périopératoire de la pose de l'endoprothèse œsophagienne alors qu'aucun traitement n'a été utilisé dans le groupe témoin. Tous les patients ont subi une radiographie 3 et 7 jours, puis 1 et 3 mois après la pose de l'endoprothèse pour évaluer sa migration, le cas échéant.

Résultats : Notre étude comportait 83 patients. Les caractéristiques démographiques étaient similaires entre les groupes. On n'a noté aucune migration de l'endoprothèse dans le groupe traité au cours des 2 semaines suivant l'intervention, tandis que la migration de l'endoprothèse a été observée chez 6 participants sur 41 (14,6 %) du groupe témoin, 3 et 7 jours après la pose. On n'a noté aucune complication périopératoire.

Conclusion : La fixation périopératoire des segments proximaux des endoprothèses au moyen d'agrafes métalliques permet de prévenir efficacement la migration précoce des endoprothèses.

Esophageal cancer is one of the most common malignant tumours in China, ranking second in all digestive malignancies. China ranks first worldwide in incidence of and death from esophageal cancer.¹ When esophageal cancers are associated with progressive dysphagia, 60%–70% of them have already lost surgical indications,² and stent implantation remains the primary option.^{3–7} Esophageal stent implantation can rapidly re-establish the esophageal passage, relieve stricture symptoms, improve the nutritional status and replace esophageal reconstruction surgery, which is risky and traumatic. Therefore, esophageal stent implantation is of high clinical importance.⁸ Because of various reasons, stent migration often occurs after implantation, especially in the short term. Between January 2011 and December 2013, we used metal clips to clamp and fix the esophageal stents during the perioperative period to prevent stent migration.

METHODS

We studied adult patients who underwent stent implantation for malignant esophageal stricture in our hospital between January 2011 and December 2013. Diagnoses of all patients were confirmed with gastroscopic and histological examinations. The Clinical Trials Committee of Lishui People's Hospital approved our study protocol, and all participants provided written informed consent before enrolling in the trial.

The patients were randomly assigned to the treatment or control groups using a random number table. We used an allocation concealment method in which the researchers responsible for study grouping did not participate in the inclusion of participants or any other process during the trial. Our study was an open-label clinical trial because the assessors of stent migration could not be blinded. Each assessor's results were confirmed by a second person in order to reduce bias.

The equipment and materials used in this study were as follows: oral electronic gastroscope (Olympus GIF-H260), nasal gastroscope (Olympus GIF-N260), esophageal dilation bougie in diameter sizes of 5, 7 and 9 mm (Cook, SGD-100-1), Blue Zebra guidewire (Medi-Globe, GGW-03-35-450), silicone-coated esophageal stents with a diameter size of 20 mm and lengths of 80–120 mm (Micro-Tech Co. Ltd., MTN-SE), disposable esophageal stent inserter with a diameter of 8 mm and length of 650 mm (Micro-Tech Co. Ltd., MTN-SR) and cold saline. Uncovered metal stents were used in this study. Stent migration is defined as a deviation or change in the stent position in the human digestive tract, which leads to partial or complete loss of luminal dilation.

Electrocardiograms, blood tests and blood clotting time were examined in all patients, and the results matched the surgical requirements. Water deprivation and fasting were prescribed for 12 hours before the surgery, and lidocaine jelly was administered orally 10 min before the operation.

In the control group, an endoscope was inserted at the proximal end of the lesion site, and a Zebra guidewire was extended to the gastric cavity under radiography guidance. After the stricture site and length were confirmed dually by endoscopy and radiography, a bougie was used to dilate the strictured segment to 9 mm. The inserters were placed at the corresponding sites along the guidewire. Sequentially, the stent was slowly released until complete apposition. Finally, the stent status was re-examined with gastroscopy. In the treatment group, the esophageal lumen was divided into 4 quadrants (anterior, posterior, left and right) under the endoscope, and 2 metal clips were symmetrically placed at the proximal end of the stent for fixation (Fig. 1 and Fig. 2). Stent position was observed on radiographs obtained 3 and 7 days and 1 and 3 months after placement.

Fig. 1. Use of 2 metal clips to fix the upper segment of the stent to prevent stent migration.

Fig. 2. Radiograph showing 2 metal clips fixed to the upper segment of the stent.

Statistical analysis

We used Student *t* tests and χ^2 tests to compare the baseline characteristics between the 2 groups. The χ^2 test was used to compare the stent migration rates between the groups. We performed our statistical analysis using SPSS software version 18.0, and we considered results to be significant at $p < 0.05$.

RESULTS

We included 83 patients in our study: 61 had squamous cell carcinoma, 21 had adenocarcinoma, and 1 had adenosquamous carcinoma. All patients had stage III or IV disease. The obstruction sites in 21 patients were in the mid-upper segments; in the other 62 patients, they were in the lower segments. Twenty-eight patients received radiotherapy, and the remaining patients either did not have surgical opportunities or refused surgery. Five patients could not drink (level 0 of dysphagia), 59 could eat only liquid food (level I), and 19 could have semiliquid food (level II). Patients were randomized into 2 groups in parity using their hospital numbers, with 42 in the treatment group and 41 in the control group. No significant differences were found between the groups in demographic and clinical characteristics, such as sex, age, pathological type, clinical stage, obstruction site, lesion length and radiotherapy history (Table 1). In this study, all implantations were primarily successful. Radiograph examinations

were performed 3 and 7 days and 1 and 3 months postoperatively to observe the status of the stents. No dropout or loss to follow-up occurred. A flow chart of enrolled patients is shown in Figure 3. The results indicated that the stents in all the patients were located appropriately with a dilation degree longer than 1.5 cm. With a total effective rate of 100%, significant improvements could be observed in the dysphagia symptoms of the patients from the treatment group 1 week postoperatively, and they could eat semiliquid food or soft food. Although no stent migrations were found 1 and 3 months postoperatively in the control group, 2 occurred 3 days postoperatively and 4 occurred 7 days postoperatively, resulting in a total effectiveness of 85.4% (Table 2). There were no perioperative complications.

DISCUSSION

As a palliative treatment, esophageal stent implantation is effective in resolving diseases, such as benign and malignant esophageal strictures and esophageal fistula, and has been widely applied in clinical practice. As more cancer patients survive, complications with stents are more frequently observed. The common complications include retrosternal pain, bleeding, reflux, stent migration and loss, and restenosis.⁹ Stent migration is the most common complication clinically, with an incidence of 12.27%, accounting for 57.82% of all stent complications.¹⁰ The possible reasons include severe vomiting and improper diet, severe coughing and high tension, and overdilated esophageal lumen.¹¹ Therefore, treatment for stent migration after esophageal stent implantation is a major problem for doctors.¹² We share our successful experience in treating short-term stent migration after esophageal stent implantation, hoping to provide a basis for clinical treatment.

Long and colleagues¹³ reported that the uncoated segment of the esophageal stent would stimulate intraluminal-oriented growth of the granulation tissues and that it would be extremely difficult to withdraw the stents 3 weeks later. In our study, the stent migration rate of the control group was 14.6%, and most of them occurred after 3–7 days. No stent migration was observed in the treatment group within 2 weeks of the operation; therefore, the difference between

Table 1. Demographic and clinical characteristics of study participants (n = 83)

Characteristic	Group; no.*†	
	Treatment, n = 42	Control, n = 41
Sex		
Male	29	27
Female	13	14
Mean age, yr	67.6	69.8
Pathological type		
Squamous cell carcinoma	30	31
Adenocarcinoma	11	10
Adenosquamous carcinoma	1	0
Dysphagia degree		
Level 0	2	3
Level 1	30	29
Level II	10	9
Obstruction site		
Mid-upper segment	11	10
Lower segment	31	31
Lesion length, cm		
4	10	10
6	21	22
8	11	9
Radiotherapy history		
Yes	13	15
No	29	26

*Unless otherwise indicated.
†All $p > 0.05$.

Table 2. Stent migration rates in the treatment and control groups (n = 83)

Migration	Group; no.*†	
	Treatment, n = 42	Control, n = 41
Timing		
3 d	0	2
7 d	0	4
1 mo	0	0
3 mo	0	0
Rate	0%	14.6%

*Unless otherwise indicated.
† $\chi^2 = 4.62$, $p = 0.032$.

these 2 groups was significant ($p = 0.032$). No stent migration occurred in either group at 1 month or 3 months, which indicated that the stent was fixed to the esophageal lumen 2–3 weeks postoperatively and that migration was unlikely to happen; therefore, preventive treatment should be performed during the perioperative period. After the endoscopic removal of the metal clips, granulation tissues, which are similar to those induced by surgical sutures, could be observed. These granulation tissues would detach from the stent spontaneously and would then be excreted through the digestive tract 1–4 weeks later, usually without complication.¹⁴ We think application of metal clips within 2 weeks of the operation will prevent stent migration. Two weeks later, when the stent is fully released, the metal clips will detach from the stent spontaneously.

Limitations

Measures to reduce bias in our study were the randomized control method, enrolment of inpatients, good

patient compliance, trained researchers and appropriate statistical analysis. However, the sample size was small owing to insufficient funds and the time and number of researchers, but we will increase the sample size in future studies. We believe our approach was appropriate and rational.

CONCLUSION

Perioperative fixation of the proximal segments of stents with metal clips is effective in preventing stent migration. However, there are still 2 noteworthy points. First, 2 metal clips should be used in the operation because 1 clip is definitely not effective enough and more than 2 clips will increase the economic burden of the patient. Second, the preexisting esophageal lumen expansion should not exceed 9 mm, and the stricture length can be determined once the nasal gastroscope penetrates the stricture. If the esophageal lumen is overdilated, the stent is prone to migration or even loss; as the inserter's diameter is only 8 mm, the 9 mm dilation is wide enough.

Fig. 3. Flow of patients through the clinical trial.

Acknowledgments: The authors thank their colleagues from the Digestive Endoscopy Center, Lishui People's Hospital, for their comments and support.

Affiliations: From the Digestive Endoscopy Center, Lishui People's Hospital, Lishui, Zhejiang, China (Wang); the Sixth Affiliated Hospital of Wenzhou Medical University, Wenzhou, Zhejiang, China (Wang); and the Department of Gastroenterology, Jinyun County Hospital of traditional Chinese Medicine, Zhejiang, China (Lou).

Competing interests: None declared.

Contributors: Both authors designed the study and acquired the data, which C. Wang analyzed. Both authors wrote and reviewed the article and approved the final version for publication.

References

1. National Cancer Research Office, Statistical Information Center of Ministry of Health. Research report on risk factor of cancer in China. 2003, Beijing: China Union Medical University Press.
2. Homs MY, Steyerberg EW, Eijkenboom WM, et al. Single-dose brachytherapy versus metal stent placement for the palliation of dysphagia from oesophageal cancer: multicentre randomised trial. *Lancet* 2004;364:1497-504.
3. Lazarakis G, Katsinelos P, Nakos A, et al. Malignant esophageal dysphagia palliation using insertion of a covered Ultraflex stent without fluoroscopy: a prospective observational study. *Surg Endosc* 2011;25:628-35.
4. Ge X. Clinical application of covered stents in treating esophageal malignant stenosis [article in Chinese]. *J Clin Rehabil Tissue Eng Res* 2010;14:702-5.
5. Conio M, Bianchi S, Filiberti R, et al. Self-expanding plastic stent to palliate symptomatic tissue in/overgrowth after self-expanding metal stent placement for esophageal cancer. *Dis Esophagus* 2010;23:590-6.
6. Dumitru A, Sabau A, Maniu D, et al. Particular aspects of endoprosthesis in malignant advanced pharyngeal-esophageal stenosis. *Chirurgia (Bucur)* 2011;106:327-32.
7. Vleggaar FP, Siersema PD. Expandable stents for malignant esophageal disease. [vii.]. *Gastrointest Endosc Clin N Am* 2011;21:377-88.
8. Burstow M, Kelly T, Panchani S, et al. Outcome of palliative esophageal stenting for malignant dysphagia: a retrospective analysis. *Dis Esophagus* 2009;22:519-25.
9. Huang ZW, Zhang QK, Wen MZ, et al. Analysis of the complications of malignant esophagus stenosis from stenting [article in Chinese]. *J Chin Clin Med Imaging* 2007;18:305-7.
10. Feng ZQ, Nie YQ. Literature analysis of endoscopic treatment of benign esophageal perforations with covered metal stents [article in Chinese]. *Chin J Endosc* 2012;18:147-50.
11. Gao G, Cao JB, Li SJ, et al. Prevention of stent migration and loss in esophageal stenting for patients with achalasia [article in Chinese]. *Hebei Med J* 2009;31:2767-8.
12. Yin SW, Xiang YM, Ye LA. The complication and management of esophageal stent in the treatment of esophageal strictures and fistula [article in Chinese]. *Mod Med Imageology* 2007;16:204-6.
13. Long HD, Yin SW, Wu X, et al. Pick-up and replacement shift esophageal stent [article in Chinese]. *Anhui Med J* 2011;32:511-3.
14. Xu GM, Li ZS. *Upper gastrointestinal endoscopy*. 1st ed. 2003, Shanghai: Shanghai Science and Technology Press.

Journal canadien de chirurgie

Nous croyons au libre accès à la recherche

Afin de continuer à assurer le libre accès à tout le contenu du JCS, partout dans le monde, les articles présentés pour publication seront assujettis à compter du 1er janvier 2014 à des frais de soumission de 100 \$ (dollars canadiens). Les auteurs

correspondants affiliés aux commanditaires du JCS seront exonérés des frais de soumission. Les articles acceptés dans les sections Recherche, Revue et Formation médicale continue sont assujettis à des frais de publication de 700 \$, dans les sections Commentaires et Discussions, à des frais de publication de 500 \$, payables sur acceptation en dollars canadiens.

Les avantages du libre accès

- Pour les chercheurs et les établissements : visibilité, utilisation et impact accrus de leur travail
- Pour les gouvernements : meilleur rendement de leur investissement dans le financement de la recherche
- Pour la société : des soins aux patients efficaces et efficients, produisant de meilleurs résultats

Les articles du JCS sont consultables gratuitement sur le site web du Journal (canjsurg.ca) et sur PubMed Central.