Review Article

Palliation of dysphagia in patients with unresectable oesophageal tumours—current methods and indications—a review

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Abstract: Dysphagia is a common symptom in patients with unresectable esophageal cancer or metastatic disease. It is a debilitating symptom compromising biological status and quality of life. This article is intended to be an analysis of the various methods currently used in the treatment of dysphagia in patients with unresectable esophageal cancer, in terms of selecting the optimal procedure for each patient. The introduction of endoscopic stenting has been a huge step forward for patients with unresectable tumors, but this indication needs to be adapted according to several criteria. Choosing the optimal stent is currently a challenge given the technical progress in this area. Palliative brachytherapy is the most effective method of improving dysphagia through a higher control of the local evolution of the disease, its indication is supported by the results of several studies. The endoscopic ablative methods currently used have promising results, but have frequently shown a transient effect on dysphagia, requiring several sessions or an association with another landing method. A recent approach is the use of combined palliation methods, which offer the benefits of each method to achieve the best and long-term efficiency for the relief of dysphagia. The selection of the optimal method to alleviate dysphagia in patients with unrecognized malignancies remains a topic of discussion.

Keywords: Esophageal cancer; esophageal stent; dysphagia palliation

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Introduction

The incidence of oesophageal cancer (EC) has increased in recent decades, it ranks 7th in the world (in Central and Eastern Asia—China, standardized incidence with age is 13.7 per 100,000 people) and 19th in Europe (UK—6.6 per 100,000) (1,2).

Thus, EC has a reserved prognosis, a reduced survival rate at 5 years of 18% and overall ranks 6th in terms of cancer mortality (3,4).

Poor survival and poor prognosis are mainly explained by the fact that half of the patients present with unresectable tumours or cannot undergo extensive surgery hence the need for palliative treatment to overcome progressive dysphagia (5).

In the current practice, there are 3 categories of patients with esophageal cancer: patients fit for surgery with a resectable tumour, inoperable patients due to unresectable tumour or metastatic disease and patients with post-therapeutic tumour recurrence.

Inoperable patients with locally unresectable advanced tumours or with metastatic disease and also patients with tumour recurrence require palliative treatment. Progressive dysphagia is present in more than 80% (6) of these patients.

Dysphagia is the most common clinical symptom in EC; its consequence is often insufficient nutrition and poor quality of life. It is one of the most distressing and debilitating symptoms and also is compromising the biological status of these patients (7).

Malnutrition is probably one of the strongest predictors of survival in EC patients (8).

The median survival of patients with metastatic EC, without treatment, is less than 6 months. Palliative therapy goal is to control the symptoms of the disease, to improve the quality of life and to prolong survival as much as possible (9).

Palliation of dysphagia is an essential goal for this category of patients, but the extent of any intervention should be as small as possible and with a minimum risk of post-procedural complications.

Different options are available for the palliation of malignant dysphagia including chemotherapy and/or radiotherapy, endoluminal stents, oesophageal dilation, laser ablation, photodynamic therapy (PDT), brachytherapy and resection or bypass surgery—all of these methods having their limitations (10).

Systemic chemotherapy concomitant with external radiotherapy (radiochemotherapy) with or without esophagectomy is the primary therapy used for advanced non-metastatic EC. Unfortunately, this management is not suited to most patients with EC.

Options for controlling dysphagia and providing adequate nutrition, in this case, include self-expanding metal stents (SEMS) or enteral feed tubes (gastrostomy or jejunostomy) inserted classically or minimally invasive. The feeding tubes do not improve dysphagia, but they can improve their nutritional status. The palliation of dysphagia occurs with the initiation of radiotherapy, but it usually takes several weeks for the dysphagia to improve. In those with severe dysphagia, this treatment may be delayed due to malnutrition and poor performance status.

Factors influencing the therapeutic decision are clinical staging (cTNM), available medical specialities (interventional gastroenterology, brachytherapy, radiotherapy), multidisciplinary team experience, comorbid illnesses, patient nutritional status, performance status, tumour characteristics and patient preferences (11).

The European Society for Gastrointestinal Endoscopy (ESGE) recommends the installation of partially or completely covered SEMS for the palliative treatment of dysphagia in the detriment of laser ablation, PDT or oesophageal bypass. For patients with longer life expectancy, ESGE recommends palliation of dysphagia by brachytherapy as a viable alternative or in combination with oesophageal stenting. ESGE does not recommend the concomitant association of external radiotherapy and endoscopic oesophageal stenting (12). Treatment of oesophageal tumours should be carried on in specialised centres for oesophageal surgery, involving multidisciplinary approach, multimodal therapy and using minimally invasive or endoscopic surgical techniques (13).

Esophageal stenting

In general, esophageal stent insertion is the preferred option for patients with a relatively poor prognosis due to the rapid progression of dysphagia and for which the poor biological condition is a contraindication for other therapies (14,15).

SEMS has reformed the palliation of dysphagia in patients with inoperable EC due to its easy insertion, relatively low complication rates and reasonably good functional outcomes (16,17). SEMS usually offers rapid improvement of dysphagia, deals with oropharyngeal secretions, reduces the risk of aspiration, restores nutrition and prevents starvation, thus increasing survival.

In the past years, SEMS has taken over the use of rigid plastic stents and surgical by-pass, being considered now the gold standard of mechanical palliation offering a safe and effective relief (10).

SEMS is less effective when used for the treatment of distal oesophageal obstruction, but can be successfully inserted in patients with proximal or cervical locations (18).

The stents find their usefulness first and foremost in the treatment of major complications of tumour invasion in the structures adjacent to the oesophagus, namely the esotracheal fistula with bronchi or mediastinum, which is important to be diagnosed promptly before the onset of sepsis.

There are several reasons for choosing stent insertion also for patients with a relatively good prognosis, but cases with contraindication for radiotherapy:

- The presence of the oesophageal fistula—insertion of a covered SEMS can successfully cover the wall defect to prevent contamination of the mediastinum and aspiration pneumonia (19,20) when the radiotherapy is contraindicated due to the tissue necrosis leading to enlargement of the defect.
- Tumour recurrence after recent radiotherapy treatment, often in the context of curative radiotherapy in combination with chemotherapy

and esophagectomy.
- ❖ Recurrent dysphagia after first-line palliative radiotherapy.

Stent type

The designs and characteristics of currently available stents may vary depending on: the material used, the forces applied by the stent (radial or axial) (21); the coating film; the anti-migration properties (22); and the mechanism of mounting the stent using a guidewire or through-the-scope. However, the differences between these stent characteristics are still insufficiently studied, as high-level evidence from comparative randomized trials is lacking.

SEMSs are composed of a variety of metal alloys of different shapes and sizes. There are three types of metal stents: uncoated, partially coated and completely coated.

The completely covered stents have the advantage of preventing the tumour invasion in the lumen of the stent and can seal an eso-tracheal fistula but have a higher migration rate. Partially covered stents have uncovered ends to prevent migration. Uncoated stents have a lower risk of migration, but they cannot prevent tumour invasion and stent occlusion. For the manufacture of stents other materials can be used, such as polyester (self-expandable plastic stent-SEPS), that are completely covered with silicone and have a higher migration rate compared with the metal ones. Another category of stents less used for palliation of dysphagia are self-expanding absorbable stents that are made of polydioxanone, are uncoated, have no antireflux system and are completely absorbable in about three months.

For stent insertion, it is sometimes necessary a prior endoscopic dilatation and the stent length must exceed the proximal and distal tumour stenosis by 4 cm (23).

Efficiency of the procedure

Oesophageal stents provide rapid relief of dysphagia, but the procedure can be associated with complications: retrosternal pain, gastroesophageal reflux (for distal tumours), stent migration, and perhaps more serious complications (24).

Some authors confirmed the effectiveness of SEMS in reducing dysphagia of inoperable EC, with an incidence of recurrence of dysphagia in 15% of patients mainly due to tumour extension beyond the stent edges (25). Other authors found that the incidence of recurrent dysphagia after oesophageal stenting increased after 3 months and remained increased for 3 more months, concluding that stenting would be appropriate in patients with poorly predicted survival (usually <3 months) (26).

Recurrent post-stent dysphagia can initially be determined by the possible migration or deformation of the stent and delayed by tumour growth beyond the stent edges (25).

The authors of the ESGE guidelines hypothesized that a partially coated SEMS is more effective in preventing stent migration by the integration of the stent into the oesophageal tumour, compared to a fully coated one (12).

On the other hand, two randomized trials showed no significant difference in recurrent dysphagia and stent migration between partially covered and fully covered stents (27,28).

Removal of an embedded partially covered SEMS can be achieved with the stent-in-stent method, which involves placing another fully covered SEMS with similar or slightly larger size followed by removal of both stents after 10–14 days (29,30). A similar method can also be applied in patients with recurrent dysphagia due to the extension of the tumour beyond the stent edges. For this indication, both stents are left in place to achieve adequate relief of dysphagia (31).

Complications of stenting

The major complications communicated are massive bleeding, stent migration, recurrence of stenosis, oesophageal perforation and fistula (32,33).

Early complications after stenting include: gastroesophageal reflux (9%), severe retrosternal pain (9%), hemorrhage (8%), aspiration pneumonia (4%) and esophageal perforation (3%).

Late complications include persistent reflux (15%), severe retrosternal pain (15%), haemorrhage (11%), aspiration pneumonia (10%) and fistula (5%) (12).

For the distal location of tumours, anti-reflux valve stents have been recommended to prevent gastroesophageal reflux (34). This is more effective in preventing gastroesophageal reflux, but with more frequent minor complications (e.g., SEMS migration and/or obstruction) (35).

The stenting of patients who were treated by radiochemotherapy was significantly associated with major complications (36). Another study found that chemotherapy or radiotherapy after stent insertion is a prognostic factor for stent migration (approximately 10%) (37).

Radioactive stents

Some studies found that the dysphagia score declined

significantly after the insertion of a segmental metallic radioactive stent. Currently, different types of metal stents are available, including embedded radioactive particles, e.g., iodine-125 seeds (^{125}I), for the combined effect of intraluminal brachytherapy as well (38).

The stenting procedure using radioactive SEMS is safe and effective for palliation of dysphagia in patients with malignant oesophageal stenosis (39), being superior to conventional coated stent insertion in terms of survival (40).

Radiotherapy

Intraluminal brachytherapy

For patients with a better life expectancy, brachytherapy is recommended due to the long-term palliative effect on dysphagia. For the reason that availability of brachytherapy in clinical practice is limited, external radiation therapy it is usually used as an alternative (14).

Brachytherapy has a positive impact on the quality of life and can provide an additional survival benefit, with the risk of minimal complications (12,41).

It is considered the most favourable palliative treatment option, but patients must have an endoscopic examination before to facilitate the correct positioning of the brachytherapy applicator. It is reported that the doses currently used range from 12 to 21 Gy administered in one to three fractions, but the optimal dose remains uncertain. Recently, it has been suggested that a higher dose may be more beneficial, given the better efficiency (84% *vs.* 51%, for 21 *vs.* 12 Gy) as reported in one study (42).

Although brachytherapy has been widely recommended for patients with long term survival expected, its use in current clinical practice is limited due to its restricted availability, lack of expertise, and complexity of the procedure (12).

Another study confirmed that brachytherapy is an effective and safe treatment option; obtaining a mean free interval of dysphagia of 99 days, the overall average survival was 175.5 days, the occurrence of fistula or recurrence of dysphagia was reported in 8.3% respectively 12.2% of patients (43).

Another study shows an efficiency rate for improving dysphagia of 86.9%; at 3 months, 67.2%; at 6 months, 47.4%; at 9 months, 37.6%; and, at 12 months, 29.4%. The total radiation dose and the number of fractions are the only factors that positively influence the success rate (42).

The amelioration of dysphagia was achieved in 55% of patients and lasted for an average period of 4.6 months; stabilization occurred in 31% and deterioration in 14% of patients treated with high-dose 2D brachytherapy (44).

The use of nasogastric feeding tubes on which radioactive particles were fixed and which were placed in the oesophageal tumour has been demonstrated to be a feasible method to provide nutrition. The method resulted in a significant improvement compared to the preoperative data (45).

External beam radiation therapy

External radiation therapy is often used as a more accessible alternative to brachytherapy.

The most commonly used palliative radiation regime include 20 Gy in five fractions and 30 Gy in 10 fractions, delivered on opposite fields in the anterior-posterior direction. Usually, fractional radiotherapy initially commences with worsening of the symptoms of dysphagia due to the radiation-induced inflammation, followed by a long-term improvement within a few weeks after the completion of the therapy.

A retrospective study on a group of 148 patients treated with 20 Gy in 5 fractions (n=132, 89%) found a reduction of dysphagia in 104 of 138 (75%) patients and for 43 patients (31%) an additional method to treat dysphagia was required (46).

Applying concurrent chemotherapy to improve outcome due to chemotherapy-induced radiosensitizing is not effective in alleviating dysphagia, patients treated with external radiotherapy alone had a lower risk of undergoing additional treatment (51% vs. 60%) compared with those treated by radiochemotherapy (47).

Another study indicates a palliative response rate (complete and partial) for dysphagia of 76% after the use of short term accelerated radiation therapy with 2D radiotherapy technique with a total dose of 12 Gy in 4 fractions for oesophageal tumours locally advanced or with metastasis (48).

Combined therapies

A comparative study showed that both low-dose external radiotherapy (5 ×4 Gy external radiotherapy) and combination radiotherapy (10 ×3 Gy external radiotherapy with 12 Gy single dose intraluminal brachytherapy) was effective for long term improvement of dysphagia in patients with inoperable or metastatic oesophageal tumours.

Combined radiotherapy has been associated with greater efficacy in the control of long-term dysphagia, suggesting that it would be appropriate for patients with a longer life expectancy (49,50). Another study that used external therapy 30 Gy in 10 fractions combined with 16 Gy brachytherapy in 2 fractions concludes that it is uncertain whether the addition of external radiotherapy has a benefit in alleviating dysphagia (51).

External radiotherapy after oesophageal stent insertion is not recommended, as it appears to produce a high number of complications (12), however, the recent ESGE guideline suggests that concomitant brachytherapy may add benefits in the alleviation of dysphagia (12).

A comparative study for the effectiveness in the control of dysphagia of the radioactive stent compared to a conventional stent showed that the radioactive stent was more efficient at 3 and 6 months after implantation and extended the survival period, without further complications (52).

Percutaneous endoscopic gastrostomy (PEG)

The introduction of PEG for patients with EC is debated, due to the risk of possible tumour seeding at the tube insertion site (53) although some authors have estimated that the risk of seeding is quite low (lower than 1 in 1,000) (54).

Several studies have reported that this method for palliation of dysphagia in patients undergoing radiotherapy is beneficial in maintaining adequate nutrition and that it would lead to a higher tolerance to treatment without significant side effects (55,56). Many radiotherapy centres start the treatment of patients with dysphagia only after the insertion of a gastrostomy, it does not in any way compromise the surgery (57).

Other authors believe that in severe oesophageal luminal obstruction, the passage of the endoscope, with the risk of oesophageal perforation, may be difficult, thus surgical gastrostomy being the alternative procedure for introducing a feeding tube (58).

Laser therapy

Neodymium-yttrium-aluminium-garnet (Nd-YAG) endoluminal laser ablation has been used as a palliation method for dysphagia, which provides an immediate improvement, but with limited durability (weeks) if not followed by complementary therapy. Persistence or recurrence of dysphagia after laser treatment usually required insertion of a SEMS (59).

This method can have complications such as pneumomediastinum, oesophageal perforation, subcutaneous emphysema, haemorrhage and death that may be related to the procedure (60).

In another study, patients treated with laser therapy had a longer survival tendency, but repeated sessions were required for a good outcome. Those with lower initial dysphagia scores can be maintained only by laser therapy (61).

A benefit has been observed in patients with adenocarcinoma of the distal oesophagus or oesophageal gastric junction—laser therapy has been able to significantly improve dysphagia, with lower morbidity and mortality rates, and without incurring higher hospital costs compared to SEMS (62).

Cryotherapy

Liquid nitrogen spray cryotherapy (truFreeze, CSA Medical, Inc., Lexington, Massachusetts, United States) has been used for palliation of dysphagia in patients with large tumours (63). This is a contactless method in which liquid nitrogen at –196° is sprayed to freeze and effectively destroy oesophageal tumours with an excellent level of tolerability and safety. Cryotherapy can also induce tumour necrosis by immunological mechanisms (64).

Spray cryotherapy has been used as a primary treatment for dysphagia or as an adjunctive treatment to improve dysphagia before systemic treatment. Improvement of dysphagia score was reported in 71% of patients in the first week and 50% of patients in the second week, with an improvement at 4 weeks, persisting in almost half of patients (65).

Previous studies have shown that intermittent cryotherapy can provide prolonged improvement of dysphagia in patients who are not eligible for systemic therapy. Compared with stenting, pain and reflux are less common, although the improvement of dysphagia may not be as great. At present, spray cryotherapy is only available in the United States, so widespread use is limited (63).

PDT

PDT is based on a photochemical reaction between a molecule that is activated by light, also called a photosensitizer, light, and the release of molecular oxygen that can be used for tissue destruction (66).

In the literature, studies show that at 4 weeks after PDT, a significant improvement in dysphagia score was observed

in approximately 90% of patients. At the same time, it has been found that PDT as a step of multimodal treatment is a safe and effective method for improving swallowing while having minimal complications. If the dysphagia relapse, radiotherapy or SEMS can be an alternative (67).

Some authors note that recurrence of dysphagia occurred earlier in the stent group compared to the group with PDT ($P<0.05$). The oesophageal stent may improve dysphagia immediately after insertion, while PDT may induce longer-term dysphagia control (68).

Other methods

Endoscopic injection of concentrated alcohol is effective in alleviating tumour determined dysphagia. In the literature, studies show that the average dysphagia score improved from initially 2.7 to 1.4 after treatment ($P<0.001$). The mean duration of improvement of dysphagia before recurrence was 35 days (69), similar results reported in another study (70).

This technique being cheap and easy to perform deserves comparative studies with more confirmed ablative therapy, such as laser photocoagulation. A comparative study of the use of argon plasma coagulation (APC) and the use of SEMS for palliation of dysphagia has shown that APC is a promising stepping stone in inoperable EC when patients cannot receive chemotherapy, but randomized controlled trials are needed to evaluate this method (71).

Conclusions

Current treatment of EC involves multidisciplinary cooperation and is reserved for specialized centres in oesophageal pathology. The palliation of dysphagia in patients with unresectable tumours remains a controversial issue for the application of the optimal procedure adapted to each patient. Insertion of SEMS is safe, efficient and faster in palliation of dysphagia compared to other methods. It has the largest use, either as a primary indication in patients with poor prognosis or with mediastinal fistula, being often a rescue method in case of failure of others types or as a part in case of multimodal treatment following an ablative procedure. New stent designs enhance the benefits by reducing the incidence of complications of conventional stents. The radioactive stent is preferable due to better efficiency in the control of dysphagia for patients with a higher life expectancy. The use of the rigid plastic tube, endoscopic dilatation alone and chemotherapy alone is not recommended for palliation of dysphagia, due to a high incidence of complications and recurrent dysphagia. Special attention should be paid to patients with recurrence of dysphagia after radiotherapy, which requires stenting due to the increased risk of complications. Brachytherapy is indicated in patients with a higher life expectancy, but unfortunately, it is not so widely used due to lack of experience, the complexity of the procedure and limited availability. The option of external radiation therapy appears to have more limited benefits in terms of palliation of dysphagia, and the addition of induction chemotherapy does not appear to bring benefits for palliation of dysphagia. PEG insertion is indicated for patients who will undergo neoadjuvant radiochemotherapy. The ablative methods continue to be sequences of multimodal management.

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Footnote

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References

1. GLOBOCAN 2018. International Agency for Research on Cancer - IARC (http://gco.iarc.fr/today) World Health Organization.

2. Bray F, Ferlay J, Soerjomataram I, et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018;68:394-424.
3. EUCAN 2018. The European Cancer Observatory (ECO). Available online: http://eco.iarc.fr
4. ECIS 2019- European Cancer Information System. Available online: https://ecis.jrc.ec.europa.eu
5. Parkin DM, Bray FI, Devesa SS. Cancer burden in the year 2000. The global picture. Eur J Cancer 2001;37:S4-66.
6. Diamantis G, Scarpa M, Bocus P, et al. Quality of life in patients with esophageal stenting for the palliation of malignant dysphagia. World J Gastroenterol 2011;17:144-50.
7. Hanna WC, Sudarshan M, Roberge D, et al. What is the optimal management of dysphagia in metastatic esophageal cancer? Curr Oncol 2012;19:e60-6.
8. Lecleire S, Di Fiore F, Antonietti M, et al. Undernutrition is predictive of early mortality after palliative self-expanding metal stent insertion in patients with inoperable or recurrent esophageal cancer. Gastrointest Endosc 2006;64:479-84.
9. Lagergren J, Smyth E, Cunningham D, et al. Oesophageal cancer. Lancet 2017;390:2383-96.
10. Abdelshafy M, Omar MA, Bary MA, et al. Self-expandable metal stent for palliation of malignant dysphagia & quality of life improvement in advanced cancer esophagus: Upper Egypt experience. J Egypt Soc Cardiothorac Surg 2017;25:262-9.
11. D'Journo XB. Clinical implication of the innovations of the 8th edition of the TNM classification for esophageal and esophago-gastric cancer. J Thorac Dis 2018;10:S2671-81.
12. Spaander MC, Baron TH, Siersema PD, et al. Esophageal stenting for benign and malignant disease: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline. Endoscopy 2016;48:939-48.
13. Achim F, Constantinoiu S. Recent Advances in Minimally Invasive Esophagectomy. Chirurgia (Bucur) 2018;113:19-37.
14. van der Bogt RD, Vermeulen BD, Reijm AN, et al. Palliation of dysphagia. Best Pract Res Clin Gastroenterol 2018;36-37:97-103.
15. Włodarczyk JR, Kużdżał J. Stenting in Palliation of Unresectable Esophageal Cancer. World J Surg 2018;42:3988-96.
16. Frenken M. Best palliation in esophageal cancer: surgery, stenting, radiation, or what? Dis Esophagus 2001;14:120-3.
17. Kaltsidis H, Mansoor W, Park JH, et al. Oesophageal stenting: Status quo and future challenges. Br J Radiol 2018;91:20170935.
18. Bethge N, Sommer A, Vakil N. A prospective trial of self-expanding metal stents in the palliation of malignant esophageal strictures near the upper esophageal sphincter. Gastrointest Endosc 1997;45:300.
19. van den Berg MW, Kerbert AC, van Soest EJ, et al. Safety and efficacy of a fully covered large-diameter self-expanding metal stent for the treatment of upper gastrointestinal perforations, anastomotic leaks, and fistula. Dis Esophagus 2016;29:572-9.
20. van Halsema EE, Kappelle WFW, Weusten B, et al. Stent placement for benign esophageal leaks, perforations, and fistulae: a clinical prediction rule for successful leakage control. Endoscopy 2018;50:98-108.
21. Mbah N, Philips P, Voor MJ, et al. Optimal radial force and size for palliation in gastroesophageal adenocarcinoma: a comparative analysis of current stent technology. Surg Endosc 2017;31:5076-82.
22. Hussain Z, Diamantopoulos A, Krokidis M, et al. Double-layered covered stent for the treatment of malignant oesophageal obstructions: systematic review and meta-analysis. World J Gastroenterol 2016;22:7841-50.
23. Sharma P, Kozarek R. Practice Parameters Committee of American College of Gastroenterology. Role of esophageal stents in benign and malignant diseases. Am J Gastroenterol 2010;105:258.
24. Dai Y, Li C, Xie Y. et al. Interventions for dysphagia in oesophageal cancer. Cochrane Database Syst Rev 2014;(10):CD005048.
25. Sharma B, Raina S, Sharma R, et al. Self-Expanding Metallic Stents (SEMS) in Inoperable Esophageal Cancer: A Prospective Analysis of Morbidity and Survival Outcomes. Indian J Palliat Care 2019;25:398-402.
26. Gao F, Xu YL, Liu YJ, et al. Outcomes of self-expandable metal stent placement for malignant oesophageal strictures. Clin Radiol 2020;75:156.e21-7.
27. Didden P, Reijm AN, Erler NS, et al. Fully vs. partially covered selfexpandable metal stent for palliation of malignant esophageal strictures: a randomized trial (the COPAC study). Endoscopy 2018;50:961-71.
28. Persson J, Smedh U, Johnsson A, et al. Fully covered stents are similar to semi-covered stents with regard to migration in palliative treatment of malignant strictures of the esophagus and gastric cardia: results of a randomized controlled trial. Surg Endosc 2017;31:4025-33.
29. Hirdes MM, Siersema PD, Houben MH, et al. Stent-

in stent technique for removal of embedded esophageal self-expanding metal stents. Am J Gastroenterol 2011;106:286-93.
30. Dumonceau JM, Deviere J. Treatment of Boerhaave's syndrome using the ultraflex self-expandable stent. Gastrointest Endosc 2000;51:773-4.
31. Homs MY, Steyerberg EW, Kuipers EJ, et al. Causes and treatment of recurrent dysphagia after self-expanding metal stent placement for palliation of esophageal carcinoma. Endoscopy 2004;36:880-6.
32. Conio M, Repici A, Battaglia G, et al. A randomized prospective comparison of self-expandable plastic stents and partially covered self-expandable metal stents in the palliation of malignant esophageal dysphagia. Am J Gastroenterol 2007;102:2667-77.
33. Bi Y, Ren J, Li J, et al. A novel fully covered self-expandable segmental metallic stents for the treatment of refractory esophageal stenosis. J Thorac Dis 2019;11:1363-9.
34. Elphick DA, Smith BA. Self-expanding metal stents in the palliation of malignant dysphagia: Outcome analysis in 100 consecutive patients. Dis Esophagus 2005;18:93-5.
35. Coron E, David G, Lecleire S, et al. Antireflux versus conventional self-expanding metallic Stents (SEMS) for distal esophageal cancer: results of a multicenter randomized trial. Endosc Int Open 2016;4:E730-6.
36. Reijm AN, Didden P, Schelling SJC et al. Self-expandable metal stent placement for malignant esophageal strictures - changes in clinical outcomes over time. Endoscopy 2019;51:18-29.
37. Park JH, Song HY, Shin JH, et al. Migration of retrievable expandable metallic stents inserted for malignant esophageal strictures: incidence, management, and prognostic factors in 332 patients. AJR Am J Roentgenol 2015;204:1109-14.
38. Tian D, Wen H, Fu M. Comparative study of self-expanding metal stent and intraluminal radioactive stent for inoperable esophageal squamous cell carcinoma. World J Surg Oncol 2016;14:18.
39. Bi Y, Li J, Yi M, et al. Self-expanding segmental radioactive metal stents for palliation of malignant esophageal strictures. Acta Radiol 2020;61:921-6.
40. Zhongmin W, Xunbo H, Jun C, et al. Intraluminal radioactive stent compared with covered stent alone for the treatment of malignant esophageal stricture. Cardiovasc Intervent Radiol 2012;35:351-8.
41. Lordick F, Mariette C, Haustermans K, et al. Oesophageal cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. Ann Oncol 2016;27:v50-7.
42. Fuccio L, Mandolesi D, Farioli A, et al. Brachytherapy for the palliation of dysphagia owing to esophageal cancer: a systematic review and meta-analysis of prospective studies. Radiother Oncol 2017;122:332-9.
43. Lancellotta V, Cellini F, Fionda B, et al. The role of palliative interventional radio-therapy (brachytherapy) in esophageal cancer: An AIRO (Italian Association of Radio-therapy and Clinical Oncology) systematic review focused on dysphagia-free survival. Brachytherapy 2020;19:104-10.
44. Burchardt W, Chyrek A, Burchardt E et al. Reducing dysphagia with palliative 2D high-dose-rate brachytherapy improves survival in esophageal cancer. J Contemp Brachytherapy 2019;11:534-40.
45. Bi Y, Zhu X, Yu Z, et al. Radioactive feeding tube in the palliation of esophageal malignant obstruction. Radiol Med 2020;125:544-50.
46. Murray LJ, Din OS, Kumar VS, et al. Palliative radiotherapy in patients with esophageal carcinoma: a retrospective review. Pract Radiat Oncol 2012;2:257-64.
47. Penniment MG, De Ieso PB, Harvey JA, et al. Palliative chemoradiotherapy versus radiotherapy alone for dysphagia in advanced oesophageal cancer: a multicentre randomised controlled trial (TROG 03.01). Lancet Gastroenterol Hepatol 2018;3:114-24.
48. Deressa BT, Tigeneh W, Bogale N, et al. Short-Course 2-Dimensional Radiation Therapy in the Palliative Treatment of Esophageal Cancer in a Developing Country: A Phase II Study (Sharon Project). Int J Radiat Oncol Biol Phys 2020;106:67-72.
49. Vermeulen BD, Jeene PM, Sijben J, et al. Low-Dose Versus High-Dose Radiation Therapy for the Palliation of Dysphagia From Esophageal Cancer: A Multicenter Retrospective Cohort Study. Pract Radiat Oncol 2020;10:e255-63.
50. Rosenblatt E, Jones G, Sur RK, et al. Adding external beam to intra-luminal brachytherapy improves palliation in obstructive squamous cell oesophageal cancer: a prospective multi-centre randomized trial of the International Atomic Energy Agency. Radiother Oncol 2010;97:488-94.
51. Sur R, Donde B, Falkson C, et al. Randomized prospective study comparing high-dose-rate intraluminal brachytherapy (HDRILBT) alone with HDRILBT and external beam radiotherapy in the palliation of advanced esophageal cancer. Brachytherapy 2004;3:191-5.
52. Chen HL, Shen WQ, Liu K. Radioactive self-expanding stents for palliative management of unresectable

esophageal cancer: a systematic review and meta-analysis. Dis Esophagus 2017;30:1-16.
53. Schrag SP, Sharma R, Jaik NP, et al. Review Complications related to percutaneous endoscopic gastrostomy (PEG) tubes. A comprehensive clinical review. J Gastrointestin Liver Dis 2007;16:407-18.
54. Rowell NP. Tumor implantation following percutaneous endoscopic gastrostomy insertion for head and neck and oesophageal cancer: Review of the literature. Head Neck 2019;41:2007-15.
55. van der Linden NC, Kok A, Leermakers-Vermeer MJ, et al. Indicators for Enteral Nutrition Use and Prophylactic Percutaneous Endoscopic Gastrostomy Placement in Patients With Head and Neck Cancer Undergoing Chemoradiotherapy. Nutr Clin Pract 2017;32:225-32.
56. Matsumoto A, Yuda M, Tanaka Y, et al. Efficacy of Percutaneous Endoscopic Gastrostomy for Patients With Esophageal Cancer During Preoperative Therapy. Anticancer Res 2019;39:4243-8.
57. Siddique MZ, Mehmood S, Ismail M, et al. Pre-operative percutaneous endoscopic gastrostomy tube placement does not increase post-operative complications or mortality in oesophageal cancer. J Gastrointest Oncol 2019;10:492-8.
58. Mahawongkajit P, Techagumpuch A, Limpavitayaporn P, et al. Comparison of Introducer Percutaneous Endoscopic Gastrostomy with Open Gastrostomy in Advanced Esophageal Cancer Patients. Dysphagia 2020;35:117-20.
59. Katsoulis IE, Karoon A, Mylvaganam S, et al. Endoscopic palliation of malignant dysphagia: a challenging task in inoperable oesophageal cancer. World J Surg Oncol 2006;4:38.
60. Mitty RD, Cave DR, Birkett DH. One-stage retrograde approach to Nd:YAG laser palliation of esophageal carcinoma. Endoscopy 1996;28:350-5.
61. Drummond RJ, Vass DG, Robertson K, et al. Comparison of endoscopic laser therapy and self expanding metal stents for palliation in patients with non-resectable oesophageal carcinoma. Surgeon 2018;16:137-40.
62. Sihvo EI, Pentikäinen T, Luostarinen ME, et al. Inoperable adenocarcinoma of the oesophagogastric junction: a comparative clinical study of laser coagulation versus self-expanding metallic stents with special reference to cost analysis. Eur J Surg Oncol 2002;28:711-5.
63. Greenwald BD. Spray cryotherapy for dysphagia palliation in esophageal cancer prior to systemic therapy: is it ready for prime time? Endosc Int Open 2020;8:E122-3.
64. Aarts BM, Klompenhouwer EG, Rice SL, et al. Cryoablation and immunotherapy: an overview of evidence on its synergy. Insights Imaging 2019;10:53.
65. Shah T, Kushnir V, Mutha P, et al. Neoadjuvant cryotherapy improves dysphagia and may impact remission rates in advanced esophageal cancer. Endosc Int Open 2019;7:E1522-7.
66. van Straten D, Mashayekhi V, de Bruijn HS, et al. Oncologic Photodynamic Therapy: Basic Principles, Current Clinical Status and Future Directions. Cancers (Basel) 2017;9:E19.
67. Yoon HY, Cheon YK, Choi HJ, et al. Role of photodynamic therapy in the palliation of obstructing esophageal cancer. Korean J Intern Med 2012;27:278-84.
68. Ding Y, Li W, Li B, et al. Comparison between photodynamic therapy and interventional esophageal stent implantation in dysphagia caused by advanced esophageal cancer. Zhonghua Yi Xue Za Zhi 2020;100:378-81.
69. Chung SC, Leong HT, Choi CY, et al. Palliation of malignant oesophageal obstruction by endoscopic alcohol injection. Endoscopy 1994;26:275-7.
70. Moreira LS, Coelho RC, Sadala RU, et al. The use of ethanol injection under endoscopic control to palliate dysphagia caused by esophagogastric cancer. Endoscopy 1994;26:311-4.
71. Sigounas DE, Krystallis C, Couper G, et al. Argon plasma coagulation compared with stent placement in the palliative treatment of inoperable oesophageal cancer. United European Gastroenterol J 2017;5:21-31.

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