Advances in Esophageal Stenting: the Evolution of Fully Covered Stents for Malignant and Benign Disease

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ABSTRACT

Self-expanding metal stents have become a leading palliative therapy for dysphagia resulting from esophageal, proximal gastric, and mediastinal cancers. Increasingly, fully covered self-expanding plastic stents and now fully covered metal stents have been used to treat a variety of benign esophageal conditions as well as cancer. Several stent designs are available in the United States and many more internationally. Each design has advantages and limitations. Knowledge of the indications for esophageal stenting and the common side effects associated with different designs allows physicians to choose the best stent for a given condition as well as to anticipate complications such as stent migration or restenosis. Compared with partially covered stents, newer, fully covered metal stents may promote less granulation tissue and subsequent stenosis and may be removable even after several weeks. However, the tradeoff may be more frequent migration. Interest in fully covered metal stents in place of fully covered plastic stents for use in strictures and leaks has also grown, despite the lack of a formal indication for metal stents in benign disease. Unfortunately, rigorous studies of newer stent designs are currently lacking.

Keywords: dysphagia; esophageal cancer; esophageal fistula; esophageal stricture; stent

BACKGROUND

Esophageal stents have undergone a dramatic evolution over the past 20 years. Prior to 1990, virtually all esophageal stents were made from rigid polyvinyl plastic or rubber. Although these devices could open an esophagus occluded by tumor, they were difficult to place, frequently caused pain, and occasionally led to bleeding and perforation. Even after placement, these relatively thick-walled stents left patients able to swallow little more than liquids. With the introduction of uncovered self-expanding metal stents (SEMS) in the early 1990s, rigid stents virtually disappeared from use in industrialized countries. Although SEMS are much more expensive than rigid stents, they are easier to place, provide a wider lumen, which allows greater meal choices, and trigger
fewer immediate complications. SEMS also require fewer repeat interventions than rigid stents and ultimately cost less over the limited lifetime of an advanced esophageal cancer patient. However, problems with uncovered SEMS soon appeared. Tumors often grew through the open mesh construction and dysphagia returned. To solve this problem, several companies began wrapping the middle of SEMS with a thin silicone or plastic covering designed to impede ingrowth of tumor, spawning the next generation of partially covered self-expanding metal stents (PCSEMS; Figure 1). These stents virtually replaced uncovered SEMS within a few years. However, PCSEMS are not without their own problems. Although the covering often prevents tumor ingrowth, hypertrophic granulation tissue at the uncovered ends can eventually obstruct the esophagus. Further, tissue overgrowth at the uncovered ends prevented easy removal or repositioning of the stents, leading to a strong contraindication for the devices for anything except palliation of malignant dysphagia or fistulae. Removable, fully covered self-expanding plastic stents (SEPSs) were introduced in 2001, opening up a host of new applications in malignant and benign diseases. However, these stents are not ideal either. Because of the plastic construction, they must be loaded onto the introducer prior to insertion. The introducer is somewhat stiff and bulky and the stents themselves exert more radial force than their metal counterparts, which can lead to patient discomfort and early migration. Most recently, fully covered self-expanding metal stents (FCSEMS) have been introduced in the latest attempt to compensate for the shortcomings of other designs (Figure 2).

Figure 2. Fully covered self-expanding stents. Right to left: WallFlex, Niti-S, Alimaxx-E, Polyflex.

This paper will explore the potential applications, benefits, and limitations of this newest generation of metal stents. Unfortunately, the published literature on these devices is limited, and it will be necessary to supplement this with expert opinion and extrapolation from related studies.

ESOPHAGEAL CANCER

It is important to review the epidemiology and natural history of esophageal cancer, as the primary application for esophageal stents remains the treatment of malignant dysphagia. The incidence of esophageal cancer is rising faster than any other malignancy in the US. Most new esophageal cancers in this country