Current Readings: The Role of Stenting in Tracheobronchial Disease

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Airway stents have gained acceptance for palliation or treatment of tracheobronchial pathologies or both since the second half of the 20th century. However, minimal advances have been made in the last 3 decades with regard to innovations in stent technology. Following a health alert issued by the Food and Drug Administration in 2005, silicone stents are now mainly used for benign pathologies whereas self-expanding metal stents are reserved for use with malignant airway obstruction. In this article, we review 5 articles published between 2010 and 2013 addressing the roles of stents in the management of malignant, benign, and post–lung-transplantation-related tracheobronchial narrowing. We identified what were the largest or most clinically relevant series in each case, but with the understanding that all are retrospective reviews with patient selection bias.

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The concept of airway stenting to alleviate airway obstruction dates back to the late 1800s with the work by Trendelenburg[1] and Bond.[2] However, over 100 years lapsed since its introduction until airway stenting received widespread acceptance. Although it has the ability in selected cases to rapidly and effectively relieve airway stenosis, significant long-term side effects of placing foreign bodies within the airway limit their use, especially for benign diseases. Montgomery[3] and Dumon[4] introduced silicone stents in the second half of the 20th century, and these remained the mainstay of stent options until self-expandable stents were introduced in the 1980s.[5] There has unfortunately not been much innovation in this area over the last 3 decades, with most expandable airway stents still designed as a cylindrical tube and prone to development of granulation tissue at their proximal and distal ends. In 2005, the American Food and Drug Administration issued a public health notification alerting practitioners against the use of metallic stents in the treatment of benign tracheobronchial pathologies; however, controversy surrounding their safety remains, mainly outside the United States. Despite its limitations, airway stenting remains an important modality in the management of central airway obstruction, especially when combined with other endoscopic treatments such as debridement, laser, balloon dilation, and cryotherapy. Herein, we review 5 articles published between 2010 and 2013 addressing the roles of airway stents in benign, malignant, and post–lung transplant tracheobronchial stenosis.

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DECANNULATION IN TRACHEAL STENOSIS DEEMED INOPERABLE IS POSSIBLE AFTER LONG-TERM AIRWAY STENTING

Terra RM, Bibas BJ, Minamoto H, et al. Ann Thorac Surg 95:440-444, 2013

> *Terra et al*[6] *showed that decannulation following stenting can be achieved in cases of inoperable benign tracheobronchial stenosis in about 20% of their cohort.*

This is an interesting retrospective study of 92 patients with benign primarily subglottic and upper tracheal stenosis—considered inoperable—who underwent airway stenting between 1998 and 2008 at a major referral tertiary hospital in Sao Paolo, Brazil, with an overall 21% rate of decannulation and with acceptable morbidity. The reasons for inoperability were long-segment tracheal stenosis ($n = 38$,

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41%, average length 4.32 cm ± 1.5 cm), high surgical risk ($n = 42$, 46%), and stent placement for nonairway surgery requiring general anesthesia ($n = 12$, 13%). Orotracheal intubation ($n = 84$, 91.3%) was the main reason for stenosis, followed by Wegener granulomatosis ($n = 3$, 3.3%). A total of 258 silicone stents were used (T-tubes, 72%; DUMON, 15%; Polyflex, 12%; and Y tube, 1%). A total of 67 patients (72%) presented with a tracheostomy at the time of evaluation before stent placement. The complications rate was moderate ($n = 35$, 38%) including granulation tissue ($n = 20$, 22%) and stent migration ($n = 5$, 5%). The primary outcome, successful decannulation—defined as sustained airway patency and absence of respiratory symptoms for more than 6 months after removal of the stent—was achieved in 19 of 21 attempted decannulations (19/92 = 21%). The mean follow-up was 37.4 months after decannulation (6-108 months) and a Kaplan-Meier estimate of successful decannulations was 28% within 5 years of stent placement. In a Cox regression model, presence of tracheostomy before stenting was the only significant predictor of poor decannulation outcome ($P = 0.046$). Days of intubation, length of stenosis, or its distance from the vocal cords were not predictive of successful decannulations.

RESULTS OF INTERVENTIONAL BRONCHOSCOPY IN THE MANAGEMENT OF POSTOPERATIVE TRACHEOBRONCHIAL STENOSIS

Jeong B-H, Um S-W, Suh GY, et al. J Thorac Cardiovasc Surg 144:217-222, 2012

Jeong et al[7] investigated the role of several endobronchial techniques for the management or treatment of stenosis that developed in the postoperative setting following major thoracic surgery.

Postsurgical stenosis of the trachea and bronchi is a challenging and complex problem. This is a retrospective cohort from Samsung Medical Center, a large tertiary hospital in Seoul, Korea. The authors examined all patients ($n = 30$), between January 2000 and July 2010, who developed symptomatic stenosis (granulation tissue $n = 16$, 53%, fibrous stricture $n = 12$, 40%, and malacia $n = 2$, 7%) following major thoracic surgeries. The most common operations were tracheal resection and anastomosis ($n = 10$, 33%), lobectomy ($n = 8$, 27%), and sleeve right upper lobectomy ($n = 6$, 20%). Median follow-up was 34 months. A total of 15 patients (50%) underwent surgical resection for malignant neoplasm of bronchus or lung ($n = 12$) or trachea ($n = 3$) whereas the rest underwent surgical resection for benign diseases: postintubation tracheal stenosis ($n = 6$, 20%), posttuberculosis tracheobronchial stenosis ($n = 3$, 10%), and trauma ($n = 2$, 7%). Median time to intervention was 54 days (4-481 days). Interventions included ballooning, bouginage, Nd:YAG laser resection, and stenting. A total of 50 silicone stents were placed in 19 patients (Natural, 33; Y stent, 13; DUMON, 3; and T-tube, 1). Subsequent stent removal was accomplished in 7 of the 19 patients (36%) with a median duration of 7 months (1-22 months) of stent placement. Median follow-up after removal was 57 months (13-74 months). There was a significant overall late complications rate (70%) including restenosis ($n = 13$, 43%), granulation tissue at the procedure site ($n = 10$, 33%), mucus plugging ($n = 9$, 30%), stent migration ($n = 6$, 32%), and malacia developed in 3 patients (16%) after stent removal, requiring permanent stenting. There was no procedure-related mortality; overall mortality rate was 17% ($n = 5$), with a median survival of 50 months (20-79 months) secondary to comorbidities and disease progression.

A RETROSPECTIVE STUDY OF SILICONE STENT PLACEMENT FOR MANAGEMENT OF ANASTOMOTIC AIRWAY COMPLICATIONS IN LUNG TRANSPLANT RECIPIENTS: SHORT- AND LONG-TERM OUTCOMES

Dutau H, Cavailles A, Sakr L, et al. J Heart Lung Transplant 29:658-664, 2010

The rate of airway stricture after lung transplant has been reported to be about 4%-15%.[8] Although a relatively rare complication, its management can be challenging. Dutau et al[9] reported their experience with silicone stents in the management of anastomotic stenosis following lung transplantation.

This is a retrospective study examining the safety and efficacy of silicone stents in the management of airway complications following lung transplantation. The series examined 117 lung transplant recipients between 1997 and 2007 at a tertiary hospital in Marseille, France. There were 23 anastomotic complications (stenosis, 18; bronchomalacia, 2; and mixed pathology, 2) in 17 patients who underwent either single or double lung transplants and subsequently required stent placement. Mean stenting duration was 266 days (24-1407 days). DUMON silicone stents were exclusively used in this study; there was significant symptomatic improvement and mean FEV1 increase by 672 ± 496 mL ($P < 0.001$). Complications occurred in 16 of 23 stented anastomoses including granulation tissue ($n = 10$), mucus plugging ($n = 7$), stent migrations ($n = 7$), and