

The Art of Rigid Bronchoscopy and Airway Stenting



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KEYWORDS

• Rigid bronchoscopy • Airway stents • Future advances in stent technology • Complications

KEY POINTS

- Interventional pulmonology, including the provision of rigid bronchoscopy and airway stenting, is an integral component of a modern lung cancer service.
- Rigid bronchoscopy offers important palliation to patients with central airway obstruction. This may be intrinsic, extrinsic or a mixed pattern of obstruction.
- Rigid bronchoscopy also has an important role in benign airway diseases; in particular post tracheostomy or post intubation tracheal stenosis.
- A wide range of airway stents are commercially available. Stent selection should be carefully made to ensure a low rate of stent complications.
- Rigid bronchoscopy and airway stenting are advanced endoscopic skills that require additional training. However, there is a wide variability in access to training as shown by a recent European survey.

INTRODUCTION

For more than a century, rigid bronchoscopy has been used as both a diagnostic and therapeutic tool in complex airways disease. With the emergence of interventional pulmonology (IP) as a specific subspecialty within respiratory medicine, there has been renaissance in its use and, for many interventional pulmonologists, it occupies a central position in the management of both malignant and benign complex airway disorders. Indeed, despite the development of new techniques, for both diagnostic and therapeutic applications, many physicians still use the rigid bronchoscope as a mainstay of the procedure.

In the hands of experienced proceduralists, patients can be offered definitive disease management in a safe, controlled environment using minimally invasive techniques. Its use allows direct access to the airway in a controlled manner and facilitates several treatment modalities, not exclusively including stent placement, endobronchial laser therapy, cryotherapy, electrocautery, argon plasma coagulation, and photodynamic therapy. Despite the development of new technologies, rigid bronchoscopy remains an invaluable skill. However, adequate training and knowledge of the procedure is vital in safely addressing central airway disease complications. A full discussion on all aspects of IP is beyond the scope of

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this article, which focuses specifically on rigid bronchoscopy and airway stenting.

BACKGROUND

Father of modern bronchoscopy is the title given to Gustav Killian, an otolaryngologist from Freiberg, Germany. Killian is credited with the invention of the rigid bronchoscope and with describing the potential therapeutic indications. The first reported procedure was the removal of a pork bone from the right main bronchus of a farmer using a rigid esophagoscope in 1876. He then went on to describe the successful removal of foreign bodies from the airways in 3 separate cases.^{1,2} In the paper "Direckte Endoskope der Luft-und Speise-wege," published in 1915, Brünings and colleagues³ reported a success rate for foreign body removal of 98.3%, with failure to extract the aspirated material in only 12 out of 701 cases. This was a significant advance in the management of a condition with a known 50% mortality before the rigid bronchoscopy era.

During this new era of "direct bronkoskopie," as coined by Killian, Chevalier Jackson,⁴ based in America, was gaining recognition for his use of rigid bronchoscopy to remove foreign bodies from both children and adults.⁵ The Mutter museum in Philadelphia displays 2374 objects recovered by Dr Jackson during his nearly 75-years-long career.⁴ Jackson also began to expand the role of rigid bronchoscopy and pioneered endobronchial treatment of tuberculosis complications. He was also the first to report endoluminal mechanical resection of endobronchial tumors.

Advances in technology in the latter decades of the twentieth century, especially with the emergence of fiberoptic imaging and bronchoscopy, significantly affected the way physicians undertook airway inspection. This ultimately resulted in the introduction of the flexible bronchoscope; with a thoracic surgeon from Japan, Shigeto Ikeda, credited with its development in 1962. The first commercially useful instrument was presented at Copenhagen in 1966⁶ and, with some additional modifications and adoption of the working channel, the Machida flexible bronchoscope became commercially available in 1968.⁵ With an increase in the popularity of the flexible bronchoscope due in part to the obvious advantages (minimally invasive, absence of need for general anesthesia, and superiority in visualizing smaller peripheral airways), there was a notable decrease in the use of rigid bronchoscopy over the 2 decades that followed. Training availability in this method became a rarity and its use became

almost obsolete except for several dedicated physicians, particularly in Europe.

These physicians continued to explore its role in airway disease. Airway laser via a rigid bronchoscope was first described in 1981 by Lucien Toty and colleagues.⁷ However, its refinement and central role in accepted standards of practice was attributed to Dr Jean Francois Dumon who is seen as the father of modern day rigid bronchoscopy and stenting. The term stent is credited to Charles Stent who developed the first custom-made mold of teeth in the nineteenth century. However, he was not to know that his name would become synonymous with this cornerstone of modern day medicine.⁵ Over the last 30 years, stents have evolved from experimental interventions to essential components in many fields of medicine and surgery, including cardiology, vascular medicine, urology, otolaryngology, and pulmonology. Literature case reports of stent deployment go back as far as 1915. However, it was not until the development of the Montgomery T-tube in the sixties⁸ and, more importantly, the major breakthrough that occurred with Dumon's⁹ development of a dedicated silicone stent for the trachea and bronchi in the mid-1980s, that stent use became standard. The first airway stent was placed in Marseille, France, in 1985. With these 2 developments, stenting became an integral part of the management of airway compromise caused by benign and malignant conditions.

With these advances in central airway management, treatment options became available for patients with both benign and malignant airway conditions. Tumor debulking with laser and stent placement in selected patients became standards in practice, offering immediate and lasting symptomatic relief and palliation of central airway obstruction in malignant disease. Rigid bronchoscopy had regained its vital role in IP, offering options to both surgical and nonsurgical candidates. However, current practices are once again changing, particularly those related to stent placement.

CURRENT ROLE OF RIGID BRONCHOSCOPY

Rigid bronchoscopy maintains a central role in advanced airway management. It serves both malignant and benign diseases. The rigid bronchoscope allows stabilization of compromised airways, treatment of palliative endobronchial disease, and treatment of nonsurgical candidates with benign conditions. More recently, it supports newer endobronchial techniques. This has resulted in the growth of IP as a specific subspecialty in respiratory medicine.¹⁰

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