Rigid Bronchoscopy

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KEYWORDS

• Interventional pulmonology • Interventional bronchoscopy • Rigid bronchoscopy
• Flexible bronchoscopy • Airway stenting • Airway obstruction • Airway stenosis

KEY POINTS

- The rigid bronchoscope is the instrument of choice in most bronchoscopic therapeutic procedures.
- The rigid bronchoscope is not only a tool to visualize the airway but also a therapeutic instrument in itself or in association with other endoscopic techniques.
- Most of the scientific associations agree on this point.
- Rigid bronchoscopy requires training and a dedicated facility or easy access to an operating room with anesthetic support.
- Rigid bronchoscopy is mandatory in airway stenting when using silicone stents, which still represent the gold standard. Interventional bronchoscopy is a minimally invasive option in a variety of cases, and can occasionally represent a bridge to definitive surgical management.
- If there are surgical contraindications, endoscopic techniques are acceptable definitive palliation interventions.

HISTORICAL BACKGROUND

Gustav Killian first described rigid bronchoscopy for therapeutic airway indications in Freiburg (Germany) in 1895. The first reported procedure involved the removal of a pork bone from the bronchus of a farmer using a rigid esophagoscope. Killian continued to experiment with rigid tubes in both cadavers and patients and, in 1898, described the successful removal of foreign bodies (FBs) in 3 more cases. The technique was further advanced by the discovery of the anesthetizing effect of locally applied cocaine. At the same time, on the other side of the Atlantic Ocean, Chevalier Jackson was instrumental in developing the modern rigid bronchoscope. In 1904, he developed an endoscope with a small light at the distal end. He pioneered endobronchial treatment of the complications of tuberculosis, which was the leading cause of airway disease during the first half of the twentieth century. He is also credited with the first reported endoluminal mechanical resections of endobronchial tumors. Other significant historical advances included the optical telescope by Broyles and the solid rod lens optical system by Hopkins.[1] Modern bronchoscopy benefited from the vision of Shigeto Ikeda, a Japanese pulmonologist, who developed the flexible bronchoscope using optic fibers,[1] which transformed the diagnostic work-up for lung cancer and visualization of the bronchial tree. It is less invasive, does not require, general anesthesia, and provides superior visualization of small peripheral airways. The rigid bronchoscope was regarded as obsolete and

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was virtually abandoned in favor of the flexible bronchoscope. Few endoscopists were exposed to the technique and adequate training became a rarity.

However, some European physicians continued to use the rigid system for the treatment of airway diseases, including Jean-François Dumon, who is regarded as a pioneer in interventional pulmonary medicine. He was one of the first bronchoscopists[2–5] to use laser therapy in the airway and standardized its use.[6,7] Another major advance was the invention of a dedicated silicone stent for the trachea and bronchi.[8] Before the era of the Dumon stents, the only available option for reestablishing patency of the trachea after surgery was the Montgomery T tube, which required a tracheotomy for placement.[9] The combination of laser debulking of the endoluminal component and postresection endotracheal stent placement when there is concurrent extrinsic compression allowed immediate and lasting palliation of malignant central airway obstruction, which allowed pulmonologists to treat central airway diseases that had formerly been considered either untreatable or treatable only via extensive, and often prohibitively dangerous, surgical procedures.

RIGID BRONCHOSCOPY EQUIPMENT

The modern rigid bronchoscope is a straight, hollow stainless steel tube that has not significantly changed from the equipment developed by Chevalier Jackson.[10] It is available in various lengths and diameters ranging from 5 mm to 13.5 mm. The barrel wall is 2 to 3 mm thick and the internal diameter is uniform throughout. The distal end of most bronchoscopes is beveled, allowing atraumatic passage through the vocal cords. The bevel can also be used to core out an endobronchial tumor and to corkscrew the bronchoscope through tight stenoses.[10,11] Slits in the distal wall of the bronchoscope allow contralateral ventilation during intubation of a main bronchus. The tracheoscope is shorter in length than the bronchoscope and has no ventilation slits. The proximal end of the bronchoscope consists of a central opening and various side ports for connection of jet ventilation or conventional ventilation devices as well as a source of illumination. The EFER-Dumon rigid bronchoscope, as manufactured by EFER Endoscopy (La Ciotat, France) has a universal proximal head that can be connected to all the bronchoscope barrels (**Fig. 1**). In addition, the various barrel sizes are color coded. Other manufacturers of rigid bronchoscopy equipment include the Texas rigid integrated bronchoscope (**Fig. 2**) from Richard Wolf (Knittlingen, Germany), the Karl Storz Rigid Bronchoscope (Tuttlingen, Germany) (**Fig. 3**), and, soon, the Dutau-Novatech rigid bronchoscope (La Ciotat, France) (**Fig. 4**). Illumination in modern rigid bronchoscopes is provided by a xenon light source with a prismatic light deflector that is attached proximally to allow full use of the bronchoscope lumen. A Hopkins rod rigid telescope is passed through the central opening of the bronchoscope barrel. The bronchoscopist can either look down the eyepiece of the telescope, or a charge-coupled chip video camera can be connected to the eyepiece for visualization on a monitor, which also allows the physician to record procedures. Before the development of the flexible bronchoscope, angled telescopes were needed to view all bronchial subdivisions, but currently most endoscopists prefer to pass a flexible bronchoscope via the barrel of the rigid bronchoscope for this purpose. The Texas rigid bronchoscope is the first fully integrated rigid bronchoscope with a semiflexible endoscope inside. The theoretic benefit of the Texas system is the full inner lumen of the rigid bronchoscope. The semiflexible endoscope is attachable to a separate channel inside the tube.

Fig. 1. The EFER rigid bronchoscope.

Various accessory instruments, including forceps, suction catheters, laser fibers, and stent delivery systems, are used during rigid bronchoscopy by passage via the proximal opening.

RIGID BRONCHOSCOPY TECHNIQUE

After induction of anesthesia, the patient's head is partially extended and the bronchoscope is

Fig. 2. The Texas rigid bronchoscope.