Laryngoscopes

These devices are used to perform direct laryngoscopy and to aid in tracheal intubation.

Components

1. The handle houses the power source (batteries) and is designed in different sizes.

2. The blade is fitted to the handle and can be either curved or straight. There is a wide range of designs for both curved and straight blades.

Mechanism of action

1. Usually the straight blade is used for intubating neonates and infants. The blade is advanced over the posterior border of the relatively large, floppy V-shaped epiglottis which is then lifted directly in order to view the larynx. There are larger size straight blades that can be used in adults.

2. The curved blade (Macintosh blade) is designed to fit into the oral and oropharyngeal cavity. It is inserted through the right angle of the mouth and advanced gradually, pushing the tongue to the left and away from the view until the tip of the blade reaches the vallecula. The blade has a small bulbous tip to help lift the larynx. The laryngoscope is lifted upwards elevating the larynx and allowing the vocal cords to be seen. The Macintosh blade is made in four sizes.

3. In the standard designs, the light source is a bulb screwed on to the blade and an electrical connection is made when the blade is opened ready for use. In more recent designs the bulb is placed in the handle and light is transmitted to the tip of the blade by means of fibreoptics. Opening the blade turns the light on by forcing the bulb down to contact the battery terminal.

4. A left-sided Macintosh blade is available. It is used in patients with right-sided facial deformities making the use of the right blade difficult.

5. The McCoy laryngoscope is based on the standard Macintosh blade. It has a hinged tip which is operated by the lever mechanism present on the handle. It is suited for both routine use and cases of difficult intubation. A more recent McCoy design has a straight blade with a hinged tip. Both the curved and the straight McCoy laryngoscopes use either a traditional bulb in the blade or a lamp mounted in the handle which fibreoptically transmits the light to the blade.

6. A more recent design called the Flexiblade exists, where the whole distal half of the blade can be manoeuvred rather than just the tip, as in the McCoy. This can be achieved using a lever on the front of the handle.

7. The blades are designed to be interchangeable between different manufacturers and laryngoscope handles. Two international standards are used:
(green system) and (red system) with a coloured marking placed on the blade and handle. The two systems have different dimension hinges and with different light source positions. The 'green system' is the most commonly used fitting standard.

Problems in practice and safety features

1. The risk of trauma and bruising to the different structures (e.g. epiglottis) is higher with the straight blade.

2. It is vital importance to check the function of the laryngoscope before anaesthesia is commenced. Reduction in power or total failure due to the corrosion at the electrical contact point is possible.

3. Patients with large amounts of breast tissue present difficulty during intubation. Insertion of the blade into the mouth is restricted by the breast tissue impinging on the handle. To overcome this problem, specially designed blades are used such as the polio blade. The polio blade is at about 120^{0} to the handle allowing laryngoscopy without restriction. A Macintosh laryngoscope blade attached to a short handle can also be useful in this situation.

4. To prevent cross-infection between patients, a disposable blade is used. A PVC sheath can also be put on the blade of the laryngoscope. The sheath has low light impedance allowing good visibility.

5. Laryngoscope handles must be decontaminated between patients to prevent cross-infection.

Fibreoptic intubating laryngoscope

These devices have revolutionized the airway management in anaesthesia and intensive care. They are used to perform oral or nasal tracheal intubation, to evaluate the airway in trauma, tumour, to confirm tube placement (tracheal, endobronchial, double lumen or tracheostomy tube) and to perform tracheobronchial toilet.

Components

1. Control unit which consists of the following:

A. Tip deflection control knob (the bending angle range is from 60-180^{o} in the vertical plane).

B. Eye piece.

C. Diopter adjustment ring (focusing).

D. Suction channel which can also be used to insufflate oxygen and administer local anaesthetic solutions.

2. The flexible insertion cord consists of bundles of glass fibres. Each bundle consists of 10000-15000 fibres nearly identical in diameter and optical characteristics.

3. Light transmitting cable to transmit light from an external source.

4. Other equipment may be needed, e.g. endoscopic face mask, oral airway, bite block, defogging agent.

Mechanism of action

1. The fibreoptic laryngoscope uses light transmitted through glass fibres. The fibres used have diameters of 5-20 μm, making them capable of transmitting light and being flexible at the same time.

2. The fibres are coated with a thin external layer of glass (of lower refractive index) thus providing optical insulation of each fibre in the bundle. A typical fibreoptic bundle is composed of up to 10 000 individual glass fibres.

3. Light enters the fibre at a specific angle of incidence. It travels down the fibre, repeatedly striking and being reflected from the external layer of glass at a similar angle of incidence until it emerges from the opposite end.

4. The fibres are 'coherently' arranged throughout the bundle. As each fibre carries a very small part of the overall picture, it is essential for the clear transmission of an image that the arrangement of fibres is the same at both ends of the fibreoptic cable.

5- The insertion cords vary in length and diameter. The latter determines the size of the tracheal tube that can be used. Smaller scopes are available for intubating children. The outer diameter ranges from 1.8 to 6.4 mm allowing the use of tracheal tubes of 3.0 to 7.0 mm internal diameter.

Problems in practice and safety features

1. The intubating fibreoptic laryngoscope is a delicate instrument that can be easily damaged by careless handling. Damage to the fibre bundles results in loss of the image and light in individual fibres which can not be repaired.

2. It should be cleaned and dried thoroughly as soon as possible after use.

VIDEOLARYNGOSCOPY

Recent advances in miniaturized, high-resolution, digital camera and fibreoptic technology have led to a new generation of 'crossover' devices. These videolaryngoscopes, offering indirect laryngoscopy, combine features of both the flexible fibreoptic scopes and the standard rigid laryngoscopes. The images are transmitted using fibreoptics or lenses and prisms with the light pathways encased in a rigid device. The cameras used offer wide views so allowing the user to see around corners, similar to the fibreoptic scopes. Certain designs have a channel that guides the tracheal tube into the trachea. Videolaryngoscopes improve the view of the

glottis, as the camera eye is only centimetres away from the glottis. Some designs use direct viewing through an eyepiece or an attached or remote screen. Their use requires minimal neck movement and can make laryngoscopy and hopefully successful tracheal intubation easier. Such devices may well supersede the classic laryngoscopes.

Fig. A wide range of laryngoscope blades. (A) Miller blades (large, adult, infant, premature); (B) Macintosh blades (large, adult, child, baby); (C) Macintosh polio blade; (D) Soper blades (adult, child, baby); (E) left-handed Macintosh blade; (F) Wisconsin blades (large, adult, child, baby, neonate); (G) Robertshaw's blades (infant, neonatal); (H) Seward blades (child, baby); (I) Oxford infant blade.

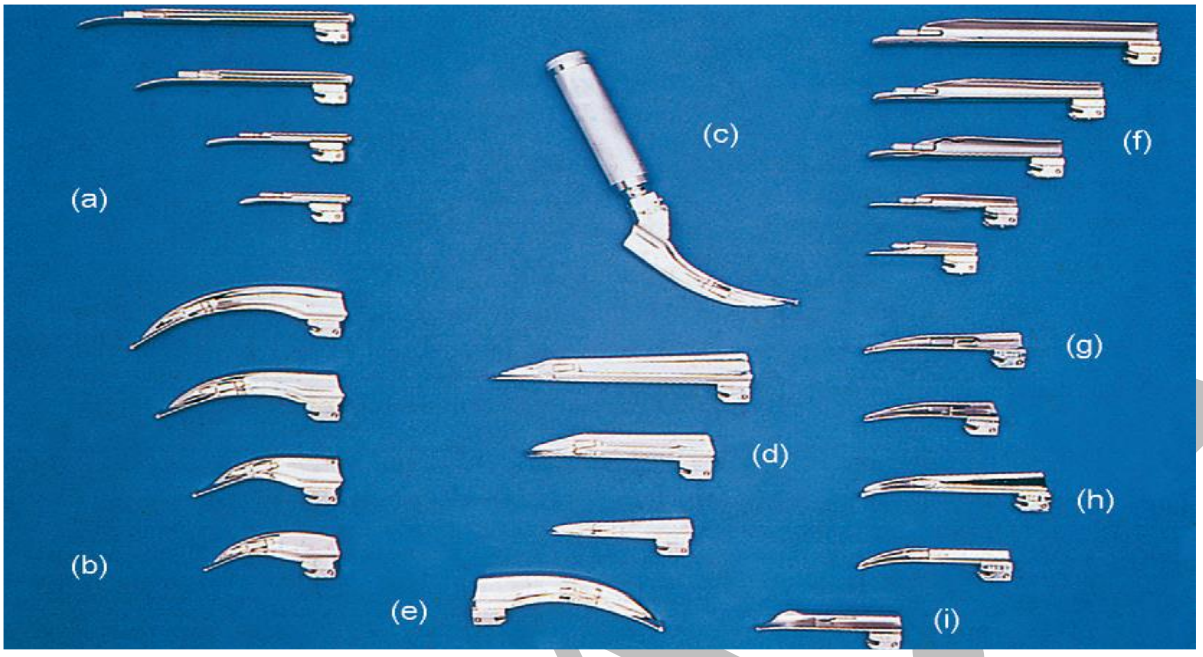
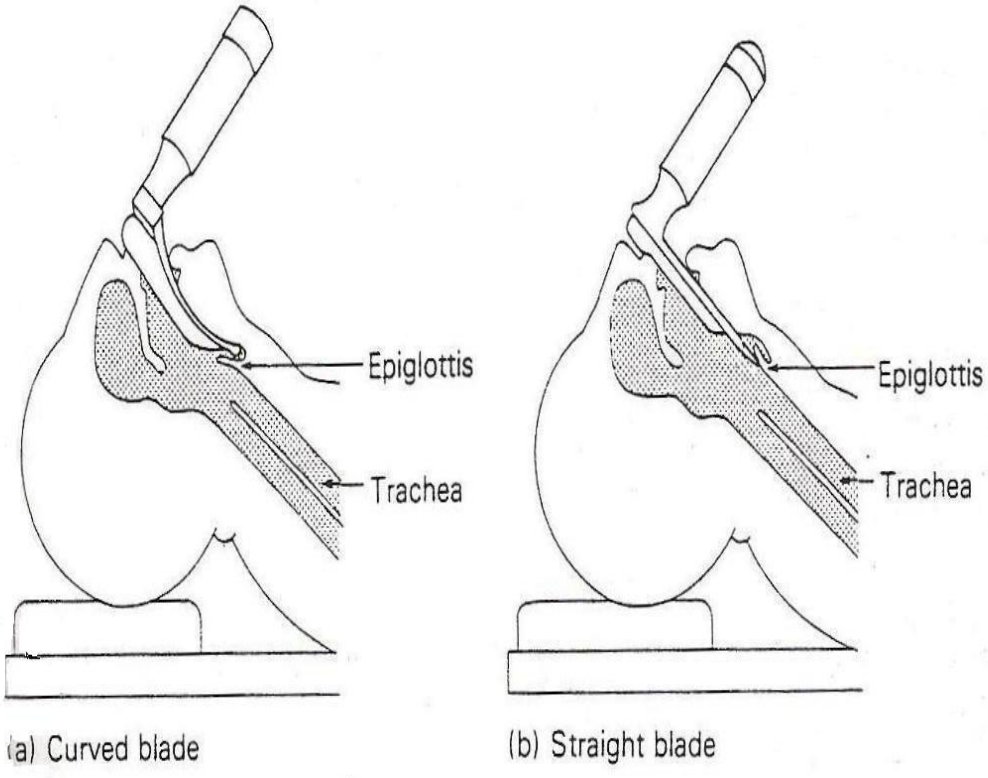


Fig. Use of the laryngoscope



(a) Curved blade (b) Straight blade

Fig. Standard disposable laryngoscope blade (top) with the light bulb mounted on the blade; fibreoptic disposable laryngoscope blade (bottom).

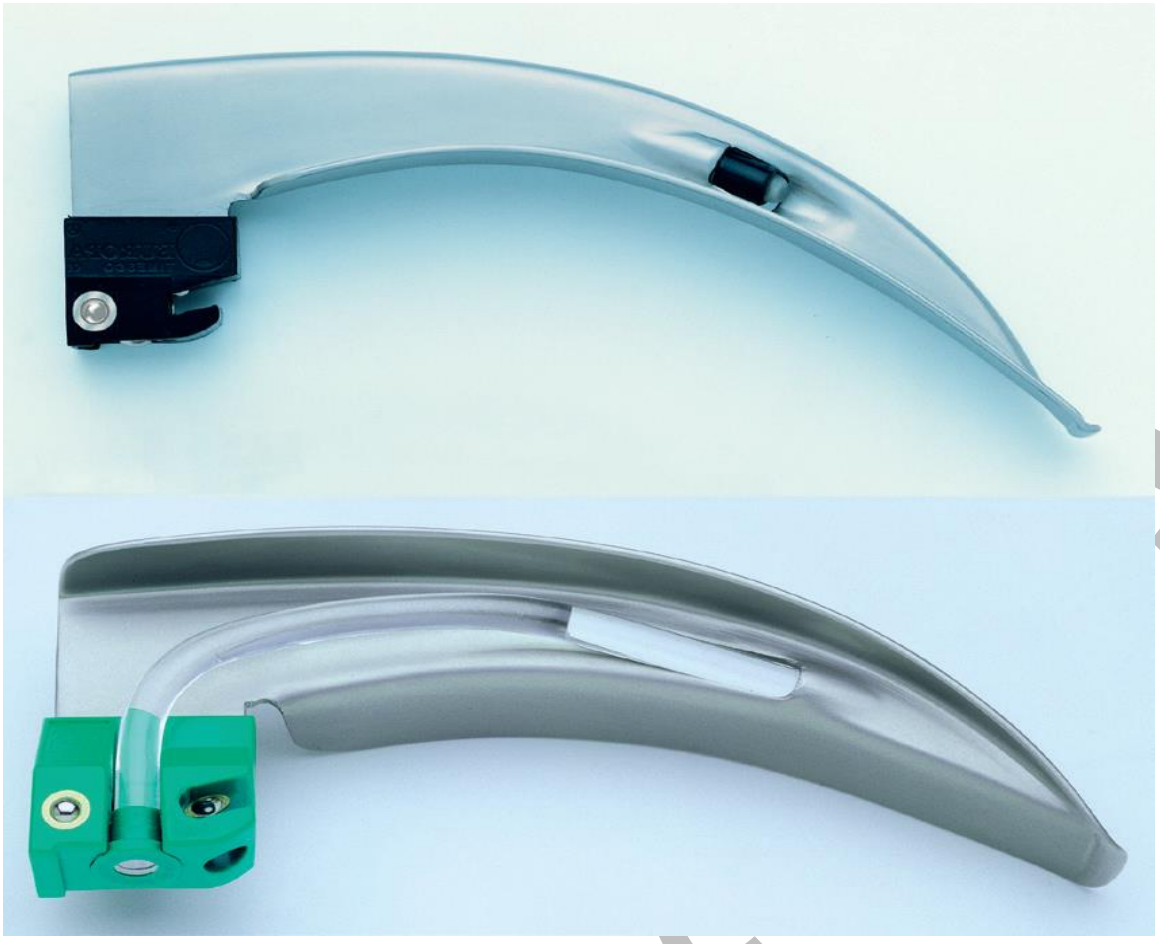


Fig. The McCoy laryngoscope, based on a standard Macintosh blade.

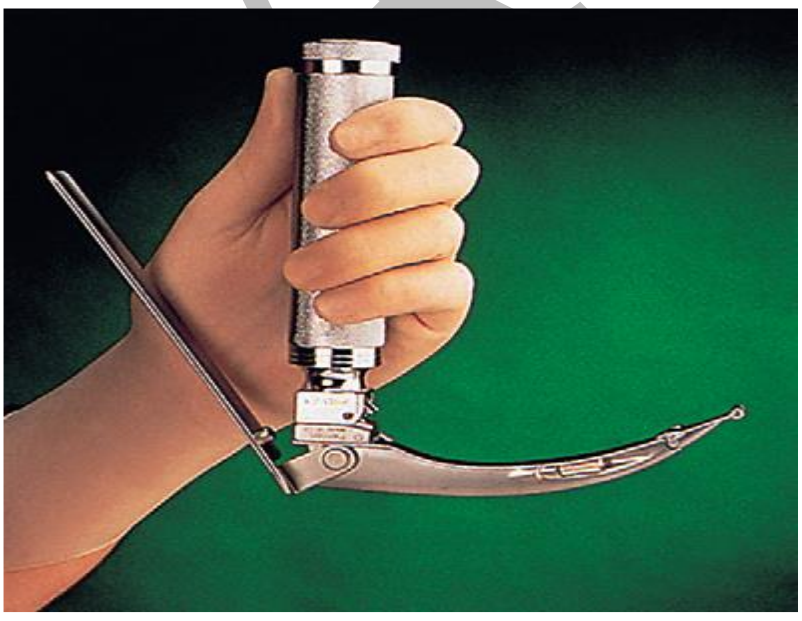


Fig. Demonstrating the McCoy laryngoscope's hinged blade tip.

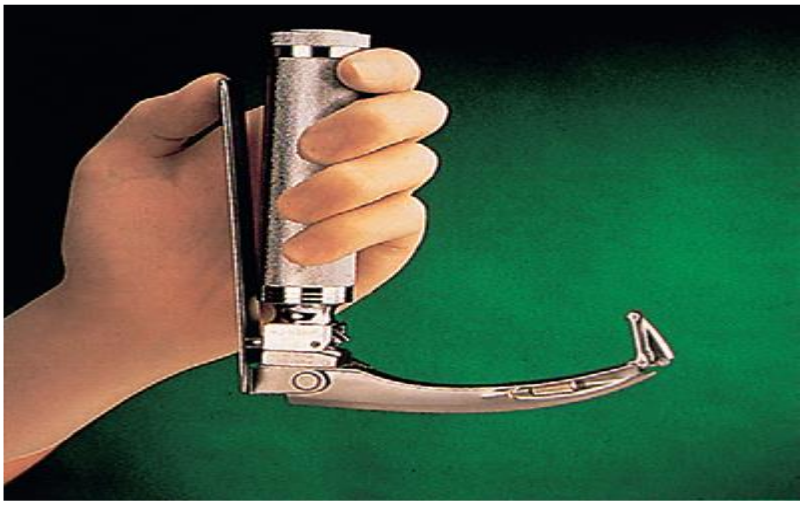


Fig. Intubating fibreoptic scope.

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Fig. The Glidescope videolaryngoscope