

Airway 101: Direct vision laryngoscopes

By the perioperativeCPD.com

Laryngoscopes are used to aid tracheal intubation and the placement of endotracheal tubes. They allow visualisation of the larynx and are used not only in operating theatres but ITU and A&E. They can also be used to visualise the larynx for suctioning, removal of a foreign body and placing nasogastric tubes and throat packs.

This module covers conventional or direct laryngoscopes. Video laryngoscopes and fibroptic intubation are covered in different modules.

History

In the late 19th century great advances were made in airway management for patients undergoing general anaesthesia. Without advanced airway support, the great safety and efficacy of modern anaesthesia would be impossible. The laryngeal tube had reportedly existed since at least 1791, and was used for a range of purposes including to facilitate breathing in oedema of the glottis, for direct delivery of medications to lung tissue, and for artificial respiration.

However, the first successful delivery of endotracheal general anaesthesia was performed through tracheotomy by German surgeon Friedrich Trendelenburg in 1871. Over the following decades, this technique was adapted in multiple settings to be delivered by oro-tracheal intubation and thus avoid the need for a surgical airway.

A further breakthrough in intubation came in 1895, when German physician Alfred Kirstein performed the first laryngoscopy with direct visualisation of the vocal cords. Previously, direct visualisation was thought impossible, and the glottis and larynx had been visible only by indirect vision using mirrors. Kirstein called his device the *autoscope*, now known as a *laryngoscope*, and in the process of its development he established many of the principles of laryngoscopy which continue to be used in clinical practice.

In 1913, Chevalier Jackson introduced a new laryngoscope blade with a light source at the tip, rather than the more distant light source used by Kirstein. That same year, Henry Janeway expanded upon this, also including batteries in the handle, a central notch for maintaining the tracheal tube in the midline of the oropharynx, and a slight curve to the tip of the blade. These changes were instrumental in popularising the use of direct laryngoscopy and tracheal intubation in anaesthesia.



Magill Laryngoscope

Sir Ivan Magill went further in 1926 with his invention, the Magill laryngoscope blade. The most significant features included a flat and wide end of the blade, improving control of the epiglottis, and a slot on the side allowing the passage of catheters and tubes without obscuring vision. Magill also developed a new type of angulated forceps (the Magill forceps) for nasotracheal intubation, and the Magill red rubber endotracheal tube.

In 1943 Sir Robert Macintosh, a New Zealand-born anaesthetist, introduced the Macintosh blade, a curved model which is the most widely used laryngoscope blade worldwide.



Macintosh Blade on laryngoscope

There are three main types of laryngoscopes, this module covers the only the first category – direct vision laryngoscopes:

- Direct vision laryngoscopes and associated blades
- Video laryngoscopes
- Fibre-optic laryngoscopes

Direct vision laryngoscopes.

The concept of direct laryngoscopy is simple—to create a straight line of sight from the mouth to the larynx in order to visualize the vocal cords. The tongue is the greatest obstacle to a good view and the laryngoscope is used to control the tongue and displace it out of the line of sight.

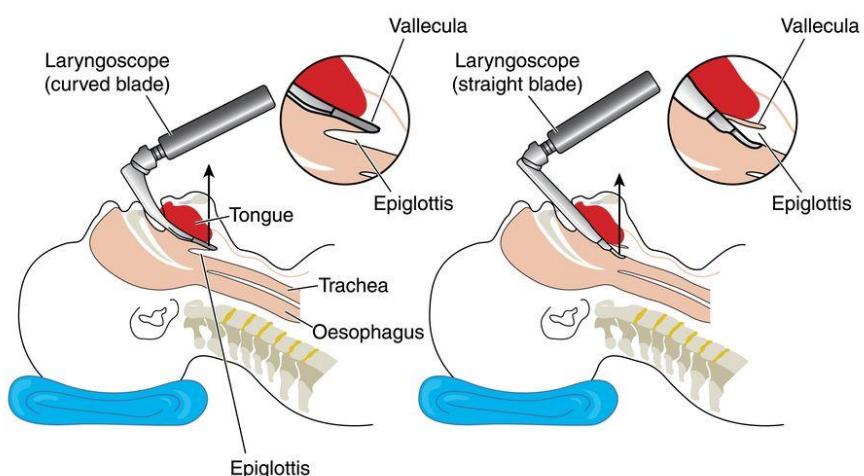
A laryngoscope consists of a handle, a blade, and a light source. It is used as a left-handed instrument regardless of the operator's handedness. The light source exits the blade towards the tip so as not to interfere with the view.



Types of laryngoscope blades

There have been more than 50 types of laryngoscope blades produced although very few are still used.

Two basic styles of laryngoscope blade are currently commercially available: the curved blade and the straight blade. The technique for using the two types is different. With a curved blade the tip is placed in the vallecula, indirectly lifting the epiglottis. In contrast to the straight blade technique, where the tip of a straight blade is placed over the epiglottis (instead of in the vallecula), lifting it directly.



Macintosh blades

The Macintosh blade is the most widely used of the curved laryngoscope blades and comes in sizes 1-5 although the size 5 is rare. Macintosh blades have a gentle curve, a vertical flange for displacing the tongue to the left, and a relatively wide square tip with an obvious knob at the end. Variations of the original Macintosh blade design, which include a smaller vertical flange and a shorter light-to-tip distance, have also been manufactured. There are also a German and American profiles which modify the original design.

The vertical flange height of the size 3 and 4 blades is similar, making it reasonable to start with the longer size 4 blade in all adults although beginners must ensure they do not insert the blade too far as this restricts the view.

Left-handed (or reverse) Macintosh blades are available for use in patients with right sided facial deformities. Despite the name, they are not specifically designed for use by left handed operators.



Macintosh size 3 blade

Miller Blades

The Miller blade, by Dr Robert Miller of Texas is the most common of the straight blades, has a narrower and shorter flange and a slightly curved tip without a knob. The smaller flange may be better when there is less mouth opening, but it makes tongue control more difficult and decreases the area of tongue displaced for visualisation and tube placement. Miller blades, like all straight blades are intended to be passed under to the epiglottis, to lift it directly in order to expose the vocal cords. In adults they are most popular in the USA, UK and most Commonwealth countries prefer curved blades for adults.

Traditionally straight blades were mainly used for paediatrics. It is easier to visualize the vocal cords using straight blades in infants, due to the larger size of the epiglottis relative to that of the vocal cords. More recently video laryngoscopes are becoming very popular in paediatrics as they are considered less traumatic.

Miller laryngoscope blades are available in sizes 0 (neonatal) through 4 (large adult).



Miller Blade

There are many other styles of curved and straight blades (e.g., Oxford, Phillips, Robertshaw, Seward, Sykes, Wisconsin, Wis-Hipple, etc.) they are not as common and some are only found on difficult intubation trolleys.

Other Straight Blades



Robertshaw



Wisconsin



Seward



Oxford

McCoy Blade

The McCoy is based on a traditional Macintosh blade but its design allows the tip to be flexed (using the lever alongside the handle) in order to lift a large or floppy epiglottis. It makes some difficult intubations easier and is commonly found on difficult airway trolleys although its use has dropped considerably with the introduction of video laryngoscopes.



Polio Macintosh

Another modification of the Macintosh design with the blade mounting on the handle at 135° rather than 90°. This allows it to be used in patients with restricted neck mobility, or large breasts, sometimes in conjunction with a stubby handle in obstetrics. Again it has been largely replaced by the video laryngoscope. It was originally invented to intubate polio patients being ventilated in an iron lung which would otherwise obstruct the handle.



Polio blade

Between the standard blade and the polio blade is the Kessel blade which has a 110° angle, again for the obese or obstetric patients.



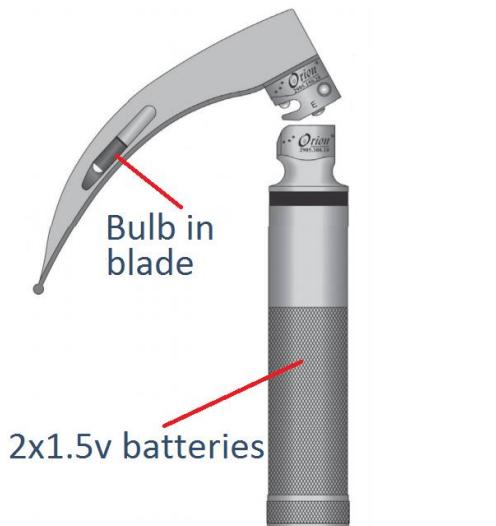
Kessel blade

Laryngoscope handles

The standard or conventional laryngoscope has a light bulb incorporated into the blade, near the tip and an electrical connection (3 volts) is made when the blade is opened ready for use. The handle itself contains only the batteries and the electrical connector. They traditionally use 2 x C size batteries.

Remember: if it has a bulb in the handle it is fibre optic not conventional.

They conform to the ISO 7376 'Black' standard so any standard handle and blade will fit together. They are generally being replaced by fibre-optic systems as they are more reliable. Fibre-optic (Green) and standard (Black) systems are not compatible.



Conventional handle & blade

Note: these are also available as single use systems. Some manufacturers produce single use brighter 6v systems which are not compatible with the traditional 3v system. If a standard blade is fitted on the 6v handle the bulb will blow.

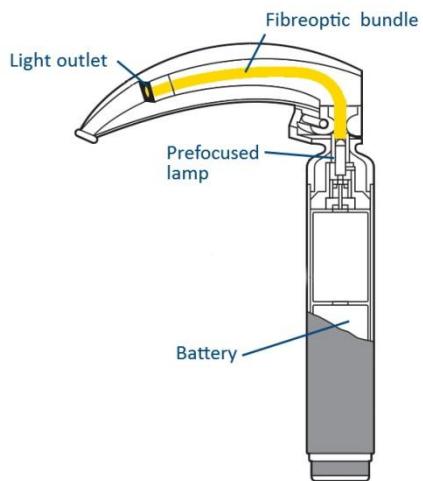
The fibre Optic Laryngoscope (Green) has its bulb located in the handle with the batteries, the light is transferred to the tip of the blade via a fibre optic bundle (or plastic equivalent). These can have a LED bulb which greatly increases the laryngoscopes light output and battery life.



Fibre optic handle & blade

Early LED bulbs had a cool white light that was not liked by many anaesthetists but these have mostly been replaced by bulbs with a more natural warmer light. These handles and blades should conform to the ISO 7376/3 'Green' standard and be marked so. There have been concerns raised the reusable fibre-optic blades repeatedly processed are prone to light degradation resulting in poor lamination and difficult intubation.

They come in both 3v and 6v versions which are interchangeable as both the bulb is contained in the handle and only light is transmitted down the blade.



Fibre optic laryngoscope configuration

Single use laryngoscopes

Single use versions of these both conventional and fibre optic laryngoscopes has become popular in some countries due to the risk of prions which are associated with vCJD (mad-cow disease.) This disease has been effectively eliminated and NICE (UK) guidelines do not consider the risk enough to recommend single-use laryngoscopes. They also have increased costs and have a much larger environmental impact.

Handle sizes

As seen below there are three main sizes of handle; standard size, paediatric and stubby handle. The stubby handle is traditionally used in obstetric or bariatric cases where the patient's breasts may restrict access of the longer handles.



Paediatric, standard, stubby fibreoptic handles

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