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Editorial

From Direct to Indirect Laryngoscopy for Endotracheal Intubation, the Pendulum Swings On

Boaz G Samolsky Dekel*

Department of Medicine and Surgery Sciences, University of Bologna, Italy

***Corresponding Author:** Boaz G Samolsky Dekel, Department of Medicine and Surgery Sciences, University of Bologna, Italy.

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Endotracheal Intubation (EI) is a critical and lifesaving procedure that is indicated in patients who, for whatever reason, cannot maintain adequate oxygenation, perform effective ventilation, or maintain protected airways. Professionals who deal with airways management should be proficient in understanding the indications for EI, the pharmacology of narcotic and neuromuscular-blocking agents, and the appropriate techniques for EI [1]. A corner stone for the latter is EI via laryngeal exposure i.e. via laryngoscopy.

Laryngoscopy may be direct or indirect. The first laryngoscopes, developed and manufactured in the 19th century, used natural light source (e.g. sunlight or oil lamps) which was focused through lens onto a reflecting mirror and thus illuminating the targeted anatomical structures; through a hole in the mirror the glottis could be viewed indirectly. Direct laryngoscopy requires the elevation of the epiglottis to achieve laryngeal exposure. Thus, in the early passed century, congruent rigid direct laryngoscopes were developed allowing EI under direct laryngeal vision. These laryngoscopes are made of a cylindrical handle and a blade. The latter is used to elevate the epiglottis indirectly (Macintosh, or curved blade) or directly (Miller, or straight blade). Further they may contain a fiberoptic, xenon halogen, or light-emitting diode light source that runs the length of the blade. Indirect laryngoscopy reappeared in the 1960s with the development of the flexible fiberoptic bronchoscope. The latter is used for many perioperative applications including tracheal intubation, endobronchial placement of double-lumen tubes and blockers, suction from and evaluation of the airways. In the last decade, driven by the constantly mounting video technology, indirect laryngeal exposure has become popular once again, this time by video laryngoscopy (VL).

Basically, the video laryngoscope, aside the external monitor, maintains the rigid laryngoscope typical structure of a handle and a blade; the blade contains an embedded light source and a camera positioned roughly at the middle of the blade. These elements are powered either from the monitor or by an internal battery [1]. Given the physical proximity of the camera to the artificially illuminated anatomical structures, it is possible, compared to direct laryngoscopy, to capture a more panoramic view of the larynx. The precise description of the electronic features of such laryngoscope goes beyond the scope of this editorial. Nonetheless, it is noteworthy that the core process of obtaining the digital image depends on the camera's photodetectors that convert light photons into electric signals as commonly done by cell phones and digital cameras to capture images. The electronic elements that provide this conversion may vary in precision, energy consumption and costs. The final image may be displayed on a color liquid crystal display, either mounted to the video laryngoscopy device itself or attached via a cable to an external monitor to allow variable mounting as well as recording and storage via a USB port and other video output via an HDMI cables.

Essential elements of the video laryngoscopes are the type and geometry of the blade. Most video laryngoscopes are designed to provide an anterior view of the glottis by using blades angulated between 60° and 90°. This enables optimal glottis visualization with less neck flexion or extension compared to direct laryngoscopy. Some video laryngoscopes may mount curved or straight blades which can be used to perform direct laryngoscopy or indirect laryngoscopy using the video component.

EI with a video laryngoscope differs as far as within the blade are present or not built-in channels through which the endotracheal tube may be introduced. For un-channeled angulated blades a stylet, molded to match the curve of the blade, is needed to achieve EI. On the contrary, a channeled blade provides a fixed pathway for the endotracheal tube but thus limits the tube manipulation and a less flexible operative viewing angle compared to an un-channeled blade. Depending on the specific device handles and blades may be of variable materials (metal or plastic) and thus have partially or fully disposable design.

Compared to conventional direct laryngoscopy, VL provides a broader laryngeal structures exposure and many healthcare providers consider it be a first-line EI technique for routine, difficult, and rescue intubations. It may also assist the placement of specialty devices which may benefit from pharyngeal and laryngeal broader imaging (double lumen tubes, nerve integrity tubes for nerve monitoring, orogastric tubes, gastroscopes etc). For VL the literature reports increased rate of overall and first-pass intubation success and decreased rates of esophageal intubations by various healthcare providers and in different settings [2-4]. It was also reported to decrease hemodynamic and hypoxemia responses to EI, as well as to decrease the forces of intubation and hence potential reduction in dental and airway trauma [5,6]. As VL, compared to direct laryngoscopy, requires decreased cervical spine extension, one of its the most promising advantage is its use for EI in both trauma and non-trauma patients with cervical spine pathology or immobilization and with limited mouth opening. Finally, VL has a unique advantage for education and training. As it provides an ameliorated anatomical display of airway structures that can be shared in real-time with other healthcare providers it enables both guidance and training in the fields of laryngoscopy and EI [7,8].

Limitations of VL may depend upon either patient, equipment, or operator limiting factors. Patient limiting factors regard both impediments for the introduction and progression of the blade through the mouth and various obstacles for the image capturing. These factors include limited mouth opening, macroglossia, abnormal tissue growth in the oropharynx, blurred vision because of fogging, or the presence of abnormal materials like secretions, blood, or vomitus in the airway [9]. As for equipment limiting factors, the issue of cost-effectiveness of VL has not been definitively cleared yet. Moreover, there is no sufficient comparative evidence to highlight differences between different types of VL devices. To note, as underlined above, both channeled and un-channeled blades require additional attention and training as the formers limit the tube trajectory and its manipulation while the latters requires appropriate use of a stylet. In both cases EI with VL is not a mere obtainment of an optimal laryngeal image but require specific proficiency for the appropriate tube insertion. It has been reported however, that the learning curve to achieve proficiency for EI with VL is shorter than that with direct laryngoscopy [10].

In summary VL represents a novel level in the procedure of assisted EI. Its main advantage resides in obtaining a broader indirect laryngeal imaging without the necessity to align the oral-pharyngeal and laryngeal axes. This and other advantages permit to overcome some of the limitations of EI using direct laryngoscopy. Nonetheless it should be stressed that the improved glottic visualization does not imply easy EI. Although VL devices are now recommended by many airways management guidelines as a primary or alternate first-line approach to EI as well as for use as a rescue device [11-14], randomized controlled studies are needed to assess for which setting and circumstances and with what device, blade geometry and structure, EI with VL is beneficial and cost-effective.

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