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Virtual and real imaging in the management of the difficult airway

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'DOWN-UP-DOWN' APPROACH TO FIBEROPTIC TRACHEAL INTUBATION : REAL AND VIRTUAL

During conventional laryngoscopy in a supine patient, the laryngoscope blade aligns the oral, pharyngeal, and laryngeal axes. For a successful tracheal intubation one has to not only visualize the trachea but also pass the tracheal tube through the glottis. When the alignment of the upper airway axes is not feasible during conventional laparoscopy, or when the tracheal tube cannot be directed into the trachea, a flexible device (such as the fiberscope) is necessary to guide it through the glottis.

It is often forgotten that the spatial relationship of the airway structures during fiberscopy varies from that during direct laryngoscopy. Illustrations in many medical textbooks incorrectly display the upper airway as a uniform curve joining the oropharynx and nasopharynx with the larynx. However, during fiberoptic tracheal intubation, either from the mouth or the nose, the fiberscope has to negotiate two angles and follow three different axes, which we have called 'down-up-down'.

In the 'down-up-down' technique the first step includes insertion of the fiberscope downwards to the posterior wall of the oropharynx (during the oral approach) or to the nasopharynx (during the nasal approach). At this point, the tip of the fiberscope is directed upward, by pushing down on the scope's handle or lever. This first angulation reveals a rostro-caudal view of the pharynx and the superior part of the epiglottis is often visualized. During the second step, the fiberscope is advanced in an upward direction towards the anterior commissure of the vocal cords, resisting to the temptation to advance the device towards the posterior part of the glottic aperture. This avoids any contact with the mucosa, reducing the risk of trauma to the arytenoids and corniculate cartilages. Once the anterior commissure is reached, the second angulation is undertaken to direct the tip of the fiberscope downwards. by pushing up on the scope's handle or lever. This will place the tip of the scope in the center of the larynx and the fiberscope is advanced downwards in the direction of the vocal cords, then passed through the glottis into the trachea until the carina is visualized. It is necessary to keep the fiberscope in the center of the tracheal lumen avoiding contact with the mucosal wall.

In order to improve the learning curve of the tracheal fiberoscopy, a 3D virtual model of the upper airway was created from images from CT scans of patients. This virtual model allows navigation into a virtual airway structures, i.e. in the upper airway as well as in the bronchial tree. This educational tool will also also permit preoperative virtual evaluation of patient's airway and practice virtual fiberoptic intubation in patients with foreseen difficult intubation.

USE OF RIGID VIDEOLARYNGOSCOPES TO FACILITATE FLEXIBLE FIBEROPTIC TRACHEAL INTUBATION : HOW TO BRING IN CLINICAL PRACTICE THE ADVANTAGES OF THE VIRTUAL TEACHING TOOL

Rigid video laryngoscopy has recently been described for difficult airway management, either with a Macintosh type blade or a specially shaped blade that allows optimal laryngeal exposure. Although this type of rigid video laryngoscopy reveals the larynx more frequently and improves the Cormack and Lehane class when compared with the conventional direct laryngoscopy, it often proves difficult to advance the tracheal tube towards the glottis and through the vocal cords, even more if the videolaryngoscope has no channel for the tube.. This represents a clear illustration of the difference between the two aspects of a successful tracheal intubation process (that is, visualization of the glottis and insertion of the tracheal tube through the glottis), and emphasizes the importance of visual control of the inserted devices. Use of a specially

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shaped stylet to aid orientation helps greatly. However, in addition to a high failure rate, a blind stylet technique is associated with a potential risk of injury of the soft palate, the anterior tonsillar pillar and other airway structures. These complications occur because the tip of the tube is not always visible on the video screen and the stylet mounted device can cause injuries while in the operator's 'blind spot'. Therefore, we suggest that instead of using a stylet, rigid video laryngoscopy may be combined with flexible fiberscopy so that the strengths of both techniques are utilized. In this setting, after induction of general anaesthesia, the anaesthesiologist performing the laryngoscopy introduces the rigid video laryngoscope until the upper larynx is visualized or the best possible view (if there is a 'difficult' airway) is obtained on the screen. Then, while holding the video laryngoscope in place, the right hand (as if holding a tracheal tube) is used to guide the distal tip of the flexible fiberscope as close as possible to the glottic inlet. A second operator (the fiberscopist) then completes the passage of the flexible fiberscope through the glottis and completes the tracheal intubation by railroading a tracheal tube over the flexible fiberscope. In our experience, the video laryngoscope facilitates progression of the flexible fiberscope by keeping the oropharynx open and preventing possible lateral advancement of the flexible device. The fiberscopist takes advantage of the double-screen view, allowing simultaneous vision of the position of the tip of the flexible fiberscope through the rigid video laryngoscope (external fiberoptic view) and the flexible fiberscopic view of laryngeal structures (internal fiberoptic view). This reproduces in the real clinical life the precise conditions of control offered during the learning process with the VFI computer program.