Shedding New Light on an Old Technique

I N 1915, the renowned mathematician and physicist Sir William Henry Bragg received the Nobel Prize in physics for his work using x-ray diffraction to analyze the structure of crystals. He was attributed the following quotation: "The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them." In this issue of ANESTHESIOLOGY, Yang *et al.*[1] present a new way of thinking about laryngoscopy (retrograde light–guided laryngoscopy [RLGL]).

Although a plethora of new tools have been developed to facilitate airway management, direct laryngoscopy (DL) remains the most commonly practiced method of performing intubation. As Yang *et al.*[1] state, the alternatives are more costly, more technically complicated, or not universally available. And so, for the foreseeable future, DL will remain a necessary skill for providers in every specialty when intubation is performed. Perhaps the greatest challenge is to effectively teach DL, a deceivingly conceptually simple procedure. Mulcaster *et al.*[2] determined that 47 attempts were needed by trainees (medical students, respiratory therapy, and paramedic students) to ensure competence with laryngoscopic tracheal intubation. Konrad *et al.*[3] found that an average of 57 attempts were needed by anesthesia residents to reach a 90% success rate and 18% of the residents needed assistance even after 80 intubations. It is interesting to note that experienced providers in specialties in which intubations are rarely performed also struggle with routine intubations.[4] Further challenges for both the learner and instructor include the lack of objective criterion to assess the efficiency or quality of performing the technique.

The DL intubation process consists of five basic steps: (1) optimal positioning of the patient, (2) adequate opening of the mouth, (3) correct insertion of the blade in the mouth, (4) advancement of the blade with exposure and identification of the larynx, and (5) placement of the tracheal tube through the glottis and into the trachea. Learners may struggle with any or all of these steps. The instructor easily corrects

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difficulty with the first three steps. However, the fourth and fifth steps require kinesthetic learning through repeated practice and are the hardest to teach.

The RLGL technique presented in the study by Yang *et al.*[1] improved learning of these critical steps in tracheal intubation, particularly the rapid identification of the correct orifice for tube placement. A light-emitting diode flashlight is placed in the area of the cricothyroid membrane. DL is performed with a laryngoscope blade with the light source switched off. The glottis is illuminated by the retrograde transmission of light and the vocal cords glow red. This bright intense light provides an obvious discrete target for the laryngoscopists to insert the breathing tube.

In their study of subjects who had never performed intubation, Yang *et al.*[1] demonstrate improvements in nearly every tracheal intubation metric using this alternative technique. They compared tracheal intubation by 20 novices in 205 patients using DL and RLGL.[1] Intubation was performed faster and with a higher success rate with RLGL than DL. The first attempt success rate was 40% in the RLGL group and 22% in the DL group, and overall success rate was 72% with RLGL and 47% with DL. The trainees also reported improved Cormack and Lehane scores with RLGL. These results combined with the fact that patients in the RLGL group reported a lower incidence of sore throat than those in the DL group suggest that the RLGL technique was superior to DL by novice laryngoscopists.

So, What Does This New Technique Mean for Us?

The immediate implication is that all teachers of laryngoscopy can use this tool to enhance learning and improve the success rates of novice laryngoscopists. However, many questions remain and further research is required to discover the broader implications of this new approach. Although

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trainees may be more successful with the technique, how will experienced laryngoscopists fare?

Is This Technique Useful in Difficult Intubations?

Glottic visualization is a prerequisite for light conduction to the operator, and many challenging intubations occur because glottic visualization is impossible or severely limited. This suggests that RLGL may not be beneficial in patients with difficult DL; however, external tracheal transillumination may facilitate fiberoptic intubation by presenting a discrete target to the operator.

How Effective is RLGL in Children?

The child's cricothyroid membrane is much smaller than that of an adult particularly in infancy, and it is unknown whether light conduction would be minimal or would be enhanced. Tracheal intubation in children is often more challenging and is associated with time pressure because of their higher oxygen consumption, decreased functional residual capacity under anesthesia, and consequent rapid oxyhemoglobin desaturation. This makes it difficult for trainees to learn to perform tracheal intubation in the smallest children, and success rates in neonates have been reported to be poor. O'Donnell *et al.*[4] reviewed video recordings of intubations in the delivery room by neonatology trainees and consultants; only 62% of intubation attempts were accomplished, and success rates for residents, fellows. and consultants were 24, 78, and 86, respectively. RLGL, if effective in children, could significantly impact the morbidity associated with intubation in delivery rooms, neonatal intensive care units, and even in the operating room.[5]

Another potential application of the RLGL technique is in emergent intubations performed outside the operating room and in the field. RLGL may improve the intubation success rate among providers who rarely intubate patients. Improperly placed breathing tubes in critically ill patients may lead to serious morbidity and mortality. One observational study noted that 25% of patients intubated in the field by paramedics had improperly placed endotracheal tubes with the majority of these tubes being in the esophagus or hypopharynx. Of these patients, 33% died while in the emergency department.[6] Even slight improvements in tracheal intubation success rates and intubation times could markedly impact the outcomes of these patient populations.

One disadvantage of the RLGL technique is the current requirement for two providers. However, this can readily be mitigated by the use of an illuminated neck collar as a light source, thereby allowing a single provider to perform the technique.

RLGL leads to higher success rates and faster intubations in trainees. However, it is unclear how this success will translate to standard laryngoscopy. We are reminded of a story of a young mother who learned to drive a car at night. She became comfortable with night driving and eventually decided to attempt a daytime drive. She described her first daytime drive as one of her most terrifying driving experiences. The new stimuli afforded by daylight were overwhelming and her confidence was completely shattered. Further research is required to evaluate how RLGL-trained novices will transition to DL without using RLGL.

RLGL represents a simple but radical change in the approach to intubation training, whereby instead of antegrade lighting, the laryngoscopist follows a retrograde light. This shift in thinking may open new doors for further exploration. What technological advances might evolve from this simple change? Might there be a stylet with a built-in photosensor that will emit a tone and help us guide the breathing tube toward the illuminated glottis? Could this technique become our standard way of lighting the airway? Sir Bragg was right when he implied that new facts move us forward, but a new way of thinking may catapult us in time!

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