Learning neonatal intubation with a video laryngoscope

Although increasing used in adult and paediatric populations, the use of video laryngoscopy in a neonatal setting has not been extensively researched. This article describes a study showing that intubation of a manikin head by medical students is more successful using video assisted technology than traditional direct vision. Subsequent intubations were re-assessed to see whether students who had previously used video laryngoscopy were less likely to succeed at intubation using direct view.

David G. Bartle
MBChB, MRCPCH
Neonatal Consultant
Centre for Women's Health, Royal Devon and Exeter NHS Foundation Trust
david.bartle@nhs.net

Roy Powell
BSc (Hons), PhD, CBiol, FSB, FHEA
Research Design Consultant, Royal Devon and Exeter NHS Foundation Trust and University of Exeter Medical School
roy.powell@nhs.net

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Key points

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1. Intubation of newborn infants is a core skill for paediatric trainees.
2. Medical students (who have never intubated a neonate or neonatal manikin before) are more likely to succeed at intubation using a video laryngoscope than by direct vision.
3. Having learnt intubation using a video laryngoscope, medical students are no less likely to succeed at intubation using direct view than if they had used direct view previously.

Background

Neonatal intubation can be technically difficult and success rates for real-time neonatal intubation are suboptimal.[1] Although a core skill for paediatric trainees, opportunities to perform neonatal intubation are decreasing due to:

- less invasive methods of ventilator support
- fewer intubations on neonatal units
- centralisation of specialist services
- fewer hours worked by trainees due to the enforcement of the European Working Time Directive.

What is already known?

In adults, video laryngoscopy is used routinely in a lot of hospitals. It has been shown that education using a video system improves intubation skills in medical students in adults.[2] Video laryngoscopy is also used increasingly in paediatric intensive care units and in paediatric emergency departments and is associated with greater first time success in the paediatric emergency department setting.[3]

Intubation in neonatal units is routinely performed using direct laryngoscopy with few video laryngoscopes available on neonatal units. A 2011 study using the GlideScope video laryngoscope, showed no significant difference between the number of attempts required for successful intubation using video laryngoscopy or direct view on a neonatal manikin.[4]

With traditional direct laryngoscopy, a viewing angle of approximately 15 degrees is achieved. With the video laryngoscope this can be up to 85 degrees as the camera is at the distal end of the blade along with the bulb. The Storz C-Mac video laryngoscope is a similar shape and size as a conventional laryngoscope; therefore technique for intubation is the same although the handle is slightly broader (**FIGURE 1**).

FIGURE 1 The Storz C-Mac video laryngoscope.

In neonatal resuscitation there is approximately a 62% success rate on each attempt for intubation with direct laryngoscopy, ranging from 24% (residents) to 86% (consultants).[1]

A previous study showed that the success rate of intubation on a neonatal manikin is improved (and oesophageal intubation decreased) when learning intubation using a video laryngoscope compared to direct laryngoscopy. Although time to successful intubation is longer using the video laryngoscope, the time difference is not clinically significant. Once intubation is mastered on manikins using the video laryngoscope, this competence is easily transferred to the use of direct laryngoscopy.[5] The make of video laryngoscope was not specified.

Having purchased a Storz C-Mac video laryngoscope, the authors felt that the success rate for intubation of their paediatric trainees was significantly improved using the video laryngoscope. In addition, by using the video laryngoscope there was total confidence with tube positioning by trainee, trainer and nursing staff as all had visualised the position during placement. This removed the period of uncertainty immediately after intubation, when arterial oxygen saturation is still dipping prior to improvement.

However, there was concern that the trainee who has learnt intubation using video laryngoscopy, might find it difficult to perform intubation by direct laryngoscopy. The authors' impression from use in their clinical setting was that, having learnt intubation using the video laryngoscope, trainees learnt how to visualise the anatomy and acquired a degree of 'muscle memory' in the technique and so were no worse at intubating using direct view than those who had previously learnt using direct view laryngoscopy.

Aim

The aim of this study was to compare intubation of a neonatal manikin head by video assisted laryngoscopy, with laryngoscopy by direct view. A second attempt at intubation was then made by both groups using direct view. This looked at whether, having used video assistance the first time, the students were less likely to be successful using a direct view on the second attempt.

Methods

This study was undertaken at the Royal Devon and Exeter NHS Foundation Trust with medical students from the University of Exeter Medical School. One hundred students were recruited to the study and randomised to the use of video assisted intubation or intubation using direct laryngoscopy. The students were year three, four and five medical students who were all performing their clinical attachments. None of the students had previously intubated a neonate or a neonatal manikin, however most had intubated an adult or an adult manikin.

A Storz C-Mac video laryngoscope was used with a size 1 Miller blade for both arms of the study. For the group that was randomised to direct view, the same equipment was used but the screen was turned around so neither the student nor the assessor could visualise the screen. A Trucorp neonatal manikin head was used for the intubation (**FIGURE 2**).

FIGURE 2 The Trucorp neonatal manikin head.

What is the study?

Randomised to use either video or direct laryngoscopy.

30 seconds to attempt intubation on manikin.

If endotracheal tube placement is successful, time to intubation is measured.

Second attempt at intubation using direct laryngoscopy (to assess if learning is improved by initial video laryngoscopy).

FIGURE 3 The slide shown to the medical students prior to intubation attempt.

Four slides (**FIGURE 3**) were shown to the students explaining the purpose of the study along with a view of a manikin pharynx (**FIGURE 4**) and also an image of the pharynx that might be visualised when intubating a baby.

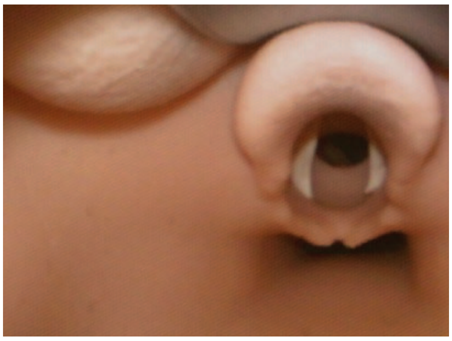

FIGURE 4 The pharynx of a neonatal manikin as viewed with the Storz C-Mac video laryngoscope.

The students were given an information leaflet and signed a consent form for participation in the study. Randomisation to one of the two arms of the study was performed using concealment of allocation: a statistician provided a block randomisation list and one of the neonatal secretaries distributed envelopes numbered 1-100. The students were allocated to video assisted intubation for their first attempt if a ticket with A was removed from the envelope and to direct view if B was removed from the envelope. None of the students witnessed each other performing the intubation as this might have helped the learning process.

A digital timer was used to time the attempt at intubation. This was started as the tip of the laryngoscope blade entered the mouth of the manikin. Direction was given to both groups by the assessor to support in the intubation, as would happen on a neonatal unit with supervision of a trainee. Advice included depth of insertion of the laryngoscope blade and amount of elevation of the blade needed. A time limit of 30 seconds was given to perform endotracheal tube (ETT) placement and the person who timed the procedure also assessed whether or not the procedure was successful. An intubation was deemed successful if the ETT passed through the vocal cords on the neonatal manikin head, regardless of the length of ETT that passed through the cords, within the time limit allocated. Failure to pass the ETT through the cords in the allotted time was classed as an unsuccessful intubation. If ETT placement was deemed successful the timer was stopped and the time to intubation was recorded in whole seconds.

A second attempt at intubation was then performed by all students using the direct view with no help from video laryngoscopy. This again was timed with success and failure criteria as outlined previously.

Statistical analysis

Continuous outcome data were tested for normality using the Shapiro Wilk test. If the data were found to be normally distributed, results were expressed using means and standard deviations. If the data were not Gaussian, they were summarised using medians, interquartile ranges and ranges. Confidence intervals (CI) were derived wherever possible. Categorical data were summarised as proportions with associated CI and percentages as appropriate. Associations were tested with the Chi-squared test and means were compared with t-tests or medians with Mann Whitney U tests for unpaired data and Wilcoxon matched pairs signed ranks test for paired data.

Results

One hundred medical students completed the study. At the first attempt:

- 32 out of 50 (64%; 95% CI 49 to 77%) of those performing intubation using video laryngoscopy were successful.

- 19 out of 50 (38%; 95% CI 25 to 53%) of those performing intubation using direct view were successful.

There was a significant difference between the two groups with the likelihood of success using a video laryngoscope being much greater (Chi-squared = 6.76, 1 degree of freedom, p=0.009).

In every case that the video was used there was good visualisation of the vocal cords. The unsuccessful intubations were as a consequence of ETT manipulation and not difficulty in identifying the cords.

Upon the second attempt:

- 27 out of 50 (54%; 95% CI 39 to 68%) of those who initially used the video laryngoscope succeeded with direct laryngoscopy.
- 21 out of 50 (42%; 95% CI 28 to 57%) of those who initially used direct view for intubation succeeded with direct laryngoscopy.

There was no difference in successful intubation between the two groups (Chi-squared = 1.44, 1 degree of freedom, p=0.23).

Time to successful intubation at the first attempt was a median of 19 seconds (interquartile range 10) in the direct view group and 15.5 seconds (interquartile range 7) in the video laryngoscope group (p=0.205).

There was a significant reduction in time taken by the direct view group between the first and second attempt, from a median of 19 to 14 seconds (p=0.007). However, the video laryngoscope group was already faster than the direct view group and the reduction in time taken, from 15.5 to 13 seconds, was not significant (p=0.581).

Discussion

Teaching intubation is often a stressful time for both trainee and trainer. This is made considerably more comfortable when the view obtained by the trainee is witnessed by the trainer and accompanying nursing staff. When a successful intubation has been performed, all involved in the procedure have confidence that the ETT has been placed correctly, which increases confidence in the trainee and the trainer. If there is a higher success rate of intubation using video, this is beneficial to the infant as there will be less hypoxia during attempts.

A weakness in the study could be that instructions given to the two groups during the procedure my have been different. This is a valid point, however it is also one of the real advantages of the use of the video laryngoscope: clear direction can be given when all share the same view.

Concern over the use of a video laryngoscope for intubation instruction centres around the worry that trainees may be less successful at intubation if they are later faced with a laryngoscope with direct view only. The study negates this concern and in fact suggests there is a tendency to greater success where the video laryngoscope was used initially.

Conclusions

Medical students are more likely to succeed at intubation of a neonatal manikin using video assisted technology. It would be important to assess the use of video assisted intubation in a large study in infants on neonatal units but it might be anticipated that, by using video laryngoscopy routinely on neonatal units, there should be more first time successful intubations, less traumatic intubations and fewer complications from intubation.

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References

1. **O'Donnell C.P., Kamlin C.O., Davis P.G., Morley C.J.** Endotracheal intubation attempts during neonatal resuscitation: success rates, duration, and adverse effects. *Pediatrics* 2006;117:e16-21.
2. **Herbstreit F., Fassbender P., Haberl H. et al.** Learning endotracheal intubation using a novel videolaryngoscope improves intubation skills of medical students. *Anesth Analg* 2011;113:586-90.
3. **Donoghue A.J., Ades A.M., Nishisaki A., Deutsch E.S.** Videolaryngoscopy versus direct laryngoscopy in simulated pediatric intubation. *Ann Emerg Med* 2013;61:271-77.
4. **Iacovidou N., Bassiakou E., Stroumpoulis K. et al.** Conventional direct laryngoscopy versus videolaryngoscopy with the GlideScope: a neonatal manikin study with inexperienced intubators. *Am J Perinatol* 2011;28:201-06.
5. **Assaad M., Lachance C., Moussa A.** *Videolaryngoscope vs Classic Laryngoscope in Teaching Neonatal Endotracheal Intubation: A Randomized Controlled Trial on Manikins.* Pediatric Academic Societies annual meeting 2013, Washington, USA. E-PAS2013:4522.389.