

Intubation during Uninterrupted Chest Compressions: How Easy?

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Airway management and ventilation are essential during advanced cardiopulmonary resuscitation for oxygenation and prevention of hypoxic organ injury. Tracheal intubation is considered a gold standard intervention as it provides optimal oxygenation without pausing for rescue breaths and acts as a good source for measuring end-tidal carbon dioxide accurately. It also helps to reduce the risk of aspiration as compared with the supraglottic devices. However, tracheal intubation can be challenging during cardiopulmonary resuscitation, due to technical difficulties of intubation while cardiac compressions are ongoing. Holding chest compressions for facilitating tracheal intubation can be associated with interruptions in cardiopulmonary resuscitation, more so, when the 2020 American Heart Association guidelines recommend minimizing pauses in chest compressions, to maintain a chest compression fraction of greater than 80%.^{1,2} Hence, there is a need to decrease the interruptions and to facilitate intubation within a short time.

Several devices are available to aid the insertion of an endotracheal tube to minimize the hands-off time (time of interruption from chest compressions), increase the first pass success rate, and prevent false intubation into the esophagus. Direct laryngoscope with Macintosh blade is a commonly used device to insert an endotracheal tube, as it is inexpensive and is easily available in all emergency settings, including cardiac ambulances. It requires manipulation of patient's neck for providing a good view of the glottis by creating an alignment of oropharyngeal, laryngeal, and tracheal axis. Most first responders have a better hands-on experience with it, as compared with other similar devices. Videolaryngoscope, on the contrary, is an extremely versatile equipment which can visualize the glottis and surrounding structures better, with less neck movement and in difficult intubation situations, like trauma. It requires only a portion of glottic visualization and can be more useful for endotracheal insertion.³ Use of videolaryngoscope has been claimed to reduce the rate of failed intubation, improve the first pass successful intubation rate, and provide better glottic views, across different patient groups and settings.

The DirEct versus VideolaryngosCope (DEVICE) trial performed on 1,417 patients by Prekker et al. found that the use of videolaryngoscope for tracheal intubation resulted in higher incidence of successful intubation on the first attempt, as compared with the direct laryngoscope.⁴ These findings and those of other similar studies may have important clinical implications because failure to intubate on the first attempt is associated with life-threatening complications. With the introduction and availability of various videolaryngoscope devices over time, it is also important

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to ascertain their performance. Numerous studies have compared direct laryngoscope and different models of videolaryngoscope, with the likes of C-MAC and King-Vision device. Among all, C-MAC device was found to be superior in terms of speed of intubation.⁵

A recent systematic review by Nedunchezian et al. evaluated various studies of airway management, comparing the usage of two or more videolaryngoscopes to assess the improved glottic view, time to successful intubation, first pass success rate, and preference of operators. Out of the total 81 studies, 50 were performed on live patients while 31 were on manikins. They found that C-MAC videolaryngoscope was the most preferred, over other videolaryngoscopes which included GlideScope, McGrath, King-Vision, Pentax Airway Scope, and Airtraq.⁶

Various trials have been conducted for tracheal intubation during cardiopulmonary resuscitation, and few were simulation trainings on manikins, while others were in real-life emergency settings, for both in-hospital and out-of-hospital cardiac arrests. However, the results have varied depending upon the scenario. In two large studies on intubation during cardiopulmonary resuscitation in the emergency department, the first pass intubation rate was better with videolaryngoscope as compared with direct laryngoscope, with the additional advantage of better glottic visualization and lower esophageal intubation rate.^{7,8} A systematic review by Cox and Tebbett retrieved six studies for analysis on whether the use of videolaryngoscope over direct laryngoscope provided any benefits when utilized for endotracheal intubation during cardiac arrest in hospital, and found that videolaryngoscope was associated with improved first pass intubation rate.⁹ In another study by Tandon et al., the time to intubation was shorter with a GlideScope videolaryngoscope as compared with a direct laryngoscope in a similar setting of simulated cardiopulmonary resuscitation with uninterrupted chest compressions, and they

found that videolaryngoscope had a shorter time to intubate.¹⁰ Other studies have emphasized the advantage of C-MAC device over other videolaryngoscopes, but its relevance in the setting of a cardiac arrest with cardiopulmonary resuscitation being performed needs to be evaluated too.

This current prospective randomized study by Kumar et al. provides fresh insights regarding intubation in such situations, where they have compared video laryngoscopy using two different devices, i.e., C-MAC and Tuoren videolaryngoscopes, with the conventional direct laryngoscope, on a manikin, thereby simulating a cardiac arrest with ongoing uninterrupted chest compressions, with a purpose to assess the time for successful intubation, number of attempts, ease of intubation, and preference of operators. They found that during intubation under simulated settings of uninterrupted chest compression, the C-MAC videolaryngoscope and direct laryngoscope required lesser time with better ease of intubation, as compared with the Tuoren videolaryngoscope.¹¹ C-MAC videolaryngoscope was the most preferred device among all operators, followed by the direct and then Tuoren videolaryngoscope.

This may be a first of a kind study from India as per available reports, where a direct laryngoscope has been compared with two commonly used videolaryngoscopes, during the golden hours of cardiopulmonary resuscitation being performed on a manikin, which may correlate with a simulated emergency setting.

Gupta et al. had earlier compared Tuoren videolaryngoscope with KingVision videolaryngoscope and found that the time taken to intubate was more with the Tuoren device.¹² However, another study comparing Tuoren videolaryngoscope with AceScope videolaryngoscope did not show any significant difference with the time to intubate and ease of intubation.¹³ Rajan et al. had recently compared the same two devices, i.e., C-MAC and Tuoren videolaryngoscopes, for nasotracheal intubation in a surgical setting with normal airway. The first pass success rate was higher, and the time taken to intubate was lesser with the C-MAC device. The glottic view was comparable, but fogging and marked hemodynamic response was a concern with the Tuoren device.¹⁴ King-Vision videolaryngoscope was compared with the Tuoren device in a study conducted by Ramesh et al., for laryngoscopy during manual inline stabilization. The first pass success rate and intubation time were better with the King Vision, but the glottic visualization was found to be better with the Tuoren device.⁵ All these studies show different perspectives and preferences about Tuoren device, which still continues to be an important and commonly used ally for intubation in different situations, across.

An important aspect of the current study is the experience of operators, where most of them were consultants or senior residents, and the speed and ease of intubation between the direct laryngoscope and C-MAC videolaryngoscope device were found to be similar by them. This echoes the findings of Kim et al. where they found that the endotracheal intubation success rate between the direct laryngoscope and videolaryngoscope devices did not differ significantly based on experience of operators during cardiopulmonary resuscitation.¹⁵ However, the study by Cox and Tebbett found that the video laryngoscopy had better first pass intubation when used by clinicians having less experience of intubation. Video laryngoscopy is also known to present a magnified and better view of the larynx without the need to align the axis of the eyes of the operator and the airway of the subject. Videolaryngoscopes, therefore, may be beneficial for operators with refractive errors as in a study by Abdalla et al., where video

laryngoscopy was found to be very helpful in presbyopic operators who were above the age of 40 years.¹⁶

The use of metronome is notable in this study, as it maintains a steady rate of chest compressions of 110/minute and is a crucial step to keep the rhythm in check without distracting the person doing intubation. Metronome use has been associated with improved depth of compressions and recoil of chest and is recommended during the cardiopulmonary resuscitation training programs.¹⁷ Though possible on a manikin, uninterrupted chest compression may be difficult to achieve especially in out-of-hospital cardiac arrest and during defibrillation in shockable rhythm.

The crossover design of this study minimizes the variability between operators performing intubation using different devices on the same subject. The randomization done for sequence of devices used, with six different combinations for using the devices, minimizes bias to some extent. Training and orientation with the devices were done before the actual trial began, and there could be a risk of bias, as familiarity and ease of handling one device over the other, during the training period, might have tipped the scale in favor of C-MAC over Tuoren videolaryngoscope. This study also proves that direct laryngoscope is comparable to videolaryngoscopes, and it continues to be an important aid in the golden hours of cardiopulmonary resuscitation, and in situations where availability of videolaryngoscopes is a concern.

The probable reason for unpopularity of the Tuoren videolaryngoscope with the operators, as stated, could have been the presence of the integrated monitor, which might interfere in the "look-in and look-out" sequence, while the C-MAC device, which has a separate monitor, required little adjustments during intubation. The hyperangulated design of the blade of the Tuoren videolaryngoscope could also be a reason for the extra time taken to negotiate the styletted endotracheal tube through the vocal cords.¹¹ Balbir et al. in their study found that intubation was easier with C-MAC videolaryngoscope when compared with the King-Vision videolaryngoscope, which also has an integrated monitor, in a manikin.¹⁸ However, a recent study by Sonali et al. compared direct laryngoscope with Tuoren videolaryngoscope in 100 patients having normal airway and undergoing elective surgical procedure. They found that the Tuoren videolaryngoscope had a shorter intubation time and superior glottic view.¹⁹ It might, therefore, not be correct to assume that operators prefer videolaryngoscopes without an integrated monitor, or these devices underperform. More such and larger studies are required to validate the same.

This study is a testimony of the times to come, when video laryngoscopy would become the gold standard for endotracheal intubation, though availability and expertise might be a constraint. Nevertheless, it emphasizes the need to be familiar with use of video laryngoscopy, which might be helpful in conditions, especially when nonanesthesiologists would be performing intubation during cardiopulmonary resuscitation in out-of-hospital or in-hospital cardiac arrest.

Though it is difficult to emulate or translate the findings of this study into real-life situations, it does provide insight on the ease of intubation, success rate, comfort, and preference of operators about the commonly available devices, while performing intubation during uninterrupted chest compressions. A matter of concern could be the performance of these devices when dealing with difficult airway situations, faced during cardiac arrest. A larger randomized controlled trial, though difficult, will provide further

insights about the superiority of one videolaryngoscope over the other in real-life difficult situations.

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REFERENCES

- Robinson AE, Driver BE, Prekker ME, Reardon RF, Horton G, Stang JL, et al. First attempt success with continued versus paused chest compressions during cardiac arrest in the emergency department. *Resuscitation* 2023;186:109726. DOI: 10.1016/j.resuscitation.2023.109726.
- Meaney PA, Bobrow BJ, Mancini ME, Christenson J, de Caen AR, Bhanji F, et al. Cardiopulmonary Resuscitation Quality Summit Investigators, the American Heart Association Emergency Cardiovascular Care Committee, and the Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation. Cardiopulmonary resuscitation quality: [corrected] Improving cardiac resuscitation outcomes both inside and outside the hospital: A consensus statement from the American Heart Association. *Circulation* 2013;128(4):417–435. DOI: 10.1161/CIR.0b013e31829d8654. Erratum in: *Circulation* 2013;128(8):e120. Erratum in: *Circulation* 2013;128(20):e408.
- Muhs AL, Seitz KP, Qian ET, Imhoff B, Wang L, Prekker ME, et al. Pragmatic Critical Care Research Group. Video versus direct laryngoscopy for tracheal intubation following cardiac arrest: A secondary analysis of the DEVICE trial. *Chest* 2025;S0012-3692(25)00004-2. DOI: 10.1016/j.chest.2024.12.031.
- Prekker ME, Driver BE, Trent SA, Resnick-Ault D, Seitz KP, Russell DW, et al. DEVICE Investigators and the Pragmatic Critical Care Research Group. Video versus direct laryngoscopy for tracheal intubation of critically ill adults. *N Engl J Med* 2023;389(5):418–429. DOI: 10.1056/NEJMoa2301601.
- Ramesh K, Srinivasan G, Bidkar PU. Comparison of tracheal intubation using King Vision (non-channelled blade) and Tuoren video laryngoscopes in patients with cervical spine immobilization by manual in-line stabilization: A randomized clinical trial. *Cureus* 2023;15(8):e43471. DOI: 10.7759/cureus.43471.
- Nedunchezian V, Nedunchezian I, Van Zundert A. Clinically preferred videolaryngoscopes in airway management: An updated systematic review. *Healthcare* 2023;11(17):2383. DOI: 10.3390/healthcare11172383.
- Okamoto H, Goto T, Wong ZSY, Hagiwara Y, Watase H, Hasegawa K. Japanese Emergency Medicine Network Investigators. Comparison of video laryngoscopy versus direct laryngoscopy for intubation in emergency department patients with cardiac arrest: A multicentre study. *Resuscitation* 2019;136:70–77. DOI: 10.1016/j.resuscitation.2018.10.005.
- Min BC, Park JE, Lee GT, Kim TR, Yoon H, Cha WC, et al. C-MAC video laryngoscope versus conventional direct laryngoscopy for endotracheal intubation during cardiopulmonary resuscitation. *Medicina (Kaunas)* 2019;55(6):225. DOI: 10.3390/medicina55060225.
- Cox L, Tebbett A. Videolaryngoscopy versus direct laryngoscopy for endotracheal intubation of cardiac arrest patients in hospital: A systematic literature review. *Resusc Plus* 2022;11:100297. DOI: 10.1016/j.resplu.2022.100297.
- Tandon N, McCarthy M, Forehand B, Carlson JN. Comparison of intubation modalities in a simulated cardiac arrest with uninterrupted chest compressions. *Emerg Med J* 2014;31(10):799–802. DOI: 10.1136/emermed-2013-202783.
- Kumar R, Kumar R, Kumar N. Comparison of macintosh direct laryngoscope with the C-MAC and tuoren videolaryngoscopes in facilitating endotracheal intubation during uninterrupted manual chest compression: A randomized crossover manikin study. *Indian J Crit Care Med* 2025;29(2):113–116.
- Gupta A, Trikha A, Ayub A, Bhattacharjee S, Aravindan A, Gupta N, et al. Comparison of KingVision videolaryngoscope channelled blade with Tuoren videolaryngoscope non-channelled blade in a simulated COVID-19 intubation scenario by non-anaesthesiologists and experienced anaesthesiologists: A prospective randomised crossover mannequin study. *Trends Anaesth Crit Care* 2021;38:42–48. DOI: 10.1016/j.tacc.2021.03.009.
- Rasheed MA, Siddiqui AK, Hasan A, Singh RB, Singh G. A comparative evaluation of Acescope video laryngoscope and Tuoren video laryngoscope in patients undergoing orotracheal intubation under general anaesthesia. *Int J Sci Res* 2023;12(11):3–6. DOI: 10.36106/ijrs.
- Rajan S, Chandrasekharan R, Mathew J, Roy RA, Rajkumar R, Paul J. Comparative evaluation of ease of nasotracheal intubation using C-MAC versus Tuoren video laryngoscope in adult surgical patients: A randomized study. *J Head Neck Physicians Surg* 2024;12(1):69–73. DOI: 10.4103/jhnps.jhnps_2_24.
- Kim JW, Park SO, Lee KR, Hong DY, Baek KJ, Lee YH, et al. Video laryngoscopy vs. direct laryngoscopy: Which should be chosen for endotracheal intubation during cardiopulmonary resuscitation? A prospective randomized controlled study of experienced intubators. *Resuscitation* 2016;105:196–202. DOI: 10.1016/j.resuscitation.2016.04.003.
- Abdalla AE, Eissa MM, Elbasyouny MR. The C-MAC video laryngoscope helps presbyopic anesthetists to overcome difficulty in neonatal and infantile intubation: A randomized controlled trial. *BMC Anesthesiol* 2025;25:24. DOI: 10.1186/s12871-024-02841-x.
- Caliskan D, Bildik F, Aslaner MA, Kilicaslan I, Keles A, Demircan A. Effects of metronome use on cardiopulmonary resuscitation quality. *Turk J Emerg Med* 2021;21(2):51–55. DOI: 10.4103/2452-2473.309137.
- Kumar B, Ratte BK, Garg R, Meena JK, Singh R, Bhatnagar S. Comparison between C-MAC and King Vision video laryngoscope (channelled blade) for tracheal intubation in aerosol-prevention intubation box for COVID-19 patients: A manikin-based study. *Indian J Anaesth* 2022;66(3):187–192. DOI: 10.4103/ija.ija_832_21.
- Bhagat SK, Lakshmi RS, Shelgaonkar V, Bhagat J. A comparative study of Tuoren video laryngoscope and macintosh laryngoscope for endotracheal intubation in normal airway patients. *Global Journal for Research Analysis* 2024;13(12):71–76. DOI: 10.361016/gjra/250855.