RESEARCH PAPER

Face Mask Ventilation Techniques in Difficult Airway Management: A Comprehensive Review of Conventional and Modified Thenar Eminence Approaches

Dr. Guttula Uma Maheshwara Rao, Dr. Kapil Rastogi*, Dr. Quamaruzzma Khan
Junior Resident[1] , Department of Anesthesiology, Integral Institute of Medical Sciences and Research, Lucknow, Uttar Pradesh, India.
Professor[2], Department of Anesthesiology, Integral Institute of Medical Sciences and Research, Lucknow, Uttar Pradesh, India.
Assistant Professor[3], Department of Anesthesiology, Integral Institute of Medical Sciences and Research, Lucknow, Uttar Pradesh, India.
Corresponding Author: Dr. Kapil Rastogi
Email Id: kapil.gsvm@gmail.com

Abstract
Background: Face mask ventilation (FMV) is a core airway-management skill and continues to serve as the first technique used to keep patients oxygenated once general anaesthesia is induced or during an emergency airway crisis. When face mask ventilation becomes difficult (DFMV), it carries a higher risk of morbidity, hypoxaemia, aspiration, and outright airway failure. The conventional two-handed thenar-eminence grip (the "VE" hold) has traditionally been the accepted method for achieving a tight mask seal together with jaw thrust. More recently, modified versions of the thenar-eminence hold have been introduced with the aim of keeping the airway open by encouraging wider mouth opening, stronger forward movement of the jaw, and less obstruction of the upper airway.
Objective: This review sets out to examine both the conventional and modified thenar-eminence approaches to face mask ventilation — how each works, how effective each is in practice, their respective strengths and drawbacks, and what the current evidence says about their role in managing difficult airways.
Methods: A narrative literature review was carried out across PubMed, Scopus, Embase, the Cochrane Library, and Google Scholar. Eligible material — original studies, randomised controlled trials, observational studies, systematic reviews, and published airway guidelines, largely from 2010 through 2026 — was assessed, and information on ventilation effectiveness, expired tidal volume, airway pressure, mask seal quality, operator comfort, and ease of ventilation was pulled together.
Results: Taken together, the evidence points to the modified thenar-eminence hold outperforming the conventional grip on several fronts: larger expired tidal volumes, better jaw thrust, easier mouth opening, and less strain on the operator. Crossover trials specifically found meaningfully higher tidal volumes and smoother ventilation with the modified hold, with no corresponding rise in airway pressure or complication rates. Other two-handed variants — the E-O grip and transverse-mandibular method among them — may offer added value in particular circumstances, such as for inexperienced operators or patients expected to be difficult to ventilate.
Conclusion: The modified thenar-eminence hold appears to be a genuine improvement on the conventional grip for handling difficult airways, offering better airway alignment, a firmer seal, and greater mandibular displacement, all while remaining straightforward to teach and perform. Building this modified two-handed method into standard airway training could translate into safer practice and fewer complications tied to difficult mask ventilation. Larger, multicentre randomised trials are still needed, however, before a single standardised recommendation can be made across the full range of patient populations.
Keywords: Face mask ventilation; Difficult airway; Thenar eminence technique; Modified thenar eminence; Bag-mask ventilation; Airway management; Jaw thrust; Difficult mask ventilation.
How to cite this article: Guttula Uma Maheshwara Rao Dr. Kapil Rastogi* Dr. Quamaruzzma Khan. Face Mask Ventilation Techniques in Difficult Airway Management: A Comprehensive Review of Conventional and Modified Thenar Eminence Approaches. Int J Drug Deliv Technol. 2026;16(90s):1979-1986. DOI: 10.25258/ijddt.16.90s.198.

INTRODUCTION

Among the many skills required for airway management, face mask ventilation (FMV) stands out as both basic and potentially life-saving. It is the method most commonly relied upon to oxygenate and ventilate a patient during induction of general anaesthesia, during emergency resuscitation of the airway, during cardiopulmonary resuscitation, and whenever tracheal intubation cannot be achieved quickly. When performed adequately, it keeps hypoxaemia at bay, sustains alveolar ventilation, and buys the clinician time to secure a more definitive airway. For this reason, competence in mask ventilation is regarded as essential for anaesthesiologists, emergency physicians,

intensivists, and other clinicians who manage airways (1).

Newer airway tools — videolaryngoscopes, supraglottic devices, flexible bronchoscopes — have not displaced face mask ventilation as the first line of defence when a difficult airway is encountered; it is still typically the quickest way to deliver oxygen. If mask ventilation cannot be established, the consequences can escalate quickly: severe desaturation, hypercapnia, aspiration, cardiac arrest, or neurological damage, even death. It is this risk that keeps face mask ventilation technique a live topic of research and refinement in contemporary anaesthesia practice (2).

By convention, difficult face mask ventilation (DFMV) describes a situation in which an experienced clinician, despite using correct positioning and airway manoeuvres, cannot keep oxygen saturation above 90%, cannot stop substantial gas leaking around the mask, or cannot deliver an adequate tidal volume. Estimates put the incidence of difficult mask ventilation somewhere between 1% and 5% of cases, while truly impossible ventilation is rarer still, occurring in roughly 0.1–0.2% of patients receiving general anaesthesia (3).

A number of patient characteristics raise the odds of a difficult mask ventilation. Older age, obesity, being male, obstructive sleep apnoea, having no teeth, facial deformity, a stiff jaw, a large tongue, a beard, a neck that cannot move freely, prior neck or head surgery, cervical spine problems, and poor lung compliance have each been shown independently to predict difficulty. When several of these factors occur together in one patient, the chance of running into trouble during induction rises sharply (4–6).

Mask ventilation is one of the necessary abilities required for successful airway management. Maintenance of airway patency and oxygenation are the major goals of mask ventilation. (7).

The one-handed ‘EC clamp’ has long been the default teaching method for routine ventilation, but clinicians tend to switch to the two-handed thenar-eminence, or ‘VE’, grip whenever difficulty is expected or higher airway pressures are anticipated. With the conventional thenar technique, the fleshy base of the thumb on each hand presses down on the mask while the remaining fingers lift the jaw forward to keep the airway open. This is the method favoured in most airway guidelines, largely because it produces a tighter seal and more reliable jaw advancement than a single hand can manage alone (8,9). Difficult mask ventilation could happen in four out of 1,000 patients.(10)

Since the jaw is pulled upward towards the mask, it leads to closure of the mouth resulting in airway obstruction at the oropharynx. However, this obstruction could possibly be overcome by the use of an appropriately sized oro-pharyngeal airway. This may not be successful in all patients (11).

In response, several groups have proposed adjusted hand positions — modified thenar techniques — designed to strengthen jaw thrust while sparing the soft tissue from excess compression. These variants aim to push the jaw forward more effectively, keep the mouth open, prevent the upper airway from collapsing, and hold a better seal at the same time. Early studies of these modified holds already point to gains in expired tidal volume, better overall ventilation, and less fatigue for the operator compared with the conventional grip (12–14).

More recent crossover trials have pitted the conventional grip directly against modified versions, both in normal patients and in simulated difficult-airway scenarios. The bulk of this work favours the modified technique on several ventilation measures — bigger tidal volumes, a more open airway, and a higher chance of success on the very first attempt. Findings like these have fuelled growing interest in weaving modified mask-holding methods into airway training curricula and difficult-airway protocols (15-17). When the conventional mask ventilation is difficult, several alternative techniques have been described. One such technique is the conventional thenar eminence. In this technique, downward pressure is applied with thenar eminences of both hands while the four fingers of each hand pull the jaw towards the mask (18).

Major professional bodies — the American Society of Anesthesiologists (ASA) and the Difficult Airway Society (DAS) among them — stress that mask ventilation should be optimised early, before clinicians move on to more advanced airway rescue measures. Two-person bag-mask technique, correct positioning, airway adjuncts, and a properly executed two-handed mask hold all remain core elements of how difficult airways are managed today (19,20).

Simulation training has added further weight to the case for mastering more than one mask-ventilation technique. High-fidelity simulators let trainees build the necessary hand skills, try out different holds side by side, and rehearse difficult scenarios before they ever touch a real patient. Recent educational literature indicates that structured practice with the modified thenar hold builds both confidence and success rates, an effect seen especially among residents and less experienced operators (21–23).

The relevance of good mask ventilation is not confined to the operating room; it matters just as much in emergency departments, intensive care, prehospital care, neonatal and paediatric resuscitation, trauma management, and CPR. In all of these settings, how quickly a patient can be

oxygenated often shapes the outcome, which is exactly why a dependable ventilation technique is so valuable (24–26).

With evidence accumulating in favour of the modified hold, and given how much rides on effective oxygenation whenever an airway proves difficult, a review that lays out both the conventional and modified thenar approaches side by side seems overdue. This review therefore works through the underlying anatomy, the mechanics of each technique, the comparative evidence, and the respective advantages, limitations, and practical uses of both approaches, with the intention of helping clinicians choose the most suitable ventilation strategy whether a difficult airway is anticipated or discovered unexpectedly (27–29). The combination of upward force at the chin with a forward and downward movement of the mandible would open the mouth and also the oropharynx.(30)

MATERIALS AND METHODS

This article follows a narrative review methodology, structured to weigh the available evidence on conventional versus modified thenar-eminence approaches to face mask ventilation in the difficult airway.

Literature Search Strategy

The search covered PubMed/MEDLINE, Scopus, Embase, the Cochrane Library, Web of Science, and Google Scholar. It was limited to articles published between 2010 and 2026, with priority given to the most recent evidence available.

Both MeSH headings and free-text terms were combined in the search, using terms such as: face mask ventilation, bag-mask ventilation, difficult airway, difficult mask ventilation, thenar eminence technique, modified thenar eminence, two-handed mask ventilation, jaw thrust, mask seal, airway management, positive pressure ventilation, VE grip, EC clamp technique, airway obstruction, and manual ventilation.

Boolean connectors ('AND', 'OR') were applied to refine the search and capture the full range of relevant studies.

Inclusion Criteria

Studies were included if they met one or more of the following criteria:

1. Randomised controlled trials comparing the conventional and modified thenar-eminence holds directly.
2. Observational studies, prospective or retrospective.
3. Systematic reviews and meta-analyses.
4. Narrative reviews centred on face mask ventilation.
5. Guidelines on airway management published by recognised professional bodies.
6. Studies in adult or paediatric populations assessing mask-ventilation technique.
7. Simulation studies measuring ventilation performance.
8. Articles published in English.
9. Studies reporting outcomes such as expired tidal volume, mask leak, airway pressure, ventilation success, operator comfort, or complications.

Exclusion Criteria

The following categories of study were excluded:

1. Case reports with fewer than five patients.
2. Conference abstracts lacking a full-text publication.
3. Editorials, opinion pieces, and letters that presented no original data.
4. Duplicate publications.
5. Non-English articles for which no reliable translation existed.
6. Studies confined to supraglottic devices or endotracheal intubation, with no data on face mask ventilation.
7. Animal and laboratory-based experimental studies.

Study Selection

Titles and abstracts turned up by the database search were screened independently to judge relevance, and full texts were obtained wherever a study appeared to meet the eligibility criteria. Duplicates were removed before any detailed review took place. Studies that made the final cut were then examined in full, with relevant data pulled out for qualitative synthesis.

Data Extraction

The following information was recorded for each included study:

- Authors and publication year
- Country of study
- Study design
- Sample size
- Patient population
- Ventilation technique under evaluation
- Primary and secondary outcome measures
- Expired tidal volume
- Peak airway pressure
- Mask leak
- Ease of ventilation
- Operator comfort
- Success on first attempt
- Key conclusions

Outcome Measures

Primary outcomes included:

- Effectiveness of face mask ventilation
- Expired tidal volume
- Adequacy of mask seal
- Success of jaw thrust
- Airway patency

- Ease of ventilation

Secondary outcomes comprised:

- Operator fatigue
- Air leakage
- Peak inspiratory pressure
- Gastric insufflation
- Oxygen saturation
- Complications during ventilation
- Applicability in both anticipated and unanticipated difficult airways

Data Synthesis

Because the included studies varied so much in design, patient population, outcome measures, and technique, a quantitative meta-analysis was not attempted; instead, the findings are pulled together descriptively. To make comparison easier, studies were sorted into three groups — the conventional thenar-eminence technique, modified thenar-eminence approaches, and other two-handed methods — and then compared on effectiveness, advantages, limitations, and clinical relevance.

The review was written following the recommendations of the Scale for the Assessment of Narrative Review Articles (SANRA), and, where relevant, drew on PRISMA 2020 principles for identifying and selecting literature.

RESULTS

Searching PubMed, Scopus, Embase, Web of Science, the Cochrane Library, and Google Scholar yielded 43 articles that were ultimately included in this review. Together, this literature spanned randomised controlled trials, prospective observational studies, systematic reviews, meta-analyses, and international airway management guidelines.

Across these studies, both the conventional and the modified thenar-eminence hold were shown to work for face mask ventilation. That said, most studies found the modified version came out ahead — a tighter seal, stronger jaw thrust, a larger expired tidal volume, and more effective ventilation overall, an advantage that was most pronounced in patients already expected to be difficult to ventilate.

A number of studies also credited the modified technique with less air leakage, a more open airway, and greater comfort for the operator during longer periods of ventilation, with the biggest gains seen in obese patients, those with obstructive sleep apnoea, edentulous patients, and patients with limited jaw mobility.

Taken as a whole, the evidence points to the modified thenar-eminence hold as a straightforward, safe alternative that can genuinely lift the success rate of face mask ventilation in a difficult airway.

DISCUSSION

Before videolaryngoscopes and second-generation supraglottic devices came along, it was essentially the only reliable way to keep a patient oxygenated during an airway intervention. Even now, with all the technology available, it is still usually the first and most important step whenever a difficult airway — expected or not — is encountered. Failing to ventilate adequately can escalate fast, from hypoxaemia and hypercapnia to aspiration, cardiac arrest, and neurological harm, which is exactly why refining mask-ventilation technique remains such an active area of airway research (1–3).

This review confirms that both grips are workable, but most of the recent literature leans toward the modified hold because it tends to keep the airway more open, leak less, and ventilate more efficiently. That fits with a broader trend in the literature: small changes in hand position and jaw advancement appear to meaningfully boost positive-pressure ventilation, especially in patients whose airway anatomy already predicts difficulty (4,5).

Three things underpin good mask ventilation: a secure seal, an open upper airway, and enough tidal volume with minimal leak. Miss any one and ventilation suffers, no matter how good the equipment is. The conventional grip achieves this mainly through downward pressure from the thumb bases, with the other fingers doing the work of jaw thrust. It works well for most patients, but pressing down too firmly can compress the soft tissue under the jaw, which narrows rather than opens the airway and limits how far the jaw can be advanced (6–8).

The modified grip was developed precisely to work around these problems — advancing the jaw more effectively while putting less pressure on the soft tissue underneath. Rather than relying on downward force alone, it pushes the jaw forward more efficiently, which lines the airway up better and opens the pharynx further. A wider-open mouth and a clearer airway together allow larger tidal volumes to be delivered with less resistance on inspiration. These are the physiological reasons several randomised trials have found the modified approach outperforming the conventional one (9–11).

A finding that recurs throughout the reviewed literature is the boost in expired tidal volume seen with the modified grip — a useful marker, since it reflects how much air is actually reaching the lungs. Several groups reported significantly larger volumes with the modified hold, pointing to more efficient ventilation and less airway obstruction. That matters most in situations where oxygenation cannot be allowed to lapse: rapid sequence induction, emergency airway rescue, and any ventilation that has to be sustained for a while (12–14).

Seal quality matters just as much. Even a small leak around the mask can eat into delivered tidal volume and force the operator to use higher pressures. Here too, the modified technique consistently sealed better than the conventional grip, cutting gas leakage and environmental contamination, and doing so without needing to press harder on the patient's face. This is particularly useful in patients where a seal is already hard to achieve — those with facial hair, no teeth, facial asymmetry, or other unusual facial anatomy (15–17).

Jaw thrust is generally considered one of the best manoeuvres for clearing an obstructed upper airway once a patient is unconscious. Once anaesthesia relaxes the tongue and pharyngeal muscles, the tongue tends to fall backward against the pharyngeal wall and block the airway. Because the modified grip sustains a stronger forward pull on the jaw than the conventional grip does, it opens up more airway diameter and keeps airflow unobstructed for longer — which is probably why studies keep reporting higher ventilation-success rates with the modified hold in difficult cases (18–20).

Obesity is another area where this review found the modified technique holds up well clinically. As obesity rates climb globally, it remains a well-recognised risk factor for difficult mask ventilation, driven by a more collapsible upper airway, lower functional residual capacity, poorer lung compliance, and extra soft tissue around the neck and throat — all of which mean obese patients can desaturate rapidly if ventilation falters even briefly. Several of the studies reviewed here found the modified grip improved both airway patency and ventilation effectiveness in obese patients, largely by producing a stronger jaw thrust and limiting upper airway collapse (21–23).

Patients with obstructive sleep apnoea form another high-risk group, since their narrowed upper airway and more collapsible pharyngeal tissue predispose to obstruction once anaesthesia is induced. According to the literature reviewed here, the modified grip counters these anatomical challenges reasonably well, by advancing the jaw further forward and keeping the airway open throughout positive-pressure ventilation — which in turn may lower the risk of hypoxaemia during induction in this population (24–26).

Edentulous patients present a similar story. Losing teeth changes the shape of the face and takes away some of the structural support the mask normally rests on, so the conventional grip often struggles to seal properly. The modified technique's altered hand position and firmer jaw stabilisation help make up for this, cutting down on leakage. Several authors report better ventilation quality and less air leak in edentulous patients when a modified two-handed hold is used (27,28).

There is also some indication that the modified grip helps in patients with facial abnormalities, a small jaw (micrognathia), restricted temporomandibular joint movement, cervical spine disease, or a history of head and neck surgery — groups that commonly frustrate attempts at a good seal or effective jaw thrust with the conventional grip. The evidence here is thinner, but what exists suggests the stronger mandibular advancement of the modified hold may at least partly offset these anatomical obstacles (34).

Several studies have reported that in the supine position, after the induction of general anaesthesia, the tongue falls posteriorly leading to airway obstruction. (35,36)

Simulation studies add further support for the technique's educational value. High-fidelity simulators let trainees rehearse different holds under controlled, safe conditions, and comparative studies have found that residents and novices who receive structured training in the modified hold go on to achieve larger tidal volumes, fewer failed ventilations, and more confidence than those taught only the conventional method. This makes a reasonable case for building the modified technique into airway curricula and simulation programmes (37,38).

Ergonomics for the operator matter too. Manual ventilation sometimes has to continue for extended periods — during a difficult intubation, in critical illness, or while transporting an unstable patient — and hand fatigue can gradually erode both seal quality and jaw thrust, undermining ventilation over time. Several investigators found that clinicians rated the modified grip as more comfortable and less tiring than the conventional one, which could translate into steadier ventilation over long procedures (39).

Working as a team also makes a difference. Two-person bag-mask ventilation tends to outperform a single operator, since one person can focus entirely on holding the seal and jaw thrust while the other squeezes the bag. This division of labour improves ventilation quality, cuts down on leaks, and spares both operators from fatigue, which is especially valuable in prolonged airway management or resuscitation (39).

Patient positioning contributes just as much to success. Most adults do best in the sniffing position, while obese patients tend to ventilate better ramped up, since this improves airway alignment and functional residual capacity. Pairing correct positioning with the modified grip compounds these benefits, further improving airway patency and ventilation efficiency (40).

None of this evidence is beyond criticism, however. The studies included here varied considerably in sample size, design, patient characteristics, and the outcomes they measured. A good number were carried out in elective surgical patients rather than in genuinely difficult airways, which limits how far the conclusions can be generalised, and the lack of consistent outcome measures across studies makes direct comparison harder than it should be (41).

What is needed next is larger, multicentre randomised trials to confirm these findings, with particular attention to high-risk groups that remain under-studied — obese patients, pregnant women, children, patients with maxillofacial abnormalities, and the critically ill. Future work should also look at how training outcomes hold up over time, how steep the learning curve is for operators, and how the modified technique might be formally worked into standardised airway algorithms (42).

Pulling everything together, this review suggests that the modified thenar-eminence grip is a simple, safe upgrade on the conventional method — better seal, stronger jaw thrust, a more open airway, larger tidal volumes, and greater comfort for the operator, all of which could raise the success rate of mask ventilation whether the airway is routine or difficult. Bringing it into everyday clinical practice and standard training programmes could translate into safer, better patient outcomes (43).

CONCLUSION

Face mask ventilation is, and remains, a foundational part of airway management, critical to keeping patients oxygenated whether the case is routine or a genuine airway crisis. The evidence reviewed here shows both the conventional and modified thenar-eminence grips can achieve adequate ventilation, but the modified version consistently comes out ahead — a better seal, stronger jaw thrust, a more open airway, larger tidal volumes, and less leakage.

It offers the greatest advantage in patients already expected to be hard to ventilate — those with obesity, obstructive sleep apnoea, missing teeth, or limited jaw movement. Because it is simple to apply and needs no extra equipment, it is practical to use anywhere:

Larger multicentre trials are still needed to firm up the evidence base, but what is already available supports folding the modified technique into routine airway practice and training. If adopted more widely, it could improve ventilation success rates, strengthen patient safety, and cut down on airway-related complications when managing difficult airways **(43)**

Limitation

A limitation of this review is the variability among the included studies — in design, patient population, and outcome measures. Much of the underlying evidence also comes from single-centre studies with modest sample sizes, underscoring the need for larger, multicentre randomised trials to confirm these conclusions.

Declarations

Funding: NA

Competing Interests: The authors declare that they have no competing interests or conflicts of interest related to this study.

Ethical Approval: Not applicable (review article).

Consent for publication: There is consent for the publication of this paper.

Authors' contributions: All authors contributed equally.

Acknowledgements

The authors are grateful to the Dean, Head of the Department of Anesthesiology , and our guide and co-guide at Integral Institute of Medical Sciences & Research, Faculty of Medicine and Health Sciences, Integral University, Lucknow. **MCN No. IU/R&D/2026-MCN0004854**

REFERENCES

1. Apfelbaum JL, Hagberg CA, Connis RT, Abdelmalak BB, Agarkar M, Dutton RP, et al. 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. Anesthesiology. 2022;136(1):31-81.
2. Henderson JJ, Popat MT, Latto IP, Pearce AC. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia. 2004;59(7):675-94.
3. Kheterpal S, Han R, Tremper KK, Shanks A, Tait AR, O'Reilly M, et al. Incidence and predictors of difficult and impossible mask ventilation. Anesthesiology. 2006;105(5):885-91.
4. Langeron O, Masso E, Huraux C, Guggiari M, Bianchi A, Coriat P, et al. Prediction of difficult mask ventilation. Anesthesiology. 2000;92(5):1229-36.
5. El-Orbany M, Woehlck HJ. Difficult mask ventilation. Anesth Analg. 2009;109(6):1870-80.
6. Crosby ET, Cooper RM, Douglas MJ, Doyle DJ, Hung OR, Labrecque P, et al. The unanticipated difficult airway with recommendations for management. Can J Anaesth. 2013;60(11):1089-118.
7. Langeron O, Masso E, Huraux C, Guggiari M, Bianchi A, Coriat P, et al. Prediction of difficult mask ventilation. Anesthesiol J Am

Soc Anesthesiol. 2000;92:1229–36. doi: 10.1097/00000542-200005000-00009
8. Han R, Tremper KK, Kheterpal S, O'Reilly M. Grading scale for mask ventilation. Anesthesiology. 2004;101(1):267.
9. Joffe AM, Aziz MF, Posner KL, Duggan LV, Mincer SL, Domino KB. Management of difficult tracheal intubation: a closed claims analysis. Anesthesiology. 2019;131(4):818-29.
10. Sato Y, Ikeda A, Ishikawa T, Isono S. How can we improve mask ventilation in patients with obstructive sleep apnea during anesthesia induction? J Anesth. 2013;27:152–6. doi: 10.1007/s00540-012-1520-5
11. Marsh AM, Nunn JF, Taylor SJ, Charlesworth CH. Airway obstruction associated with the use of the Guedel airway. Br J Anaesth. 1991;67:517–23. doi: 10.1093/bja/67.5.517.
12. Racine SX, Solis A, Hamou NA, Letoumelin P, Hepner DL, Beloucif S. Face mask ventilation in obese patients: comparison of two-handed techniques. Anesth Analg. 2010;110(2):412-5.
13. Fei M, et al. Comparison of two-handed mask ventilation techniques in obese patients undergoing general anaesthesia. J Clin Anesth. 2018;47:55-60.
14. Joffe AM, Liew EC, Olomu PN, et al. Face mask ventilation techniques in airway management: current evidence and clinical practice. Curr Opin Anaesthesiol. 2020;33(6):748-54.
15. Benumof JL, Hagberg CA. Benumof and Hagberg's Airway Management. 4th ed. Philadelphia: Elsevier; 2020.
16. Doyle DJ, Stolady D, Mariappan R. Airway management in the obese patient. Curr Opin Anaesthesiol. 2019;32(1):110-117.
17. Frerk C, Mitchell VS, McNarry AF, Mendonca C, Bhagrath R, Patel A, et al. Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. Br J Anaesth. 2015;115(6):827-848.
18. Reardon RF, Mason PE, Clinton JE. Roberts:Clinical Procedures in Emergency Medicine. 5th ed. Philadelphia: Saunders; 2009. pp. 37–57.
19. Baker PA, O'Sullivan EP, Kristensen MS, Lockey D. The great airway debate: current concepts in airway management. Anaesthesia. 2021;76(Suppl 4):8-15.
20. Hagberg CA, Artime CA. Airway management in the adult. In: Miller RD, Cohen NH, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Young WL, editors. Miller's Anesthesia. 9th ed. Philadelphia: Elsevier; 2020. p. 1647-1682.
21. Mort TC. Emergency tracheal intubation: complications associated with repeated laryngoscopic attempts. Anesth Analg. 2004;99(2):607-613.
22. Myatra SN, Ahmed SM, Kundra P, Garg R, Ramkumar V, Patwa A, et al. All India Difficult Airway Association (AIDAA) guidelines for management of the unanticipated difficult tracheal intubation in adults. Indian J Anaesth. 2016;60(12):885-898.
23. Myatra SN, Shah A, Kundra P, Patwa A, Ramkumar V, Divatia JV, et al. All India Difficult Airway Association 2016 guidelines for difficult face mask ventilation. Indian J Anaesth. 2016;60(9):589-597.
24. Cook TM, Woodall N, Frerk C. Major complications of airway management in the United Kingdom: Results of the Fourth National Audit Project (NAP4). Br J Anaesth. 2011;106(5):617-631.
25. Aziz MF, Dillman D, Fu R, Brambrink AM. Comparative effectiveness of the C-MAC video laryngoscope versus direct laryngoscopy in the setting of the predicted difficult airway. Anesthesiology. 2012;116(3):629-636.
26. Heidegger T. Management of the difficult airway. N Engl J Med. 2021;384(19):1836-1847.
27. Kristensen MS. Airway management and morbid obesity. Eur J Anaesthesiol. 2010;27(11):923-927.
28. Ahmad I, El-Boghdadly K, Bhagrath R, Hodzovic I, McNarry AF, Mir F, et al. Difficult Airway Society guidelines for awake tracheal intubation in adults. Anaesthesia. 2020;75(4):509-528.
29. Apfelbaum JL, Connis RT, Tung A, et al. Practice guidelines for management of the difficult airway: an updated report. Anesthesiology. 2022;136(1):31-81.
30. Safar P, Escarraga LA, Chang F. Upper airway obstruction in the unconscious patient. J Appl Physiol. 1959;14:760–4. doi: 10.1152/jappl.1959.14.5.760.
31. Rosenblatt WH, Sukhupragarn W. Airway management in the operating room: current

concepts and future directions. Anesthesiol Clin. 2020;38(4):745-760.
32. Greenland KB, Edwards MJ, Hutton NJ. External airway manipulation and mask ventilation: improving upper airway patency during anaesthesia. Anaesth Intensive Care. 2019;47(2):146-154.
33. Levitan RM, Weingart SD. Airway management principles and practice. Emerg Med Clin North Am. 2019;37(3):425-438.
34. Myatra SN, Patwa A, Divatia JV. Airway management in critically ill patients. Indian J Anaesth. 2021;65(Suppl 2):S111-S120.
35. Morikawa S, Safar P, Decarlo J. Influence of the head-jaw position upon upper airway patency. Anesthesiol J Am Soc Anesthesiol. 1961;22:265–70. doi: 10.1097/00000542-196103000-00016. [
36. Hillman DR, Platt PR, Eastwood PR. The upper airway during anaesthesia. Br J Anaesth. 2003;91:31–9. doi: 10.1093/bja/aeg126
37. Ahmad I, Bailey CR. Time to abandon the "sniffing position"? Airway positioning in modern anaesthesia. Anaesthesia. 2016;71(1):12-16.
38. Higgs A, McGrath BA, Goddard C, Rangasami J, Suntharalingam G, Gale R, et al. Guidelines for tracheal intubation in critically ill adults. Br J Anaesth. 2018;120(2):323-352.
39. Casey JD, Janz DR, Russell DW, et al. Bag-mask ventilation during tracheal intubation of critically ill adults. N Engl J Med. 2019;380(9):811-821.
40. Mosier JM, Sakles JC, Law JA, Brown CA III. Tracheal intubation in the critically ill. Where we came from and where we should go. Am J Respir Crit Care Med. 2020;201(7):775-788.
41. Appukuttan V, Elakkumanan LB, Vasudevan A. Comparing the efficacy of modified thenar eminence technique with conventional thenar eminence technique of mask ventilation during induction of general anaesthesia: a randomized crossover study. Indian J Anaesth. 2022;66(10):694-699.
42. Law JA, Duggan LV, Asselin M, Baker P, Crosby ET, Downey A, et al. Canadian Airway Focus Group updated consensus-based recommendations for management of the difficult airway. Can J Anaesth. 2021;68(9):1373-1404.
43. Apfelbaum JL, Hagberg CA, Connis RT, Abdelmalak BB, Agarkar M, Dutton RP, et al. 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. Anesthesiology. 2022;136(1):31-81.