International Journal of Medical Anesthesiology

E-ISSN: 2664-3774
P-ISSN: 2664-3766
www.anesthesiologypaper.com
IJMA 2023; 6(4): 34-39
Received: 17-08-2023
Accepted: 22-09-2023

Amer Bahir Soliman
Anesthesiology, Department of Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Tanta University, Tanta, Egypt

Wafaa Madhy Attia
Anesthesiology, Department of Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Tanta University, Tanta, Egypt

Attia Gad Elhaq Ebrahim
Anesthesiology, Department of Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Tanta University, Tanta, Egypt

Mohammad Ebrahim Okab
Anesthesiology, Department of Surgical Intensive Care and Pain Medicine Department, Faculty of Medicine, Tanta University, Tanta, Egypt

Corresponding Author:
Amer Bahir Soliman
Anesthesiology, Department of Surgical Intensive Care and Pain Medicine, Faculty of Medicine, Tanta University, Tanta, Egypt

Difficult intubation predictors in obstructive sleep apnea patient

Amer Bahir Soliman, Wafaa Madhy Attia, Attia Gad Elhaq Ebrahim and Mohammad Ebrahim Okab

DOI: https://doi.org/10.33545/26643766.2023.v6.i4a.431

Abstract
OSA refers to a chronic condition of sleeping disorders affecting breathing due to the presence of upper airway obstruction, and episodic attacks of apnea or hypopnea during sleep. In anesthesia of OSA cases, the essential worry of the vast majority of anesthetists is to assess the airway due to the elevated risk of DTI (Difficult tracheal intubation) in comparison with the normal individuals. According to American society of anesthesiology, DTI refers to trials to intubate the patient for > 2 times or trials lasting >10 min by qualified anesthesiologist. The clinical tests for prediction of DTI aren't efficient in OSA patients. However, the measurement of NC (neck circumference), MP (Mallampati) scoring and TM (thyromental) distance are helpful as a part of preoperative airway assessment; yet can't be applied in emergency or critical care as the patient is usually not cooperative to follow instructions. There are two intubation techniques: Primary which include direct, indirect and awake fibrotic intubation (AFOI). Secondary intubation techniques. SAD has a pivotal function during managing cases having difficult airways. Potential uses of ultrasound are to predict difficult intubation, diagnose OSA, confirm endotracheal tube placement, predict efficient extubation, in addition to US-guided superior laryngeal nerve block.

Keywords: Obstructive sleep apnea, intubation predictors

Introduction

Obstructive sleep apnoea (OSA) is the most fatal type of breathing sleep disorders, manifested by repeated attacks of obstruction of the upper airway partially or completely leading to insufficient alveolar gas exchange with consequently desaturation [1, 2].

The different abnormalities of the airways that manifest as OSA are big sized tongue, collapsible airways and crowded Oropharyngeal components, etc. [3]. Indeed, US is considered a highly sensitive and distinct modality for predicting troublesome intubation in OSA cases presented for elective operation vis measurement of TBT, distances between lingual arteries (DLA), HMD in addition to the condylar mobility [4].

Causes of difficult airway [5]:

- Congenital syndromes like [6, 7]: Pierre-Robin, Treacher-Collins, Goldenhar, down, Kippel-Feil syndromes.
- Acquired: infection, arthritis, benign or malignant tumours, trauma, obesity, acromegaly goiter disease as well as acute burn [8].

A global assessment should include the following: Inter-incisor distance, teeth, palate, temporo-mandibular joint movement, measuring the sub mental space, observing the neck of the patient, existences of hoarse voice / stridor or history of tracheostomy, systemic or congenital diseases, presence of infections of airway and presence of some physiological conditions like pregnancy and obesity [9].

Specific tests for assessment: [Mallampatti's test [10] and thyromental (T-M) distance (Patil's test)].

Scores for airway assessment
- Wilson score system
- LEMON airway assessment method
- Cormack –lehane scoring system.
- El-Ganzouri score

OSA severity classification
Mild type of OSA means that the apnea hypopnea index (AHI) reaches 5–15 episodes/ hrs. Moderate type means that the AHI reaches 15–30 episodes/hrs, whereas severe type means that the AHI reaches > 30 episodes /hrs [11].

Risk factors of OSA [12].
Obesity**,** older age, sex, nasal abnormalities, chronic nasal congestion**,** narrowed airway, DM Type 2, dyslipidemia, hypertension, cardiovascular diseases**,** smoking, alcohol consumption**,** asthma, COPD and family history of sleep apnea [13].

Diagnosis of OSA
- **Symptoms of OSA:** Snoring, repeated breaks in breathing, excess somnolence during the day, morning headache, restlessness and depression or irritability [14, 15].
- **Signs of OSA:** loud snoring, observing periodic stoppage of breathing during sleep, sudden awakening associated with gasping or choking, waking up with dryness of mouth or sore throat, morning headaches, excessive daytime sleepiness, poor concentration during the daytime, altered mood, increased ABP and accentuated P2 heart sounds (pulmonary hypertension) [12].
- **Screening tools:** [STOP-BANG questionnaire, Epworth Sleepiness Scale (ESS) and Berlin Questionnaire), polysomnography (PSG)] [16, 17].
- **Complications of OSA:** Daytime fatigue and sleepiness, hypertension, DM, cardiovascular problem, depression and anxiety, difficult airway postoperative complication [intensive care unit (ICU) admission, confusion, pneumonia, bleeding and prolonged hospitalization and sleep-deprived partners [15, 18, 19].

Management of OSA
Conservative treatments include
1. Patient education, weight reduction, positional therapy, smoking cessation, avoidance of alcohol, sleeping tablets and sedatives.
2. Non-surgical treatment

- **Positive airway pressure (PAP) treatment:** it represents the primary modality of management in OSA. Multiple equipment for delivering PAP have been developed, the commonest is continuous PAP (CPAP) which can maintain a continuous level PAP in spontaneously breathing patients [20, 21].
- **Mouthpiece (oral device):** Although PAP is usually efficient in the management of OSA, oral appliances can be used instead of it in some cases with mild or moderate OSA. In addition, it can be used for cases with severe OSA who cannot use CPAP [22].
- **Pharmacological treatment:** Weight-loss, nasal decongestants, serotonergic medications, noradrenergic medications, potassium channel blockers, carbonic anhydrase inhibitor and potassium-sparing diuretic.

Surgical treatment: The goal of surgery is to ameliorate the QOL, decrease the risk of cardiovascular & cerebrovascular or other medical events as well as increase longevity. Upper airway surgery is efficient in cases who have OSA because of a marked obstruction of the upper airway caused by a problem that can be corrected via surgery, although PAP remains first-line therapy in many patients with anatomic abnormalities of the upper airway [23].

Airway management in OSA
In anesthesia of OSA patients, the essential worry of the vast majority of anesthetists is to assess the airway due to the elevated risk of DTI (Difficult tracheal intubation) in comparison with normal individuals [24]. DTI is determined according to the American society of anaesthiology as > 2 trials at intubation or trials lasting >10 min by qualified anestheologist [25].

Predictors of difficult airway endotracheal intubation (by direct intubation) [26]
- Prior difficult intubation.
- Interincisor (Intergingival in edentulous patients) distance < 4 cm / 3 fingers.
- HMDe (HM distance in cases of extension) < 5.3 cm, HMDn (in neutral position) ≤ 5.5 cm, and HMD Ratio ≤ 1.2 [27] (Figure 1).
- Thyromental distance is less than 6 cm [28] (Figure 1).
- Sternomental distance is less than 12 cm (Figure 1).
- Head and neck extension is less than 30° from neutral (Figure 1).
- MP Oropharyngeal classification class III & IV [29].
- Insufficient protrusion of the mandible (the patient is unable to place lower incisors anterior to upper incisors) or Upper Lip Bite Test Class III (the patient is unable to touch his upper lip by the lower teeth) [30].
- NC (Neck circumference) > 50 cm [31].
- Cervical fat pad or ‘hump’ [32].
- Lack of sub-mental compliance (hard and noncompliant).
- Obstructive Sleep Apnea due to the presence of bulky neck soft tissue in addition to the collapsible airway.
- Higher LEMON scores [33].

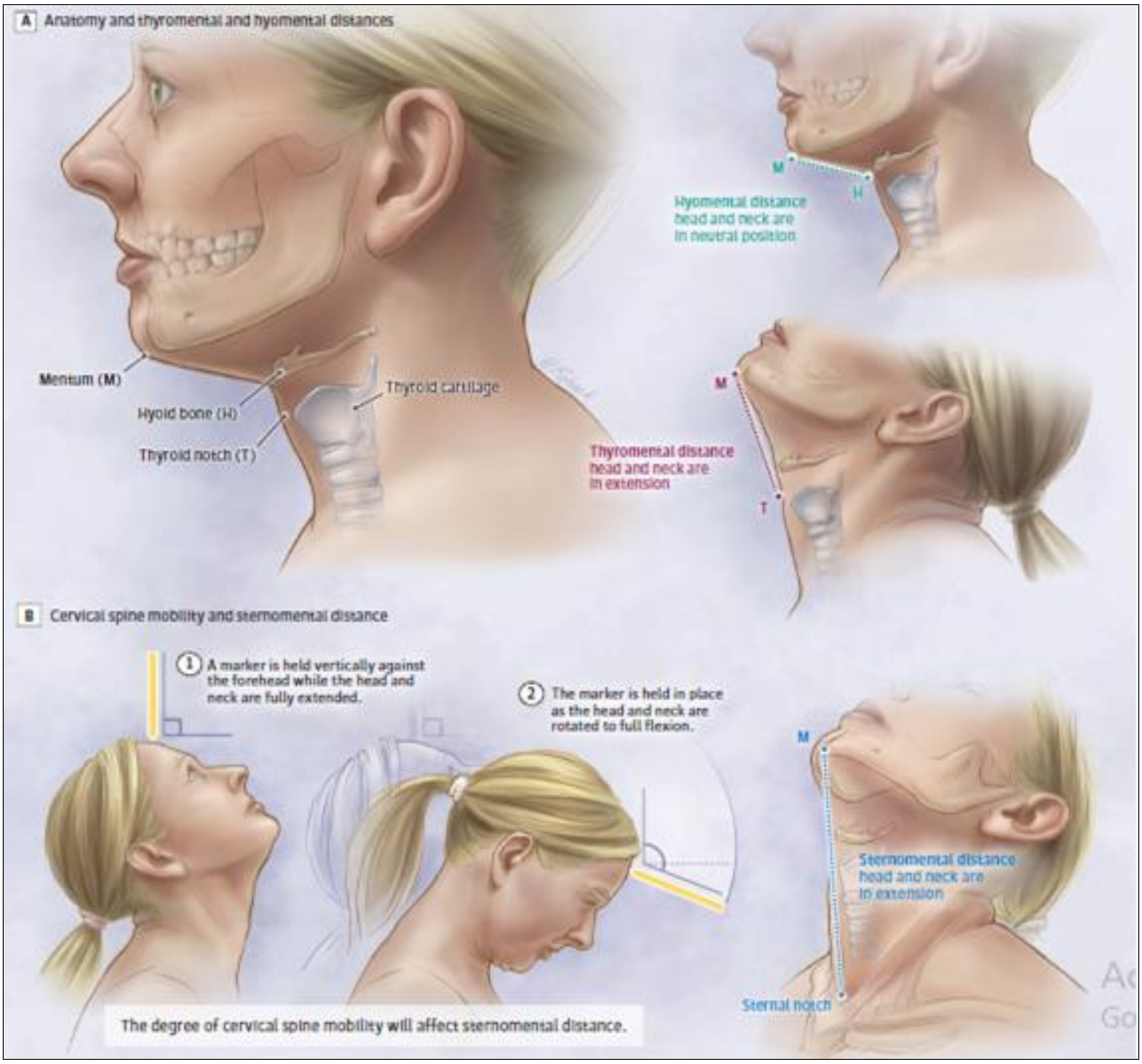

Fig 1: Measurement for TM, sternomental, and HM distance. [30]

The clinical tests utilized to predict DTI aren't useful in OSA patients. However, measuring NC (neck circumference), MP (Mallampati) scoring and TM (thyromental) distance are helpful as a part of preoperative airway assessment, yet can't be applied in emergency or critical care as the patient is usually not cooperative to follow instructions [24]. The rationale for using US (ultrasound) for assessing tissues surrounding the larynx depends upon observing the process of intubation by introducing the blade in the mouth directly and displacing the tongue, epiglottis and hyoid bone into the subglossal space [34].

Primary intubation techniques

- **Direct intubation:** various approaches can be used instead of the direct intubation as primary intubation method such as the indirect intubation, the usage of semi-rigid scopes as well as the fiberoptic intubation [24, 35].
- **Indirect intubation:** multiple studies have demonstrated the usage of indirect intubation gor facilitating tracheal intubation in cases with OSA. The Airtraq laryngoscope was designed to help visualizing the glottis along with the passage of endotracheal tube (ETT) across the vocal cords without requiring positioning of the oral, pharyngeal and laryngeal axes [36]. Videointubation enhances the CL (Cormack – lehane) grade of view in comparison with the direct intubation in the majority of OSA cases [37].
- **Awake fiberoptic intubation (AFOI):** Some physicians prefer such approach when there's marked decrease of inter-incisor distance. AFOI specifically has a place in OSA cases where there's previous experience of difficult mask ventilation and/or DTI [38], or where this was expected from the indirect laryngoscope. Secondary intubation approaches that utilize ventilation via a LMA or supraglottic equipment, have made AFOI less commonly used in OSA cases [24].

Secondary intubation techniques

Supraglottic airway devices (SAD) have a crucial role in managing cases having difficult airway. In contrast to other alternative methods to standard tracheal intubation, such as videointubation or intubation stylets, they permit ventilation even in cases having difficult face mask ventilation and synchronous usage as a conduit for TI. Insertion doesn't cause trauma, their usage is considered familiar from elective anesthesia, and in comparison with TI, can be learned easily for users with little experience in dealing with the airway [39, 40].

Postoperative airway complications

there are many Severe life-threatening complications including severe hypoxemia (decreased SpO2 levels ≤ 80 percent during attempts), excessive CVS collapse (systolic ABP 65 mmHg recorded ≥ one time or 90 mmHg for 30 minutes in spite of administration of 500–1000 ml of crystalloids/or colloids solution loading and/or necessitating administration of vasoactive support, cardiac arrest, and mortality [39, 41]. Mild to moderate drawbacks include oesophageal intubation, supraventricular& ventricular arrhythmia, or all (without a pulseless rhythm) necessitating treatment, dental injuries, aspiration, or dangerous irritability [41].

Management using CPAP or BiPAP (bilevel PAP) as a prophylactic measure reduces postoperative airway obstruction, pulmonary dysfunction and might reduce the rate of respiratory infections [42]. Intubation and extubation have to be carried out very cautiously in obese cases suffering OSA since they're more sensitive to opioid-induced respiratory depression, they should be monitored continuously either visually or electronically [43]. Pulmonary function might improve via the use of good analgesics; yet opioid analgesia should be administered with cautious in such patients.

Ultrasonographic parameters that predict difficult intubation

Essential uses of US are to predict difficult intubation, diagnose OSA, confirm placing of the endotracheal tube, predict efficient extubation, and US-guided superior laryngeal nerve block [44]. Various studies have proved the distinction of US-guided methods compared to the landmark approach in determination of structures. US guidance promotes the approach safety and operator confidence in addition to decreasing the time needed to perform such approaches [45].

The linear high-frequency transducer is quite appropriate in imaging superficial airway's structure (within 2–3 cm from the skin) and the curved low-frequency transducer, is highly efficient in imaging sagittal and parasagittal view of various components in the submandibular as well as supraglottic areas, particularly due to the wider field of view [46].

Cartilaginous components (thyroid & cricoid cartilages) are homogeneous with hypoechoicity. Muscle and connective tissue are shown as hypoechoic striated heterogeneously arranged appearance. Fat and glandular components are shown as homogeneous areas with mildly to strongly hyperechoic compared to the nearby soft tissues, according to their fat content in the glands [47]. Figure 2-3.

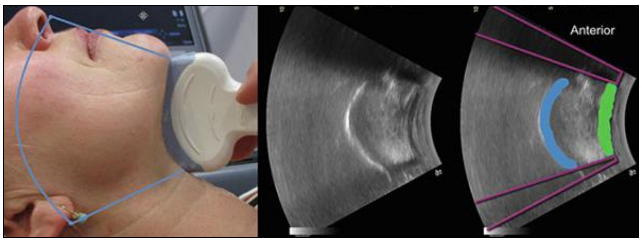

Fig 2: Sagittal scanning plane of mouth and tongue

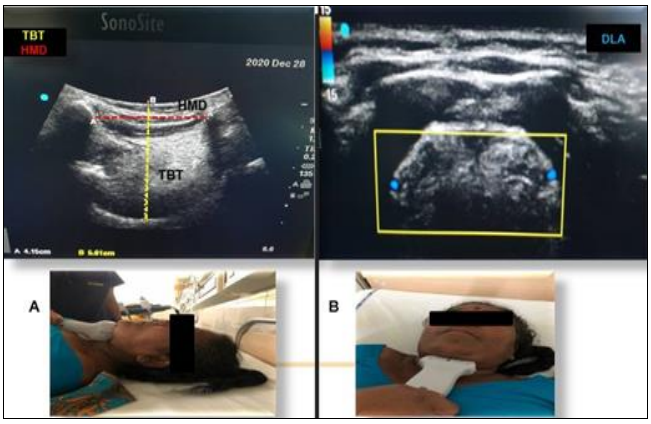

Fig 3: US distances, types of scan probes and positions: TBT (Tongue base thickness); HMD (Hyo-mental distance); DLA (Distance between lingual arteries). A- Curvilinear probe, mid-sagittal plane; B- Linear probe, transverse plane [48]

References

1. Moula AI, Parrini I, Tetta C, Luca F, Parise G, Rao CM, *et al*. Obstructive Sleep Apnea and Atrial Fibrillation. Journal of clinical medicine. 2022;11:1242.
2. Xia F, Sawan M. Clinical and Research Solutions to Manage Obstructive Sleep Apnea: A Review. Sensors (Basel). 2021;21:1784.
3. Corso RM, Sorbello M, Buccioli M, Carretta E, Nanni O, Piraccini E, *et al*. Survey of Knowledge and Attitudes about Obstructive Sleep Apnoea Among Italian Anaesthetists. Turkish journal of anaesthesiology and reanimation. 2017;45:146-52.
4. Prabhakar A, Fiza B, Ferrero N, Moll V. The Utility of Ultrasound in Airway Management. In: Li J, Ming-Der Chow R, Vadivelu N, Kaye AD, editors. Ultrasound Fundamentals: An Evidence-Based Guide for Medical Practitioners. Cham: Springer International Publishing; c2021. p. 61-3.
5. Kornas RL, Owyang CG, Sakles JC, Foley LJ, Mosier JM. Society for Airway Management's Special Projects C. Evaluation and Management of the Physiologically Difficult Airway: Consensus Recommendations from Society for Airway Management. Anesth Analg. 2021;132:395-405.
6. Johansen M, Veyckemans F, Engelhardt T. Congenital anomalies of the large intrathoracic airways. Paediatr Anaesth. 2022;32:126-37.
7. Song JA, Bae HB, Choi JI, Kang J, Jeong S. Difficult intubation and anesthetic management in an adult patient with undiagnosed congenital tracheal stenosis: a case report. J Int Med Res. 2020;48:300060520911267.
8. Gupta S, Sharma R, Jain DJIJA. Airway assessment: predictors of difficult airway. Indian Journal of Anaesthesia. 2005;49:257-62.
9. Cranshaw J, Cook T, Allman K, Wilson I. Airway assessment and management. Oxford handbook of anaesthesia. 2022;3:969-81.
10. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, *et al*. A clinical sign to predict difficult tracheal intubation: a prospective study. Can Anaesth Soc J. 1985;32:429-34.
11. Gumidyala R, Selzer A. Preoperative optimization of obstructive sleep apnea. Int Anesthesiol Clin. 2022;60:24-32.

12. Panahi L, Udeani G, Ho S, Knox B, Maille J. Review of the Management of Obstructive Sleep Apnea and Pharmacological Symptom Management. Medicina (Kaunas). 2021;57:1173.
13. Magliulo G, Iannella G, Ciofalo A, Polimeni A, De Vincentiis M, Pasquariello B, *et al*. Nasal pathologies in patients with obstructive sleep apnoea. Acta Otorhinolaryngol Ital. 2019;39:250-6.
14. Rundo JV. Obstructive sleep apnea basics. Cleve Clin J Med. 2019;86:2-9.
15. Jyothi I, Prasad KR, Rajalakshmi R, Kumar RS, Ramphanindra T, Vijayakumar T, *et al*. Obstructive Sleep Apnea: A Pathophysiology and Pharmacotherapy Approach. Noninvasive Ventilation in Medicine-Recent Updates: IntechOpen; c2019.
16. Deenadayal DS, Bommakanti V. Preventive Aspects in Obstructive Sleep Apnea. Management of Snoring and Obstructive Sleep Apnea. Singapore: Springer Singapore; c2022. p. 109-11.
17. Homoud M. Adults' Knowledge and Beliefs Surrounding Obstructive Sleep Apnea: Seton Hall University; c2019.
18. Mediano O, González Mangado N, Montserrat JM, Alonso-Álvarez ML, Almendros I, Alonso-Fernández A, *et al*. [Translated article] International consensus document on obstructive sleep apnea. Archivos de Bronconeumología. 2022;58:T52-T68.
19. Maher LL, Coke LA. Diagnosis and treatment of obstructive sleep apnea and its impact on cardiovascular disease. Journal of the American Association of Nurse Practitioners. 2022;34:389-96.
20. Drager LF, Malhotra A, Yan Y, Pepin JL, Armitstead JP, Woehrle H, *et al*. Adherence with positive airway pressure therapy for obstructive sleep apnea in developing vs. developed countries: a big data study. J Clin Sleep Med. 2021;17:703-9.
21. Skiba V, McLellan B. Safe use of donated positive airway pressure devices to increase access to treatment for obstructive sleep apnea: a clinical outreach program. J Clin Sleep Med. 2022;18:1455-7.
22. Srivastava P, Devi L, Chauhan VJJDOE. Treatment with Oral Appliances in Obstructive Sleep Apnea. Journal of Dentistry and Oral Epidemiology. 2021, 1.
23. De Vito A, Woodson BT, Koka V, Cammaroto G, Iannella G, Bosi M, *et al*. OSA Upper Airways Surgery: A Targeted Approach. Medicina (Kaunas). 2021;57:690.
24. Myatt J, Haire K. Airway management in obese patients. Curr Anaesth Crit Care. 2010;21:9-15.
25. Henderson JJ, Popat MT, Latto IP, Pearce AC, Difficult Airway S. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia. 2004;59:675-94.
26. Tamire T, Demelash H, Admasu W. Predictive Values of Preoperative Tests for Difficult Laryngoscopy and Intubation in Adult Patients at Tikur Anbessa Specialized Hospital. Anesthesiol Res Pract. 2019;2019:1790413.
27. Kalezic N, Lakicevic M, Milicic B, Stojanovic M, Sabljak V, Markovic D, *et al*. Hyomental distance in the different head positions and hyomental distance ratio in predicting difficult intubation. Bosn J Basic Med Sci. 2016;16:232-6.
28. Brodsky JB, Lemmens HJ, Brock-Utne JG, Vierra M, Saidman LJ. Morbid obesity and tracheal intubation. Anesth Analg. 2002;94:732-6; table of contents.
29. Sharma D, Prabhakar H, Bithal PK, Ali Z, Singh GP, Rath GP, *et al*. Predicting difficult laryngoscopy in acromegaly: a comparison of upper lip bite test with modified Mallampati classification. J Neurosurg Anesthesiol. 2010;22:138-43.
30. Detsky ME, Jivraj N, Adhikari NK, Friedrich JO, Pinto R, Simel DL, *et al*. Will this patient be difficult to intubate? the rational clinical examination systematic review. Jamaican Nurse. 2019;321:493-503.
31. Ezri T, Gewurtz G, Sessler DI, Medalion B, Szmuk P, Hagberg C, *et al*. Prediction of difficult laryngoscopy in obese patients by ultrasound quantification of anterior neck soft tissue. Anaesthesia. 2003;58:1111-4.
32. Gaszynski T. Standard clinical tests for predicting difficult intubation are not useful among morbidly obese patients. Anesth Analg. 2004;99:956.
33. Reed MJ, Dunn M, McKeown D. Can an airway assessment score predict difficulty at intubation in the emergency department? Emergency medicine journal. 2005;22:99-102.
34. Gupta D, Srirajakalidindi A, Ittiara B, Apple L, Toshniwal G, Haber H, *et al*. Ultrasonographic modification of Cormack Lehane classification for pre-anesthetic airway assessment. Middle East J Anaesthesiol. 2012;21:835-42.
35. Leong SM, Tiwari A, Chung F, Wong DTJJoCA. Obstructive sleep apnea as a risk factor associated with difficult airway management-A narrative review. Journal of Clinical Anesthesia. 2018;45:63-8.
36. Ndoko SK, Amathieu R, Tual L, Polliand C, Kamoun W, El Housseini L, *et al*. Tracheal intubation of morbidly obese patients: a randomized trial comparing performance of Macintosh and Airtraq laryngoscopes. Br J Anaesth. 2008;100:263-8.
37. Marrel J, Blanc C, Frascarolo P, Magnusson L. Videolaryngoscopy improves intubation condition in morbidly obese patients. Eur J Anaesthesiol. 2007;24:1045-9.
38. Hyman JB, Rosenblatt WH. Awake Intubation Techniques, and Why It Is Still an Important Skill to Master. Current Anesthesiology Reports. 2022;12:382-9.
39. Rosenblatt WH, Yanez ND. A Decision Tree Approach to Airway Management Pathways in the 2022 Difficult Airway Algorithm of the American Society of Anesthesiologists. Anesth Analg. 2022;134:910-5.
40. Timmermann A. Supraglottic airways in difficult airway management: successes, failures, use and misuse. Anaesthesia. 2011;66 Suppl 2:45-56.
41. Brodsky JB. Positioning the morbidly obese patient for anesthesia. Obes Surg. 2002;12:751-8.
42. Gross JB, Bachenberg KL, Benumof JL, Caplan RA, Connis RT, Cote CJ, *et al*. Practice guidelines for the perioperative management of patients with obstructive sleep apnea: a report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea. Anesthesiology. 2006;104:1081-93; quiz 117-8.
43. Finkel KJ, Searleman AC, Tymkew H, Tanaka CY, Saager L, Safer-Zadeh E, *et al*. Prevalence of undiagnosed obstructive sleep apnea among adult surgical patients in an academic medical center. Sleep

Med. 2009;10:753-8.
44. Osman A, Sum KM. Role of upper airway ultrasound in airway management. Journal of intensive care. 2016;4:52.
45. You-Ten KE, Siddiqui N, Teoh WH, Kristensen MS. Point-of-care ultrasound (POCUS) of the upper airway. Can J Anaesth. 2018;65:473-84.
46. Vaquero MÁF, Piña MA, Aymerich MJAUoAM. An Update on Ultrasonography as a Tool for Airway Management. An Update on Airway Management. 2020;3:15-30.
47. Stieger-Vanegas SMJP, Ocutft SAP. POCUS: Musculoskeletal–soft tissue. Point-of-Care Ultrasound Techniques for the Small Animal Practitioner. 2021:647-61.
48. Padhy S, Padhy N, Patro A, Kar AK, Jonnavithula N, Durga P, *et al*. Submental ultrasound for assessment of difficult mask ventilation in patients with obstructive sleep apnoea posted for surgery under general anaesthesia. A prospective observational study. Trends in Anaesthesia and Critical Care. 2021;41:61-8.

How to Cite This Article
Soliman AB, Attia WM, Ebrahim AGE, Okab ME. Difficult intubation predictors in obstructive sleep Apnea patient. International Journal of Medical Anesthesiology 2023;6(4):34-39.