The Dilemma of Airway Assessment and Evaluation

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Citation

M Ali Magboul. *The Dilemma of Airway Assessment and Evaluation*. The Internet Journal of Anesthesiology. 2004 Volume 10 Number 1.

Abstract

The available predictive methods, like the LEMON or the MELON scale, the LM_MAP, the Four Ds, the Wilson Risk Score, Magboul 4M & Ms, and many others, still give a place for projects like difficult intubation in the unexpected difficult airway.

Projects like unanticipated difficult airway in normal patients are perfect signals for our inability to solve this problem to date. The second question; is these predictors telling us about difficult airway or difficult intubation, because the answer to both questions is different.

INTRODUCTION

The subject of airway assessment and evaluation has been widely discussed. Although many predictive methods and scores have been suggested, nevertheless, we still lake a true scientific predictive protocol that all airway management physicians can depend on. The available predictive methods, like the LEMON or the MELON scale, the LM_MAP, the Four Ds, the Wilson Risk Score, Magboul 4M & Ms, and many others, still give a place for projects like difficult intubation in the unexpected difficult airway.

Projects like unanticipated difficult airway in normal patients are perfect signals for our inability to solve this problem to date. The second question; is these predictors telling us about difficult airway or difficult intubation, because the answer to both questions is different.

The prediction of difficult intubation has proven to be controversial [2]. What is in defining of difficult intubation [3]? There are two different technical skills: exposing the glottis by conventional laryngoscope; and insertion of the endotracheal tube into the cords. The former is generally termed difficult if one gets a poor view of the target (Cormack Lehane grade 3 or 4 view) [1]; the latter, if after an arbitrary number of attempts (usually 3), the tube cannot be placed [1].

The issue of access through the oral cavity, and exactly how much of the posterior pharynx one can see employing simple maneuvers like the Mallampati Scale, has been repeatedly demonstrated to be of value in evaluating the airway for difficulty [4,5,6,7].

Two things should be evaluated separately based on history, examination, and diagnostic tests.

1. Ventilation
2. Intubation

HOW DO WE PREDICT DIFFICULT MASK VENTILATION (DMV)?

In a general adult population, DMV was reported in 5% of the patients.

Maintenance of airway patency and oxygenation are the main objectives of face-mask ventilation. Difficult mask ventilation was defined as the inability of an unassisted anesthesiologist to maintain the measured oxygen saturation as measured by pulse oximetry > 92% or to prevent or reverse signs of inadequate ventilation during positive-pressure mask ventilation under general anesthesia.

Yildiz et al concluded it that Mallampati class 4, male patients, history of snoring, increasing age, and increasing weight were found to be risk factors for DMV in his study.

Langeron et al suggested five recognized criteria as independent factors for a DMV. The Five Predictors of difficult bag and mask ventilation and Oxygenation, can be summarized in the word “OBESE”.

The Five Predictors of difficult bag and mask ventilation and

Oxygenation, can be summarized in the word “OBESE”

1. The Obese (body mass index > 26 kg/m2)
2. The Bearded
3. The Elderly (older than 55 y)
4. The Snorers
5. The Edentulous

(Age older than 55 yr, body mass index > 26 kg/m2, beard, lack of teeth, and history of snoring), the presence of two indicating high likelihood of DMV (sensitivity, 0.72; specificity, 0.73)... A simple DMV risk score was established. Being able to more accurately predict DMV may improve the safety of airway management.

HOW DO WE PREDICT DIFFICULT INTUBATION (DI)?

There are many slogans used to memorize these tests, like the LEMON or MELON scale, the LM_MAP, the Four Ds, the Wilson Risk Score, and Magboul 4Ms.

WHAT ARE THE LEMON OR MELON PHYSICAL SIGNS FOR PREDICTING DIFFICULT INTUBATION?

(Ron Walls uses the LEMON law - Look externally, Evaluate the 3-3-2 rule, Mallampati, Obstruction, Neck mobility - in his National Emergency Airway Management Course)

Figure 1

Figure 2

Physical signs	Less difficult airway	More difficult airway
Look externally	• Normal face and neck • No face or neck pathology	• Abnormal face shape • Sunken cheeks • Edentulous • "Buck teeth" • Receding mandible • "Bull-neck" • Narrow mouth • Obesity • Face or neck pathology
Evaluate the 3-3-2 rule	• Mouth opening > 3F • Hyoid-chin distance > 3F • Thyroid cartilage-mouth floor distance > 2F	• Mouth opening < 3F • Hyoid-chin distance < 3F • Thyroid cartilage-mouth floor distance < 2F
Mallampati	• Class I and II (can see the soft palate, uvula, fauces +/- facial pillars)	• Class III and IV (can only see the hard palate +/- soft palate +/- base of uvula)
Obstruction	• None	• Pathology within or surrounding the upper airway (e.g. peri-tonsillar abscess, epiglottis, retro-pharyngeal abscess)
Neck mobility	• Can flex and extend the neck normally	• Limited ROM of the neck

EVALUATING FOR DIFFICULTY OF THE AIRWAY

It is estimated that between 1 and 3% of the patients who need endotracheal intubation there exists airway problems that makes this procedure difficult. Recognition of these difficult airways allows the paramedic to proceed with caution and consider other options for airway maintenance. It affords the paramedic the time for equipment preparation such as the cricothyrotomy kit, which is not part of the normal airway security procedure. The pneumonic LEMON is useful in the evaluation of a patient prior to endotracheal intubation and may identify some of the potential problems for the endotracheal intubation.

LOOK EXTERNALLY

External indicators of either difficult intubation or difficult ventilation include: presence of a beard or moustache, abnormal facial shape, extreme malnourishment, a person without teeth, facial trauma, obesity, large front teeth or “buck teeth”, high arching palate, receding mandible, and/or a short bull neck.

Figure 3

EVALUATE 3-3-2- 1 RULE

3 Fingers between the patient's teeth (patient's mouth should be opened adequately to allow for the placement of three fingers between the upper and lower teeth)

3 Fingers between the tip of the jaw and the beginning of the neck (under the chin)

2 Fingers between the thyroid notch and the floor of the mandible (top of the neck)

1 Finger lower Jaw Anterior Sublaxation.

Figure 4

MALLAMPATI SCALE

This scoring system was first introduced in 1985 in the Canadian Anesthesia Society Journal based on the work of Mallampati. Place the patient in a seated position and have them hold head in a neutral position with mouth open wide and the tongue fully extended. The paramedic should visualize on of the following classifications:

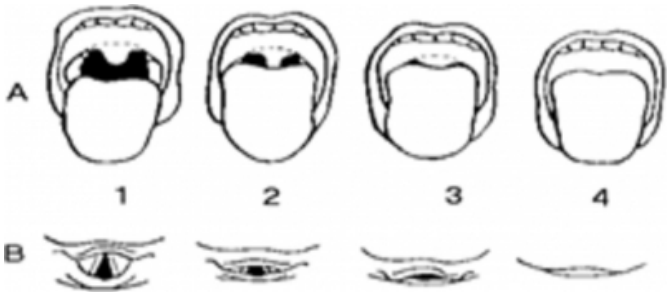
Class I (easy)—visualization of the soft palate, fauces, uvula, and both anterior and posterior pillars

Class II—visualization of the soft palate, fauces, and uvula

Class III—visualization of the soft palate and the base of the uvula

Class IV (difficult)—the soft palate is not visible at all

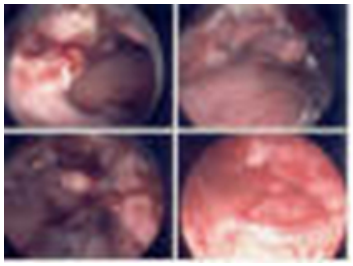
Figure 5



OBSTRUCTION

Besides the obvious difficulty if the airway is obstructed with a foreign body, the paramedic should also consider other obstructions such as tumor, abscess, epiglottis, or expanding hematoma.

Figure 6



NECK MOBILITY

Ask the patient to place their chin on their chest and tilt head backwards as far as possible. Obviously, this will not be possible in the presence of a trauma patient.

We will try to review some of the available predictor scale and discuss their value and limitations.

M J Reed1, M J G Dunn1 and D W McKeown2, concluded in their study that airway assessment score based on criteria of the LEMON method is able to successfully stratify the risk of intubation difficulty in the emergency department. Patients with a poor laryngoscopic view (grades 2, 3, or 4) were more likely to have large incisors, a reduced inter-incisor distance, and a reduced thyroid to floor of mouth distance. They were also more likely to have a higher airway assessment score than those patients with a good laryngoscopic view.

CAN AN AIRWAY ASSESSMENT SCORE PREDICT DIFFICULTY AT INTUBATION IN THE EMERGENCY DEPARTMENT?

M J Reed, M J G Dunn, and D W McKeon. Emerg. Med. J. 2005 22: 99-102.

Michael F. Murphy forwarded a cautionary note with respect to the Mallampati maneuver in respond to this investigation. They recognize that it may not be possible to perform in all comers, but it is a valuable part of the airway exam, particularly when a patient is found to have a class 3 or 4 view, and it is worth seeking, even if the search is somewhat difficult. LEMON is primarily intended to ensure and expedite as complete an evaluation as possible recognizing the realities of emergency airway management [5, 6, 16, and 17]. The most important aspect of the guideline, though, lies in sensitivity, not specificity. The intent is not to determine, with precision, whether the patient will, or will not be a difficult Laryngoscopy. Rather, the goal is to identify every patient for whom Laryngoscopy might be difficult, recognizing that in many identified cases, Laryngoscopy may well turn out to be reassuringly routine.

WHAT IS THE LM – MAP (LARYNGEAL MASK MAP) RULE FOR AIRWAY ASSESSMENT?

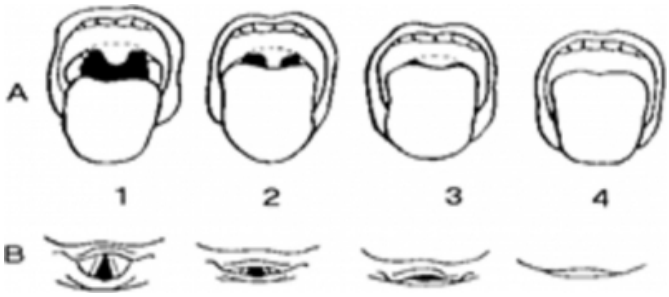
L = Look for External face Deformities.

Figure 7

M = Mallampati

Class I = visualization of the soft palate, fauces, uvula, anterior and posterior pillars.
Class II = visualization of the soft palate, fauces and uvula.
Class III = visualization of the soft palate and the base of the uvula.
Class IV = soft palate is not visible at all.

Figure 8



M = Measurements 3-3-2-1 OR 1-2-3-3 Fingers.

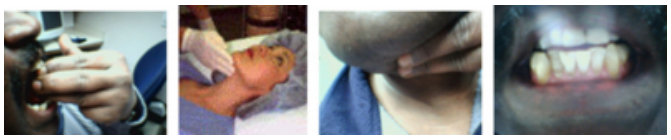
3- Fingers Mouth Opening

3- Fingers Hypomental Distance. 3Fingers between the tip of the jaw and the beginning of the neck (under the chin)

2- Fingers between the thyroid notch and the floor of the mandible (top of the neck)

Finger Lower Jaw Anterior sublaxation

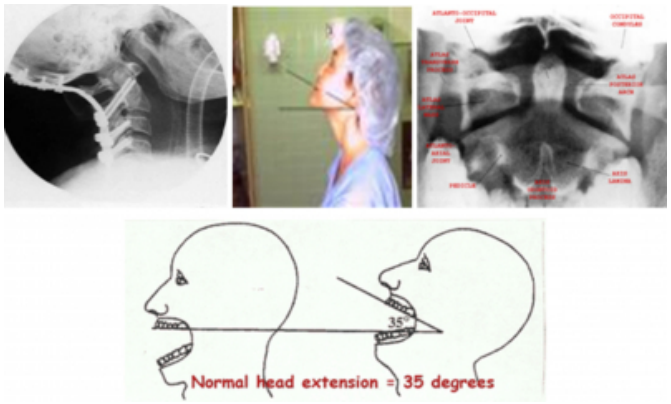
Figure 9



A = A- O Extension (Atlanto- Occipital)

The angle between the erect and extended the “normal” amount of extension equals 35 degrees. The atlanto-ocipital joint. Additionally, limited A-O joint extension is present in certain pathological states such as spondylosis, rheumatoid arthritis, halo-jacket fixation, and in patients with symptoms indicating nerve compression with cervical extension.

Figure 10



P = Pathological obstructive Conditions, Edema / Glottic Trauma

Figure 11

WHAT ARE THE 4 DS?

The following Four D's also suggest a difficult airway:

- Dentition (prominent upper incisors, receding chin)
- Distortion (edema, blood, vomits, tumor, infection)
- Disproportion (short chin-to-larynx distance, bull neck, large tongue, small mouth)
- Dysmobility (TMJ and cervical spine)

SUGGESTED APPROACH TO EVALUATING A DIFFICULT AIRWAY INCLUDES THE FOLLOWING CLINICAL EVALUATIONS

- Look externally for evidence of face or neck pathology, a short receding mandible or a bull neck
- Check whether the patient can open his mouth to 3 patient-sized fingers, and check that the patient can readily jut his jaw forward 1 patient-sized finger.
- Check that the hyoid-to-chin distance is > 3 adult fingers (> 6 cm) in an adult, and > 2 adult fingers (> 3cm) in a child, and 1 adult finger (> 2cm) in an infant
- Check that there is room for 2 fingers between the top of the thyroid cartilage and the floor of the mouth (adult patient)
- Check that the upper incisor teeth are not prominent, that the mouth is not narrow and that the palate is not high-arched and narrow
- Check the relative tongue-to-pharyngeal size by noting whether the base of the uvula is visible when the patient opens his mouth widely, and check whether the tongue is disproportionately large (modified Mallampati technique using a tongue blade in a supine patient)
- Check that the patient can extend his neck > 35° at

the Atlanto-occipital joint (if a C-spine injury is not a clinical consideration)

WHAT IS WILSON RISK SCORE AIRWAY MANAGEMENT ASSESSMENT?

Figure 12

	Parameter Risk level
Weight	0-2 (>90kg = 1;> 110 kg =2)
Head and neck movement	0-2
Jaw movement	0-2
Receding mandible	0-2
Buck teeth	0-2
	TOTAL = Maximum 10 points

WHAT ARE THE MAGBOUL 4 MS?

Again it is another easier way to memorize predictors of difficult intubation [8]. It is a simple visual way to remember what to look for when evaluating & assessing the Airway:

A. Difficult Ventilation assessment:

For ventilation remember a snoring (OBESE) Santa

1. Over weight
2. Beard
3. Elderly
4. Snoring
5. Edentulous

B. Difficult Intubation Assessment:

For Intubation remember the 4(M & Ms) with (STOP) sign

- Mallampati
- Measurement
- Movement
- Malformation & STOP

M =Malformation of the skull, teeth, obstruction, & Pathology (the Macros and Micros). We can memorize them with the word (STOP)

S = Skull (Hydro and Microcephalus)

T = Teeth (Buck, protruded, & loose teeth. Macro and Micro mandibles)

O= Obstruction (due to obesity, short Bull Neck and swellings around the head and neck)

P = Pathology (Craniofacial abnormalities & Syndromes: Treacher Collins, Goldenhar's, Pierre Robin, Waardenburg syndromes)

Various craniofacial abnormalities arise from maldevelopment of the 1st and 2nd visceral arches, which form the facial bones and ears during the 2nd mo of gestation. These malformations include cleft lip and cleft palate; Treacher Collins' (mandibulofacial dysostosis), Goldenhar's (oculoauriculovertebral dysplasia), Pierre Robin, and Waardenburg syndromes; hypertelorism; and external and middle ear deformities.

Figure 13

Skull Pathology | Teeth | Obstruction

Figure 14

Score	1	2	3	4
Mallampati	Grade 1	Grade 2	Grade 3	Grade 4
Measurement	3 mouth open	3 thyro Mental	2 Hypo mental	1 sublaxation
Movement	Left	Right	Flexion	Extension
Malformation	Skull hydrocephalus & Micro	Teeth buck teeth & Micro / Macro Jaw	obstruction Obesity Short, bull neck, and swellings	Pathology & Syndromes Treacher Collins, Goldenhar's, Pierre Robin, stridor Waardenburg syndromes) Quinsy , Down's & Law set ears
TOTAL	4	4	4	4

If the patient Score 8 or higher, he is likely to be a difficult intubation [8].

Currently we are getting 100% correct prediction from this score, but obviously, more multi-center study and data will be needed to support this opinion.

CONCLUSION

The American Society of Anesthesiology definitions:

Difficult airway: is the existence of clinical factors that complicate either ventilation administered by face mask or intubation performed by experienced and skilled clinicians.

Difficult ventilation has been defined as the inability of a trained anesthetist to maintain the oxygen saturation > 90% using a face mask for ventilation and 100% inspired oxygen, provided that the preventilation oxygen saturation level was within the normal range.

Difficult intubation has been defined by the need for more than three intubation attempts or attempts at intubation that last > 10 min. This latter definition provides a margin of safety for preoxygenated patients who are undergoing elective intubation in the operating room. Such patients in stable circumstances can usually tolerate 10 min of attempted intubation without adverse sequelae.

Airway evaluation is a vital part in our anesthesia practice. We should spend all the necessary time to correctly evaluate patient airway. Mistakes have happened in the past due to ill judgment and insufficient evaluation.

The moral of the story is to stick to one of these so many methods, what ever is easier for you to memorize and follow. Stick to it at all the times, and implement it strictly in all your patients prior to induction of anesthesia.

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