ORIGINAL RESEARCH

The preoperative evaluation of risk variables associated with difficult intubation

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ABSTRACT
Aim: The preoperative evaluation of risk variables associated with difficult intubation is the goal. **Material and methods:** Consent to participate in the study was obtained from one hundred adults of either gender who were planned to undergo elective procedures requiring general anaesthesia and tracheal intubation, including abdominal, urological, neurosurgical, ophthalmic, cardiac, orthopaedic, and ENT operations. After inducing the patients with injections of thiopentone sodium 5 mg/Kg, nalbuphine 0.1 mg/Kg, and atracurium 0.5 mg/Kg, a laryngoscopy was carried out after three minutes. Throughout the process of intubation, some details were recorded, such as the number of tries, the best view of laryngoscopy, the required size of the blade, and whether or not tracheal pressure was administered. The view at larngoscopy was graded by Cormack Lehane in the following manner:Grade 1 - if part of vocal cord visible. Grade 2 - if only the arytenoids were visible. Grade 3 - if only epiglottis was visible. Grade 4 - if epiglottis was not visible. **Results:** The incidence of difficult intubation, as determined by nine different characteristics, is three percent (3%) out of every hundred instances. One of these was a Cormack-Lehane Grade II case, one was a Grade III case, and one was a Grade IV case. Of the Grade III cases, one was intubated on the third attempt with the stylet, and the other was intubated by manipulation. The Grade IV case was intubated with the assistance of an intubating laryngeal mask. Mallampati class-3, neck circumference >40cms, and subluxation grade-2 each had a sensitivity of 35%, 19%, and 18% respectively; only one patient with inter-incisor distance of 3cms had a 100% sensitivity. **Conclusion:** This study found that an inter-incisor distance of 3 centimetres was the most sensitive predictor for difficult intubation, followed by a Mallampati class-3, a neck circumference of more than 40 centimeters, and a subluxation grade-2. Even though all of the tests have their uses, the study came to the conclusion that an inter-incisor distance of 3 centimeters was the most sensitive predictor.

Keywords: Intubation, laryngoscopy, Ent, General Anaesthesia

INTRODUCTION

Anesthesiologists have a significant amount of cause for worry when it comes to the patient's inability to maintain a patent airway after the induction of general anaesthesia. Tracheal intubation with direct laryngoscopy is still the technique of choice for the majority of situations when it comes to securing the airway. Nonetheless, direct laryngoscopy intubation may be challenging in 1.2% of patients, even those who seem to have normal airways. [1] Patients are at a higher risk of problems as a result of the unforeseen difficulty in performing laryngoscopic intubation. These consequences might range from a sore throat to serious airway injuries. In addition, there are rare instances in which the anesthesiologist may not be able to keep the patient's airway open, which might result in severe problems such as brain damage or even death. The difficulty of establishing a patent airway in a patient might vary depending on the patient's anatomy as well as other considerations. During the preoperative evaluation and planning for anaesthetic management, it is essential to identify the patient as having a difficult airway. This is done so that endotracheal intubation and positive pressure ventilation can be achieved safely through alternative methods of tracheal intubation such as fiberoptic bronchoscopy. Prior to administering anaesthesia, patients may be evaluated according to a number of clinical parameters, such as mouth opening (according to the Mallampati classification), head and neck

mobility, the capacity to prognath, thyromental distance, and body weight. Accurate preoperative prediction of potential difficulty with intubation can help reduce the incidence of catastrophic complications by alerting anaesthesia personnel to take additional precautions prior to initiating anaesthesia and establishing an artificial airway. This can help reduce the likelihood that the patient will experience a catastrophic complication. In addition, a more accurate prediction of difficulty with intubation might reduce the frequency of unnecessary manoeuvres (such as awake intubation), which are related to false positive predictors. This is important in the detection of patients who are at risk for difficult airway management, and it can be done by noting anatomical landmarks and clinical factors associated with difficult airway. On the other hand, it is not entirely clear if accurate prediction is even feasible, much alone how one should choose the factors to be analysed. [2] Despite the fact that a number of studies have employed a single risk factor or a combination of risk variables (also known as multivariate analysis) to predict a challenging airway, the actual difficulty of the airway remains unknown. The ease of laryngoscopic intubation is dependent on a number of different airway features; yet, it is not possible for a single assessment of the airway to reliably predict how difficult intubation would be.[3-10]

MATERIAL AND METHODS

Consent to participate in the study was obtained from one hundred adults of either gender who were planned to undergo elective procedures requiring general anaesthesia and tracheal intubation, including abdominal, urological, neurosurgical, ophthalmic, cardiac, orthopaedic, and ENT operations. Individuals who required fast sequence intubation, had a history of problematic intubation, had an unstable cervical spine, or had anatomical deformity of the head and neck were not allowed to participate in the research.

The patient was decided upon by the random selection of a coin toss. The same anesthesiologist who was engaged in the patient's anaesthetic treatment performed both the pre-operative evaluation of the patient's airway in the pre-induction room on the day of surgery, as well as the post-operative evaluation of the patient's airway. On a proforma, the information on the patient was entered. The information that was gathered on the patient included their age, gender, weight, height, dentition (whether they had regular teeth or buck teeth), and an airway test that could be performed simply at the bedside. These tests were:

1. Test for mandibular movement

Mouth opening (inter-incisor distance) patient asked to open his/her mouth as wide as possible and the distance between upper and lower incisor was measure in the midline. “subluxation” of the mandible the patient was asked to protrude his/her lower incisor as far aspossible and protrusion ranked as:

- lower incisor anterior to upper incisor.
- lower incisor not anterior to upper incisor.
- lower incisor fails to reach to upper incisor.

2. Test for mandibular space

- Thyromental distance- the patient was asked to extend the head as far as possible, keeping the mouth closed. The straight distance from inside of mentum to thyroid notch measured.
- Length of mandibular ramus” - the distance between tempomandibular joint and angle of mandible measured.

3. Test for atlanto-occipital extension, the “sterno- mental distance” - the patient was asked to extend the neck and the distance between genial tubercle and sternal notch was measured.

4. Test for oropharangeal view - the Mallampati test the patient was asked to open the mouth maximally, protrude the tongue and phonate. The view thus seen is ranked into four classes:

Class 1 - soft palate, fauces, uvula & pillar seen.
Class 2 - soft palate, fauces& uvula seen.
Class 3 - soft palate & base of uvula seen.
Class 4 - soft palate not visualized.
BMI and neck circumference were measured.

METHOD OF ANAESTHESIA

After inducing the patients with injections of thiopentone sodium 5 mg/Kg, nalbuphine 0.1 mg/Kg, and atracurium 0.5 mg/Kg, a laryngoscopy was carried out after three minutes. Throughout the process of intubation, some details were recorded, such as the number of tries, the best view of laryngoscopy, the required size of the blade, and whether or not tracheal pressure was administered.

Since it has been demonstrated that using both of these parameters improves the reliability of identification of difficult laryngoscopy tracheal intubation, the definition of difficult laryngoscopic intubation was based on the best laryngoscopic view as well as the number of laryngoscopy attempts. This was done in order to meet the requirements of the American Thoracic Society. The view at larngoscopy was graded by Cormack Lehane in the following manner:

Grade I - if part of vocal cord visible.
Grade II - if only the arytenoids were visible.
Grade III - if only epiglottis was visible.
Grade IV - if epiglottis was not visible.

Difficult intubation in our study was defined as number of larngoscopyattempts + grade of larngoscopy, the score <4 or 4 was taken as easy intubation and a Score >4 as difficult intubation.

RESULTS

The investigation included a total of one hundred patients ranging in age from 38 to 68 years old. Among them, thirty were undergoing general surgical procedures, twenty were undergoing gynaecological procedures, and thirty were undergoing urological procedures. The remaining twenty were undergoing ENT procedures, ophthalmological procedures,

orthopaedic procedures, neurosurgical procedures, and cardiac procedures. Patients' characteristics such as sex, Mallampati scale, diagnostic features, risk factors, and their connection to the Cormack Lehane class are provided in Table I. Table I also includes the patients' names. The incidence of difficult intubation, as determined by nine different characteristics, is three percent (3%) out of every hundred instances (Table II). One of these was a Cormack-Lehane Grade II case, one was a Grade III case, and one was a Grade IV case. Of the Grade III cases, one was intubated on the third attempt with the stylet, and the other was intubated by manipulation. The Grade IV case was intubated with the assistance of an intubating laryngeal mask. Table 1 illustrates the amount of external laryngeal pressure that should be applied, the size of the blade that should be utilised, and the number of times that an individual should try a simple or difficult intubation. Other anatomical landmarks and clinical risk factors were less sensitive, as sternomental distance 12cm had the lowest sensitivity and positive predictive value in identifying patients with difficult intubation but high specificity. Mallampati class-3, neck circumference >40cms, and subluxation grade-2 each had a sensitivity of 35%, 19%, and 18% respectively; only one patient with inter-incisor distance of 3cms had a 100% sensitivity.

A correlation has been found between the grade distribution on the Cormack Lehane (CL) exam and the Mallampati score. Seventy-five of the 100 patients were classified as being in Mallampati class-1; 72 patients associated with CL grade-I, one patient connected with CL grade-II, and two patients linked with CL grade-III. 23 patients had a Mallampati class-2 diagnosis; 20 of them linked with a CL grade of I, 2 with a grade of II, and 1 with a grade of IV. There were two individuals who were classified as Mallampati class 3, and one of them linked with CL grades I and III.

Table I. Assessment between "Laryngoscopic View" (Grade I, II, III, IV) and Patients' Characteristics

Parameter	No of patients	CL1&2	CL3&4	Easy	difficult
Sex					
Male	40	38	2	39	1
Female	60	57	3	58	2
BMI					
<30	93	90	3	91	2
>30	7	6	1	6	1
Dentition					
Normal	90	88	2	88	2
Buck teeth	10	9	1	9	1
Inter incisor gap					
<4.5cm	1	0	1	0	1
4.5 or >4.5cm	99	98	1	97	2
Mallampati					
1	75	73	2	73	2
2	23	22	1	22	1
3	2	1	1	1	1
Neck circumference					
<40	97	95	2	94	3
>40	3	2	1	2	1
Thyroment distance					
<6.5	10	9	1	89	1
>6.5	90	90	0	10	0
Sternoment. distance					
<12	10	10	0	10	0
>12	90	89	1	88	2
Subluxation					
1	88	87	1	87	1
2	12	10	2	10	2
3	0	0	0	0	0
Ramus mandible					
<6	60	59	1	58	2
>6	40	38	2	38	2

Table 2: Characteristics of Patients and Difficult Intubation according to Glotic view

Cormack Lehane Grades	Intubation Easy	Intubation Difficult
1	90	0
2	7	1
3	0	1
4	0	1

DISCUSSION

Our research found that there was a 3% incidence of difficult intubation using direct laryngoscopy, which is much higher than the 1.5% that Baldwa NM et al. observed. [1] During the preoperative exam, the majority of anesthesiologists will do an assessment of the airway and provide a forecast about the degree of difficulty in performing a laryngoscopy. Even when utilizing the best posture and going to great lengths to calm the patient, anaesthetists may sometimes struggle to intubate a patient who seems to be in otherwise good health. [2] Although many of these techniques require specialised training, experience, assistance, and equipments, virtually all difficult airways can be secured by the selective use of specialized tracheal intubation techniques, such as intubating LMA, LMA CTrach[11], fiberoptic laryngoscope, and senascope[10], if they are recognized prior to attempts at tracheal intubation. However, this is only possible if the airway in question is a difficult one.

In the event that a difficult airway is not recognized prior to an attempt at tracheal intubation, the outcome can be catastrophic. This is due to the fact that the personnel and equipment required for utilizing the specialized tracheal intubation technique may not be immediately available, and the patient's spontaneous respiratory effort may have been eliminated as a result of anaesthesia or a muscle relaxant. Additionally, the patient's airway may have been compromised by foreign debris. So, one of the most critical skills that an anesthesiologist may have is the ability to recognize patients who are likely to have an airway that cannot be successfully secured by a simple direct laryngoscopy. [3]

There is a substantial study data source that contains descriptions of historical information, results from physical examinations, and radiographic characteristics that are connected with the difficult airway. When taken as a whole, the body of research literature suggests that one of the most essential underlying notions is that the difficult airway is the result of a number of anatomic and pathologic characteristics. When this idea is examined, it emerges as one of the most important concepts. So, it was only logical that a sensible approach to assessing the airway would entail taking a detailed history, doing a rigorous physical exam, and looking at pertinent X-rays whenever there was enough time to do so. [4]

For the purpose of predicting the difficulty of endotracheal intubation, we chose nine factors. As compared to George and Jacob[5], who reported a sensitivity of 54.5% with Mallampati, class-3 Mallampati only had a sensitivity of 35% and a positive predictive value of 52%. Also, we discovered that other anatomical land marks and clinical risk factors were less capable of attaining a high level of sensitivity. The two anatomical land markings with the highest sensitivity were the neck circumference greater than 40 centimeters and the subluxation grade-2. Just one patient had an interincisor distance of 3 centimeters, which had a predictive accuracy of 100 percent for difficult intubation. Unfortunately, the Mallampati score, along with all of the other anatomical and clinical indices, had a low sensitivity and failed in their ability to predict poor laryngeal view. This may be due to the fact that multivariate airway risk indices derived from large population samples appear to improve the positive predictive value. [6]

In clinical practise, there are a number of reasons that may lead to decreased sensitivity estimates. For instance, reliability estimates will be lowered if patients do not follow instructions effectively or consistently or if they find it difficult to evaluate a position. Patients need to have the needed manoeuvres properly defined to them and when necessary even shown to them. Asking patients to repeat the manoeuvres until they are completed correctly will also assist boost the reliability of the tests. [7]

The second aspect relates to the correlation of Mallampati with Cormack Lehane grade in predicting difficult endotracheal intubation. In our study, one patient with CL grade-IV and Mallampati class-2 was intubated by intubating LMA. This was accomplished by intubating the laryngeal mask airway (LMA).[8-12]

Laryngeal grade-III is not completely suitable to characterise difficult intubation, as in one out of two patients with CL grade-III, intubation was done by simple manipulation without the use of an aid. Although the definition of difficult intubation is related to the concept of limited laryngoscopic view, we find that laryngeal grade-III is not completely suitable to characterise difficult intubation. According to the findings of one research, the laryngeal grade was not sufficient on its own as a measure of the difficulty of intubation; nonetheless, it was an important component of the difficulty. Sadly, there is no definition of difficult intubation that is commonly acknowledged by medical professionals. A difficult tracheal intubation is described by the American Society of Anesthesiologists (ASA) as one in which "proper insertion of endotracheal intubation using conventional laryngoscopy take more than three tries, or more than 10 minutes."

CONCLUSION

This study found that an inter-incisor distance of 3 centimetres was the most sensitive predictor for difficult intubation, followed by a Mallampati class-3, a neck circumference of more than 40 centimetres, and a subluxation grade-2. Even though all of the tests have their uses, the study came to the conclusion that an inter-incisor distance of 3 centimetres was the most sensitive predictor.

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