Original Contribution

A validation study of the intubation difficulty scale for obese patients☆,☆☆

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Abstract
Study objective: An intubation difficulty scale (IDS) is the most commonly used tool to pronounce difficult intubation among obese patients in research area. There have not been any studies on assessing the use of IDS. The objectives were to determine the performance of the IDS among obese patients to define difficult tracheal intubation (DI) according to the subjective assessment of the difficulty experienced and to identify their optimal cutoff points.
Design: Cross-sectional study.
Setting: Tertiary care hospital.
Patients: Adult obese Thai patients who underwent conventional endotracheal intubation.
Measurements: Data of subjective assessment of the difficulty experienced by category—easy, somewhat difficult, and difficult—were collected from experienced anesthetic personnel who performed endotracheal intubation. IDS scores were collected by research assistants.
Main results: There were 552 obese patients recruited. The incidence of somewhat DI was 14.3% and that of DI was 2.2%. The overall performance of the IDS using area under the receiver operating characteristic curves of somewhat DI is 0.99 with 95% confidence interval (CI) of 0.98 and 0.99 and that of DI is 1 (95% confidence interval, 1-1). For somewhat DI, the optimal cutoff point is 2; it provides sensitivity and specificity of 100% and 92%. The IDS scores of 5 indicate DI which had sensitivity and specificity of 100% and 100%.
Conclusions: The IDS remains a good tool to declare DI among obese patients. It is recommended that a score of 2 or higher is an optimal cutoff point to indicate somewhat DI and a score of 5 or higher is an optimal cutoff point to indicate DI.
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1. Introduction

Difficult tracheal intubation (DI) remains a critical concern in producing an anesthesia-related hypoxic brain that can increase morbidity and mortality in anesthetic practice [1]. Therefore, a variety of criteria for airway assessment have been studied to predict DI prior to anesthesia. At present, there is, however, no universally accepted definition of a difficult

airway. For example, the American Society of Anesthesiologists Task Force on Management of Difficult Airways described difficult intubation as an intubation when tracheal intubation required multiple attempts, in the presence or absence of tracheal pathology [2]. Some studies defined difficult intubation as poor glottic visualization or a high-grade laryngeal view or failure to see the glottis by line of sight, or due to laryngeal or tracheal distortion or narrowing. Cormack and Lehane [3] described intubation failure in obstetric patients by illustrating a scheme for views of the laryngeal inlet while performing laryngoscopy. This scheme has become a standard measurement of glottic views and facilitates communication between researchers and clinicians.

The definitions of DI as described before appear to be very diverse and subjective. At present, the most commonly used tool in research to declare difficult intubation with an objective measure in obese patients is an intubation difficulty scale (IDS). This tool is composed of 7 variables in which the sums of the scores categorize the severity after performing the intubation as easy endotracheal intubation, slightly difficult endotracheal intubation, and very difficult endotracheal intubation. The IDS score could be used to compare the difficulty of intubation under varying circumstances by summation of these 7 variables or isolating variables of interest [4]. There have not been any studies in validating of the IDS for obese patients. Thus, the primary objective of this study was to determine the performance of the IDS in obese patients to define DI according to the subjective assessment of the difficulty experienced, and the secondary objective of this study was to identify optimal cutoff points of the IDS in those patients.

2. Materials and methods

2.1. Subject

This study was approved by the Siriraj Institution Review Board, and the ethics committees of Suratthani, Taksin, and Phaholpolpayuhasena Hospitals.

Patients enrolled in the study comprised adult obese patients, defined by a body mass index ≥ 30 kg/m^2, who were undergoing elective surgery under general anesthesia with conventional orotracheal intubation. Patients were excluded if they had outstanding characteristics of difficult intubation: any upper airway pathology or obvious malformations of the upper airway, that is, maxillofacial fractures or tumors, a cervical spine fracture, pregnancy, a full stomach, a history of difficult intubation or failed intubation or needing alternative intubation techniques, or initially managed with alternative airways such as fiberoptic intubation, video laryngoscopy, or using a laryngeal mask airway.

2.2. Procedure

Informed consent was obtained from all patients. All patients were assessed preoperative airway tests including the

modified Mallampati test, the interincisor gap, the thyromental distance, and the sternomental distance. Standard monitors, including pulse oximetry, noninvasive blood pressure, and electrocardiogram, were applied before conducting anesthesia. All tracheal intubations were performed by anesthetists with more than 2 years of full-time experience. The anesthesiologists who conducted the anesthesia were not restricted by a study protocol, and they were free to choose the laryngoscopic position and intubating technique judged best to achieve optimal visualization in each particular patient. Any types of direct laryngoscope blade, including the Macintosh blade number 3-4, the Miller laryngoscope blade, or the Mccoy blade, could be used for the first laryngoscopy in each case. The patient was placed in the sniffing or ramp positions as appropriate. The decision making of the intubation, that is, time to stop trying conventional intubation or choices of alternative airway devices, was at the discretion of the in-charge anesthesiologist. Patients received preoxygenation by breathing 100% oxygen through a facemask for more than 3 minutes. General anesthesia was induced with sodium thiopental or propofol, and an intubating dose of succinylcholine 1-2 mg/kg of total body weight or atracurium 0.4-0.6 mg/kg of total body weight. The performances of the intubations were observed by a research assistant.

Table 1 Baseline characteristics of patients (n = 552)

Variables	
Women, n (%)	411 (74.5)
Age (y), median (IQR1,IQR3)	50 (38,61)
Height (kg), median (IQR1,IQR3)	158 (153,165)
Weight (kg), median (IQR1,IQR3)	84 (77,93.6)
BMI (kg/m^2), median (IQR1,IQR3)	32.9 (31.2,35.9)
Surgical procedure, n (%)	
• General	239 (43.3)
• Gynecologic	88 (15.9)
• Orthopedic	72 (13.1)
• ENT surgery	64 (11.6)
• Neurologic	24 (4.4)
• Urological	22 (4.0)
• Ophthalmic	19 (3.4)
• Other	24 (4.3)
Airway assessment tests	
• Interincisor gap (cm), mean ± SD	5.1 ± 0.7
• Modified Mallampati test, n (%)	
Classes I-II	336 (60.9)
Classes III-IV	216 (39.1)
• Thyromental distance (cm), mean ± SD	9.6 ± 1.5
• Sternomental distance (cm); mean ± SD	16.4 ± 2.1
Positions, n (%)	
• Sniffing	514 (93.1)
• Ramp	38 (6.9)
Degree of difficult tracheal intubation	
Easy	461 (83.5)
Somewhat difficult	79 (14.3)
Difficult	12 (2.2)

ENT = ear, nose, and throat; IQR = interquartile range (IQR1 referred to the 25th percentile and IQR3 referred to the 75th percentile), SD = standard deviation; cm = centimeters.