



Original contribution

Usefulness and diagnostic value of the NEMA parameter combined with other selected bedside tests for prediction of difficult intubation



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ABSTRACT

Study objective: To assess the usefulness of the new NEMA (Neck Circumference Minus Acromion–Acromion Distance) parameter, in preoperative identification of patients' difficult intubation and compare it with other commonly used scales and tests.

Design: Prospective study.

Setting: District Specialist Hospital of Lublin, Poland.

Patients: Six hundreds twenty-nine patients underwent nonemergency surgical interventions.

Measurements: The NEMA parameter was confronted with: Modified Mallampati classification, TMD, RHTMD, NC, MPND, SMD, I-I D, A-AD, and medical history of difficult intubation and diagnosed obstructive sleep apnea syndrome or snoring.

Main results: Higher medians of NEMA and Mallampati parameters were reported in patients with difficult intubation. AUC for Mallampati parameter was 0.733 while the NEMA parameter's AUC was 0.625. Sensitivity and specificity for Mallampati and NEMA parameter were respectively 0.79; 0.55 and 0.42; 0.75. Significantly higher MPN, RHTMD, Mallampati, and NEMA parameter were observed in patients in whom the BURP was used. Easy intubation occurs more frequently in patients with a history of OSAS or snoring than in those with difficult intubation.

Conclusion: It seems that none of the known bedside tests for predicting difficult intubation have a discriminating power sufficient for clinicians. Our study draws attention to a novel parameter, called NEMA, which appears to be a strong predictor of DEI, especially in combination with the Mallampati scale.

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1. Introduction

Endotracheal intubation is a medical procedure performed electively in operating room conditions as well as in many life-saving situations outside the operating suite or in an ambulatory environment. Experience in restoring airway patency is essential in almost every medical specialty. Respiratory events related to a difficult airway consist of a significant number of anesthesia-related morbidity and mortality causes [1–5]. Prediction of difficulties connected with airway management is thus immensely important in clinical practice. Therefore, according to the current requirements, the pre-anesthetic visit should include an assessment of a patient for intubation difficulty, which is based on many parameters [6,7]. Past anesthetic evidence has shown that these predictors are neither sufficiently effective nor specific [8–12]. Taking into

consideration poor accuracy of many factors used alone some investigators made a proposition of multivariate screening models [13–19]. A large drawback of tests based on multiple parameters is that its complexity makes it difficult to implement in everyday practice and obtaining the data is time consuming. Respecting these issues there still remains an enormous need for research, which would define simple and efficient parameters that could be included in the preoperative assessment for difficult intubation risk. An ideal solution could be to combine a few, easily measurable anatomical parameters into a test that would be effective in detecting risk of difficult intubation. The test would be quick and easy to perform. There is a field full of controversies and never ending debates regarding elements of a combined test for airway evaluation. The significance of many anatomic structures and their relationship with poor laryngoscopy conditions is a subject of exploration and discussion [20].

The aim of the study was to assess the usefulness of the new NEMA (Neck Circumference Minus Acromion–Acromion Distance) parameter, which was recently developed by our team, in preoperative

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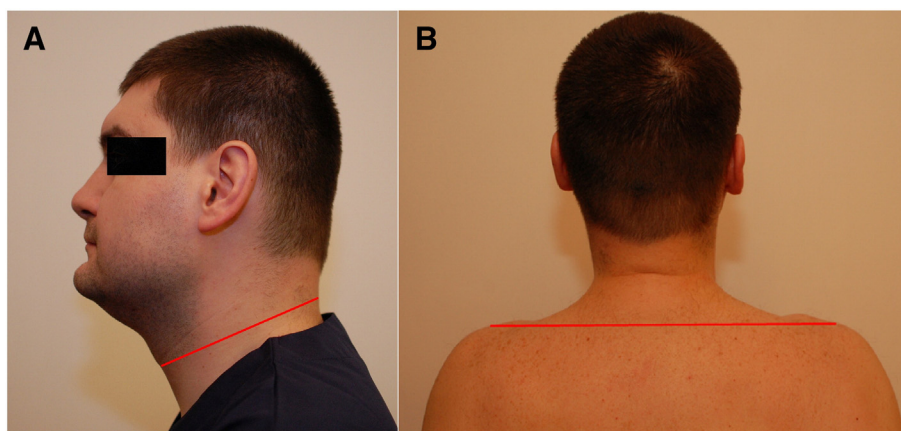


Fig. 1. Method of the neck circumference (A) and the acromion-acromion distance (B) measurement.

identification of patients' difficult intubation and compare it with other commonly used scales and tests.

2. Material and methods

The study enrolled 629 patients admitted to the District Specialist Hospital of Lublin in Poland who underwent nonemergency surgical interventions. All patients were informed about the aims of the study and written consent was obtained from each patient. The study was approved by the Ethical Committee at the Medical University of Lublin (decision No: KE-0254/242). All patients received general anesthesia with endotracheal intubation for elective abdominal, urological, vascular, otolaryngological (ENT) and orthopaedic surgery.

Each patient underwent a pre-anesthetic evaluation during which height, weight, BMI, sex and age were assessed. The clinical airway assessment consisted of a oropharyngeal examination using Mallampati classification [21] with the Samssoon and Young modification [22] and measurement of the following anatomic parameters: thyromental distance (TMD – distance from the thyroid notch to the superior border of the mandibular mentum), neck circumference (NC) and the acromion to acromion distance (AAD). Subsequently, the ratio of the patient's height to the thyromental distance (RHTMD) and the NEMA parameter were calculated. Mental protuberance to the tip of the nose (MPN), sternomental distance (SMD), interincisor distance (I-ID) was obtained in 420 patients as well as in those with difficult intubation history and obstructive sleep apnoea syndrome (OSAS) or snoring were also recorded in the group of 219 patients. Both, the Mallampati classification and all anatomical measurements were evaluated in patients in the sitting position.

Neck circumference was measured at the level of the thyroid cartilage of the larynx (Fig. 1A). Measurement of the acromion-acromion distance (A-AD) was made in a sitting position of the patient upright with patients' upper limbs along the body (Fig. 1B). The difference between neck circumference and acromion-acromion distance (neck circumference minus acromion-acromion distance, NEMA) was obtained from previously collected data (NC and A-AD). And the assumption is that NEMA parameter describes the relationship between the circumference of the neck and shoulder width, corpulence of the body. Components of NEMA are easy to measure even for inexperienced, novice intubator.

Table 1
Medians and min-max of patients' biometric data.

	M:F	median age (years)	Weight (kg)	Height (cm)	BMI (kg/m ²)
Total population	365:264	53.50 18.00–85.00	74.00 42.00–145.00	167.00 146.00–200.00	26.40 16.30–49.80

All data was collected by a single investigator in the preoperative period and was not known to the other anesthesiologist who performed the intubation and the rest of the anesthetic procedures on the following day.

Two anesthesiology specialists and one anesthesiology resident with >3 years of experience assessed the patients. Induction drugs and type of neuromuscular blocking agent were chosen by the anesthesiologist performing the anesthesia. Choice of the Macintosh laryngoscope size depends on the anesthesiologists' preferences.

The visualization of the glottis was assessed using the Cormack-Lehane scale [23] after potential application of optimisation maneuvers like BURP (backward, upward, rightward pressure maneuver of the larynx). Difficult intubation was defined by the Cormack-Lehane grade 3 or 4 of laryngeal view. The experience of the operator and the use of necessary maneuvers optimizing the glottal view were also registered. All intubations in the study were performed under muscle relaxation. Intubation conditions were assessed by the anesthesiologist in a special form directly after inducing anesthesia.

The NEMA parameter was confronted with: Modified Mallampati classification, TMD (thyromental distance), RHTMD (ratio of the patient's height to the thyromental distance), NC (neck circumference), MPND (mental protuberance to tip of the nose distance), SMD (sternomental distance), I-I D (inter-incisor distance), A-A D (acromion-acromion distance) and medical history of difficult intubation and diagnosed obstructive sleep apnea syndrome or snoring.

Differences between group populations were assessed using χ^2 , Mann-Whitney *U* test. An area under ROC curve (AUC) was used to evaluate the accuracy of particular predictors of difficult intubation, as well as identify cutoff values for optimal sensitivity and specificity.

The results were presented as median and min-max and percentages. Data was analyzed using SPSS Statistics v.16 software with *p* value of less than of 0.05 considered to be significant.

3. Results

Patients' demographics are presented in Table 1.

Specialists have performed 236 intubations (37.52%) and the resident intubated 393 patients (62.48%) during a 12-month time frame. There were no significant differences between them so data were not analyzed according this factor.

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