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Ultrasound-Guided Airway Assessment in Obese Patients Undergoing Bariatric Surgery a Randomized Clinical Trial

Felipe Mendes Faria[1], Larissa Manzan de Alcantara Borges[1], Mateus Ferreira de Siqueira e Silva[1], Gustavo Siqueira Elmiro[1], André Luiz Braga das Dores[1] and Giulliano Gardenghi[2]*

[1]Teaching and Training Center of the Anesthesia Clinic (CET - CLIANEST), Goiânia/GO, Brazil

[2]ENCORE Hospital, Aparecida de Goiânia/GO, Brazil and Center for Teaching and Training Center of the Anesthesia Clinic (CET - CLIANEST), Goiânia/GO, Brazil

ABSTRACT

Introduction: Anesthetic planning for obese patients must be effective to avoid unexpected adverse events. The introduction of ultrasound (USG) in medicine has made it possible to identify, assess, and predict the possibility of Difficult Airway (DA).

Objective: To evaluate whether ultrasound parameters can be predictors of DA in the obese patient population. Furthermore, to establish correlations between traditional DA indicators and the parameters obtained by ultrasound, with the goal of verifying the agreement and accuracy between the methods.

Method: A randomized clinical trial compared the assessment of already validated clinical indicators for predicting DA and USG parameters defined after a literature review.

Results: 132 individuals were randomized, subdivided into 66 patients in the conventional airway assessment group and 53 patients in the conventional airway assessment + USG group. The evaluation of basic patient characteristics in the USG and conventional groups showed that both groups were homogeneous in terms of weight (114.3 ± 16.9 kg vs. 116.9 ± 23.8 kg, p: 0.51), height (165.6 ± 8.0 cm vs. 166.3 ± 8.9 cm, p: 0.66), and body mass index (BMI) (41.7 ± 5.7 vs. 42.0 ± 6.6, p: 0.76). USG evaluation of the airway showed that the skin-epiglottis distance (SED) was < 2.7 cm in 73.3% of patients in the USG group, and the skin-hyoid distance (SHD) was < 1.41 cm in 60.4%. The primary outcome was the occurrence of Difficult Intubation (DI), which was significantly higher in the USG group (18.9%) compared to the conventional group (4.5%, p: 0.01). There was no significant difference in the use of a videolaryngoscope (22.6% in the USG group vs. 16.7% in the conventional group, p: 0.42) or intubation-related complications.

Conclusion: The integration of USG proved advantageous in clinical practice for airway assessment, reducing the incidence of intubation-related complications and improving the potential management of complex cases.

***Corresponding author**

Giulliano Gardenghi, ENCORE Hospital, Aparecida de Goiânia/GO, Brazil and Center for Teaching and Training of the Anesthesia Clinic (CET - CLIANEST), Goiânia/GO, Brazil, Email: coordenacao.cientifica@ceafi.edu.br.

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Introduction

Obesity is a highly prevalent chronic disease of substantial significance within the global health context [1]. Among the predictors of Difficult Intubation (DI), the obese population has a higher chance of presenting increased neck circumference, reduced submandibular space compliance, and limited cervical mobility, for instance, thus constituting a high-risk population for airway management.

Ineffective airway management remains one of the leading causes of morbidity and mortality in perioperative and emergency settings. The occurrence of unexpected DI during general anesthesia represents a potentially fatal event, requiring increasingly sensitive and specific predictive assessment strategies [2].

The prediction of Difficult Airway (DA) is a multifactorial process that depends on anatomical and functional variables as well as the operator's clinical judgment. This reflects the challenge of translating qualitative variables into objective scores, resulting in significant variability in the incidence rates of DA and DI, which range from 5% to 22% [3,4].

In this scenario, ultrasonography (USG) emerges as a complementary diagnostic tool with the potential to overcome some limitations of traditional clinical methods. Upper Airway ultrasonography (UA-USG) offers an objective and reproducible approach, allowing the direct visualization of relevant anatomical structures, such as the tongue, hyoid bone, thyrohyoid membrane, epiglottis, and trachea [5,6].

The use of Point-of-Care USG provides additional advantages, such as rapid execution at the bedside, absence of ionizing radiation, and independence from patient displacement to the imaging department. The integration of UA-USG into pre-intubation assessment protocols represents a paradigm shift in the approach to DA, especially in emergency settings, where

the anticipation of difficulties can be decisive for the clinical outcome [7].

Recent studies have demonstrated a correlation between ultrasonographic findings and laryngoscopic difficulty, using the Cormack-Lehane grades (CLG) observed during direct laryngoscopy as a reference [4]. Measurements such as tongue thickness and temporomandibular joint mobility have been proposed as potential predictors of DA. However, contradictory results, reduced sample sizes, and the absence of standardized scanning protocols limit the clinical applicability of existing findings [5].

Given this context, the main objective of this study is to evaluate whether ultrasound parameters can be predictors of DA in the obese patient population, based on the evaluation of ultrasound parameters already used in the literature in eutrophic patients. Furthermore, it seeks to establish correlations between traditional DA indicators, such as the Mallampati and CLG classifications, and the parameters obtained by ultrasound, with the goal of verifying the agreement and accuracy between the methods. The study also proposes to describe the epidemiological profile of DA in the evaluated obese patients.

Methods

A randomized clinical trial was conducted to evaluate validated clinical indicators for predicting DA, obtained through clinical examination, and ultrasonographic parameters defined after a literature review. The obese population [body mass index (BMI) > 30] undergoing bariatric surgery at the Hospital do Coração de Goiás (HCOR) was evaluated in the anesthetic recovery environment, preceding admission to the operating room. Patients referred to HCOR for bariatric surgery who agreed to participate in the study by signing the Informed Consent Form (ICF) were included. The sample size calculation was performed to ensure adequate statistical power to detect significant differences between the techniques. Based on a 95% confidence level (α=0.05) and a 5% margin of error, a total sample size of 132 patients was determined. This calculation was based on the anticipated variability of the primary outcome measure, specifically the prevalence of DA in obese patients undergoing bariatric surgery and was aimed at providing sufficient power to detect a statistically significant difference between the groups evaluating DA prediction indicators. The final sample size was adjusted to consider potential patient dropout, ensuring that the minimum necessary sample of 132 subjects was reached. Patients with cognitive deficit rendering them unable to comprehend the researchers' guidelines and those who refused to participate in the study by not signing the ICF were excluded. Tabulation and statistical analysis were performed using Microsoft Excel®, version 2010. Quantitative variables were presented as means, standard deviations (SD). The distribution of these variables was analyzed using the Kolmogorov-Smirnov test, when necessary, to calculate normality. Qualitative variables were presented as absolute numbers and proportions. The Chi-Square test was adopted for non-parametric data. The level of significance was established as 5% ($p \leq 0.05$) The SAS® University Edition software was used for these calculations. For the evaluation of patient risk factors, an analysis of the data entered into the electronic health record system (TASY®) covering the study period was performed. The analysis in question investigated the baseline data of the studied individuals, comprising all items that were part of the pre-operative anamnesis, systematically surveying the data of interest (epidemiology, anamnesis, physical examination, associated comorbidities, medication in use). The collected data were tabulated directly on a computer, using specific spreadsheets in the Excel 2010® software.

There was no interference from the research team in the indication of gastroplasty or in its technical execution. All patients underwent pre-anesthetic evaluation less than one week before the surgery. Upon arrival at the surgical center, patients were evaluated by the nursing team and again by the anesthesiology service, in addition to the cross-check of the pre-anesthetic evaluation performed via the TASY® system. All patients were received in the pre-anesthetic recovery room, preceding entry into the operating room, immediately following admission to the surgical center. Patients were positioned in the supine position and assessed for clinical parameters predicting DA, and, according to randomization, for ultrasonographic parameters or not. The evaluation of clinical indicators included the analysis of nine predictors of difficult orotracheal intubation: history of previous DI (classified as yes or no), interincisor distance (classified as □ or >3 cm), thyromental distance (classified as < or ≥6 cm), sternomental distance (classified as < or ≥12.5 cm), cervical extension (classified as good or poor), Mallampati classification (graded I to IV), mandibular protrusion (classified as good or poor), neck circumference (classified as < or ≥40 cm), and submandibular space compliance (classified as good or poor).The ultrasonographic evaluation included assessment of the skin-to-hyoid bone distance (SHD), the skin-to-epiglottis distance (SED), and the ratio between mento-hyoid distances (MHR) with the neck in neutral and extended positions. For SHD assessment, the scan was performed caudally down the neck starting from the tongue in a transverse orientation with the high-frequency linear probe. The next important structure visualized is the hyoid bone (Figures 1 and 3A), which appears as an "inverted U." In the transverse view, this structure is superficial and hyperechoic, projecting a large acoustic shadow. In the sagittal or parasagittal incidence, it is perceived as a small, curved structure associated with the acoustic shadow. The measurement was performed with the head in the neutral position.

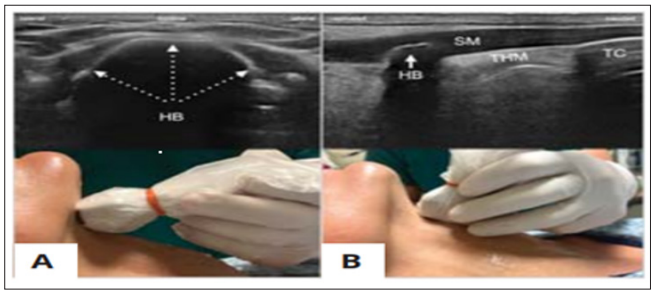

Figure 1: Hyoid Bone (HB) in Transverse (A) and Sagittal (B) Orientations
HB: Hyoid Bone; **SM:** Infrahyoid Muscles; ****TC:** Thyroid Cartilage; **THM:** Thyrohyoid Membrane

To evaluate the SED, the epiglottis was located deep to the thyrohyoid membrane, using the high-frequency linear probe, also with the head in the neutral position. The epiglottis is the cartilaginous structure that appears in the transverse orientation as a flattened curvilinear hypoechoic structure deep to the hyperechoic pre-epiglottic space (Figures 2 and 3B), which mainly contains fat and connective tissue. The posterior border is hyperechoic due to the air-mucosa interface. The epiglottis can also be visualized in the sagittal or parasagittal orientation as a curved hypoechoic structure. If better visualization was required, the patient was asked to protrude the tongue and swallow to move the hyoid bone away.

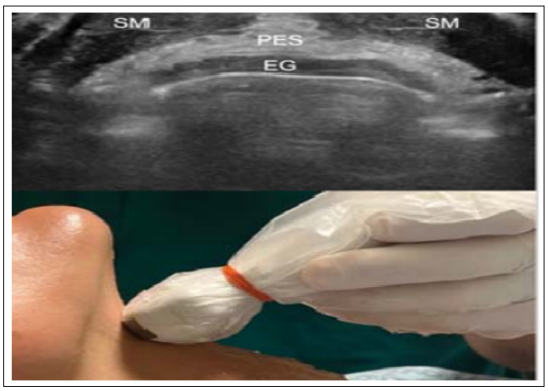

Figure 2: Transverse Ultrasound of the Epiglottis Immediately Caudal to the Hyoid Bone. Observe the Hyperechoic PES and the Curvilinear Hypoechoic GE in a Transverse Section. GE: Epiglottis; PES: Pre-Epiglottic Space; SM: Infrahyoid Muscles

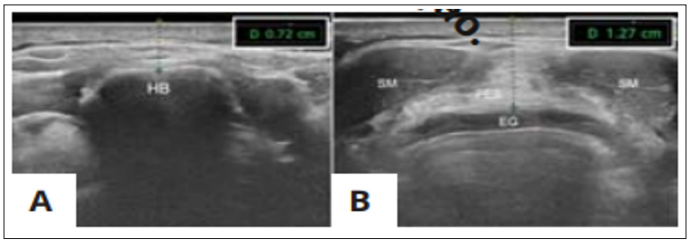

Figure 3: Measurement of (A): Skin-to-Hyoid Bone Distance (SHD). (B): Skin-to-Epiglottis Distance (SED)

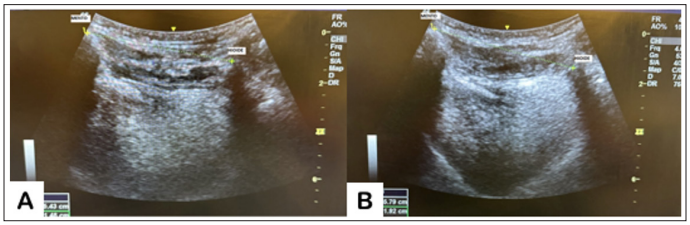

Figure 4A: Measurement of the Mento-Hyoid Distance (MHD) with a Curvilinear Transducer in the Neutral Position.
Figure 4B: Measurement of the MHD with a Curvilinear Transducer in the Extended Position

The hyomental measurements, in neutral and extended positions, were performed with a curvilinear transducer (Figure 4). The hyoid bone and the mentum were identified by performing a longitudinal median sagittal scan in the suprahyoid region. The hyoid bone and the posterior aspect of the mental symphysis were the two hyperechoic osseous structures that displayed a posterior acoustic shadow, located between the hypoechoic muscles that form the floor of the mouth [8].

After the assessment in the pre-anesthetic recovery room was completed, the patients were transferred to the operating room, positioned, and monitored with a cardioscope, pulse oximeter, blood pressure cuff, and CONOX®. Compression stockings and pneumatic boots were placed on all participants, and oxygen was supplied via nasal cannula at 2 to 3 L/min. Venous punctures were performed in the upper limb using antiseptic technique, utilizing 22G or 20G catheters. As appropriate for the drug administered, the corrected ideal weight [corrected ideal weight=(actual weight−ideal weight)×0.4+ideal weight] was calculated for all patients for correct dosing. Infusion was started with ketamine 0.5 mg/kg, dexmedetomidine 1 mcg/kg, lidocaine 1 mg/kg, parecoxib 40 mg, dexamethasone 10 mg, scopolamine + dipyrone 20 mg+2500 mg, and the antibiotic cefoxitin, as recommended by the institution's Hospital Infection Control Committee, at a dose of 4 g. These drugs were diluted in 250 ml of saline solution and administered over 10 to 15 minutes. 100% Oxygen was administered at a dose of 10 L/min via a mask for denitrogenation for 5 minutes, and then intravenous induction was performed with sufentanil 0.2 to 0.3 mcg/kg, propofol 1 to 2 mg/kg, and rocuronium 0.6 to 0.8 mg/kg. The method of orotracheal intubation was selected according to the indication of the attending anesthesiologist, choosing between conventional laryngoscopy or videolaryngoscopy, with or without the aid of a bougie. After orotracheal intubation was performed and confirmed by capnography and pulmonary auscultation, each research participant was classified regarding the difficulty of orotracheal intubation (defined by the anesthesiologist based on CLG and need for bougie use), the need for videolaryngoscope use, and associated complications, when present.

This study was approved by the Ethics Committee of the Hospital de Urgências de Goiás under the number CAAE: 79718424.8.0000.0033.

Results

Figure 5 illustrates the flowchart of the individuals included in the study. A total of 132 participants were initially selected and subsequently distributed equally between two groups: conventional assessment (n = 66) and conventional assessment combined with USG (n = 66). In the group that underwent only conventional assessment, all 66 individuals were fully evaluated. In the group that received the combined assessment (conventional + USG), 53 participants completed the protocol, with 13 losses during the process. This diagram summarizes the selection and follow-up process of the participants until the conclusion of the analysis. Both groups presented similar physical and clinical characteristics, as shown in Table 1.

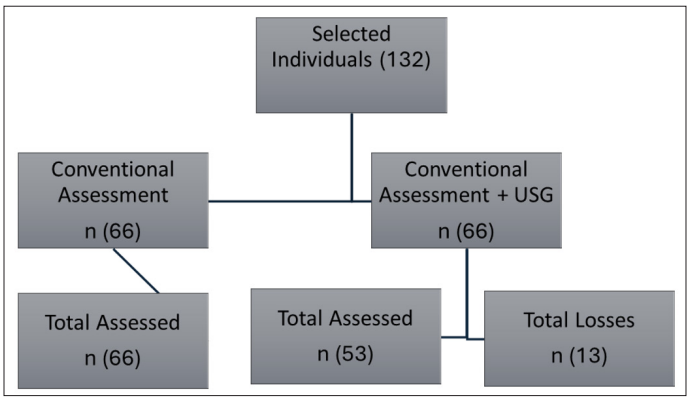

Figure 5: Flowchart of the Included Individuals

Table 1 presents the physical and clinical characteristics of the sample studied. It can be observed that both groups presented a similar profile, without significant differences between the variables analyzed, indicating homogeneity between them.

Table 1: Basic Characteristics of the Sample

	CONVENTIONAL + USG	CONVENTIONAL	P
Weight (Kg)	114.3 ± 16.9	116.9 ± 23.8	0.51
Height (cm)	165.6 ± 8.0	166.3 ± 8.9	0.66
BMI (Kg/cm2)	41.7 ± 5.7	42.0 ± 6.6	0.76
Age (years)	37.6 ± 12.2	37.6 ± 12.2	0.99
ASA II/III	13/40 (24.5%/75.5%)	14/52(21.2%/78.8%)	0.92
Previous surgeries	2.1 ± 1.1	1.8± 1.0	0.20
Number of comorbidities	2.5± 0.9	2.5 ± 1.2	0.86
Smoking	0 (0%)	0 (0%)	
Etilism	2 (3.8%)	1 (1.5%)	
Sedentary	41 (77.4)	55 (83.3%)	
Sedentary + etilism	2 (3.8%)	5 (7.6%)	
No social habits	5 (9.4%)	1 (1.5%)	

Abbreviations: USG: Ultrasonography; **Kg:** Kilogram; **Cm:** Centimeters; **BMI:** Body Mass Index; **ASA:** American Society of Anesthesiologists;
Source: Authors' Own Elaboration.

Table 2 describes the variables evaluated in the clinical airway analysis. The results indicated no statistically significant difference between the groups studied

	CONVENTIONAL + USG	CONVENTIONAL	P
MALLAMPATI			0.88
I	8 (15.9%)	7 (10.7%)	
II	31 (59.1%)	35 (52%)	
III	12 (22.7%)	16 (24.2%)	
IV	1 (2.3%)	8 (12.1%)	
PREVIOUS DIFFICULT OTI			0.83
YES	1 (2%)	1 (1.5%)	
NO	52 (98%)	65 (98.5%)	
INTERINCISOR DIST.			0.57
≤ 3 CM	16 (30.6%)	17 (25.8%)	
> 3 CM	37 (69.4%)	49 (74.2%)	
THYROMENTAL DIST.			0.51
< 6 CM	4 (8.2%)	8 (12.1%)	
≥ 6 CM	49 (91.8%)	58 (87.9%)	
STERNOMENTONIAN DIST.			0.37
< 12,5 CM	9 (16.3%)	7 (10.6%)	
≥ 12,5 CM	44 (83.7%)	59 (89.4%)	
CERVICAL EXTENSION			0.37
GOOD	51 (95.9%)	65 (98.5%)	
POOR	2 (4.1%)	1 (1.5%)	
MANDIBULAR PROTRUSION			0.8
GOOD	44 (83.3%)	53 (81%)	
POOR	9 (16.7%)	13 (19%)	
NECK CIRCUMFERENCE			0.47
< 40 CM	22 (41.7%)	31 (47%)	
> 40 CM	31 (58.3%)	35 (53%)	
SUBMANDIBULAR COMP.			0.44
GOOD	45 (85.7%)	53 (80.3%)	

POOR	8 (14.3%)	13 (19.7%)	

Abbreviations: USG: Ultrasonography; **OTI:** Orotracheal Intubation; **dist:** Distance; comp: Compliance.
Source: Authors' Own Elaboration.

Table 3 describes the variables evaluated using UA-USG.

Table 3: Ultrasound Evaluation of the Airway

SKIN-EPIGLOTTIS DISTANCE (CM)	
< 2.7 +/- 0.19	39 (73.3%)
2.7 +/- 0.19	14 (26.4%)
SKIN-HYOID DISTANCE (CM)	
< 1.41 +/- 0.3	32 (60.4%)
1.41 +/- 0.3	21 (39.6%)
MENTO-HYOID RATE (CM)	
< 1.1	53 (100%)
1.1	0 (0%)

cm: Centimeters
Source: Authors' Own Elaboration.

Table 4 shows the outcomes related to intubation. The results indicated that DI was the only outcome with a statistically significant difference.

Table 4: Outcomes Related to Intubation

	CONVENTIONAL + USG	CONVENTIONAL	P
DIFFICULT OTI			
YES	10 (18.9%)	3 (4.5%)	
NO	43 (81.1 %)	63 (95.5%)	
VIDEOLARYNGOSCOPE			0.42
YES	12 (22.6%)	11 (16.7%)	
NO	41 (77.4%)	55 (83.3%)	
COMPLICATIONS			1.0
YES	0 (0%)	0 (0%)	
NO	53 (100%)	66 (100%)	

Abbreviations: USG: Ultrasonography; **OTI:** Orotracheal Intubation.
Source: Authors' Own Elaboration.

Table 5 describes the number of previous surgeries the patients had undergone.

Table 5: Number of Previous Surgeries

Number of surgeries	CONVENTIONAL USG	CONVENTIONAL
0	14 (26.4%)	15 (22.7%)
1	17 (32.1%)	23 (34.8%)
2	11 (20.8%)	16 (24.2%)
3	5 (9.4%)	10 (15.2%)
4	6 (11.3%)	1 (1.5%)
5	1 (1.5%)	0 (0%)

USG: ultrasonography.
Source: Authors' Own Elaboration.

Discussion

Preoperative identification of a DA plays a decisive role in the safe conduct of anesthesia, enabling appropriate planning, selection of suitable devices, and involvement of experienced personnel [3,4].

In the study conducted by the incidence of DA in obese patients was 32.48%. In this study, DI in obese patients occurred in 18.9% of those assessed with USG of airway and in 4.5% of patients assessed by conventional evaluation. In the generally reviewed literature, the incidence of difficult laryngoscopy ranges between 9.5% and 16.7% in the general population and between 12% and 31% in obese patients [9]. The occurrence of difficult laryngoscopy is influenced by multiple patient and procedure related factors. Among the determinants are head positioning, inadequate neuromuscular blockade, the experience of the professional performing the laryngoscopy, and the employment of specific maneuvers during direct laryngoscopy [9].

Given this context, recent studies have pointed to USG as a promising tool for the anatomical evaluation of airway. The method is fast, non-invasive, and can assist in predicting difficult laryngoscopy prior to anesthetic induction. However, there is no consensus on which ultrasonographic measurements would be most effective, especially when considering variations related to the body composition of the eutrophic versus obese population and the examiner's experience. Based on this gap and prior literature, this study evaluated three ultrasonographic parameters already tested in other research: SHD, SED, and MHR, comparing them with conventional clinical methods.

The study was conducted with 132 subjects, who were randomized into two groups: 66 patients for conventional airway assessment (clinical parameters) and 66 patients for conventional assessment combined with UA-USG evaluation. In the group that included the ultrasonographic airway assessment, there was a loss of 13 patients from the randomized sample, attributed to the unavailability of the USG device during its maintenance period and the unavailability of trained personnel to perform the evaluation. Among patients whose airway assessment was combined between the conventional and USG methods, DI was observed in 18.9%. In contrast, DI occurred in 4.5% of the cases in the group assessed solely by clinical parameters (conventional method).

In the assessment of the ultrasonographic parameter SED, the findings were categorized as: < 2.7 cm and >=2.7 cm, both with a SD of 0.19 cm. The measurement >=2.7 cm was considered a predictor of DA. Specifically, 26.7% of the assessed patients presented with SED >= 2.7 cm, and 73.3% presented with SED < 2.7 cm.

For the assessment of SHD, the cutoff measurements were established as: < 1.41 cm and >= 1.41 cm, with a SD of 0.3 cm. Measurements >= 1.41 cm were associated with DA. The former measurement corresponded to 60.4% of the findings, and the latter to 39.6% of the patients.

Regarding the assessment of the MHR, obtained by the mento-hyoide distance (MHD) in neutral and extended positions, the findings indicated a measurement of < 1.1 cm in 100% of the sample. Measurements >=1.1 cm would be predictive of DA.

In the combined assessment methods (UA-USG + conventional), out of the 53 evaluated patients, ten presented with DI. Of these ten patients, five presented with a SED measurement >= 2.7 cm (with a SD of 0.19 cm) and five presented with a SHD measurement >=1.41 cm (with a SD of 0.3 cm). Half of the DI in this group did not have SED and SHD measurements consistent with predictive values for DI found in previously published literature. No patient with DI in this group presented with an MHR greater than 1.1 cm.

Of these ten cases of DI, six were performed using a video laryngoscope. None of these patients had a prior history of DI. Half of these patients (five) presented with a Mallampati Score of III or IV, and the other half presented with a Mallampati Score of I or II.

Furthermore, in this group, 14 patients had a SED measurement >= 2.7 cm (with a SD of 0.19 cm). Of these, five experienced DI and nine did not. Regarding the SHD measurement, 21 patients presented with >= 1.41 cm (with a SD of 0.3 cm). Of these, only five presented with DA and 16 did not experience difficulty. The video laryngoscope was utilized in 12 patients (six with DI and six without DI). Only one of the 53 patients had a prior history of DI and no difficulty was encountered during intubation for this patient in the study. By conventional assessment in this group, 13 patients presented with Mallampati Class III or IV (five had DI and eight did not).

In the review conducted by, the MHD in the neutral and extended neck positions was significantly smaller in patients with difficult laryngoscopy and proved to be a useful marker in predicting difficult laryngoscopy in both obese patients and the general population [10]. In our study, however, no such relationship was found. Regarding the SED, the review associates higher CLG with SED values (with cutoff points ranging from 1.615 to 2.75 cm). Based on the prevalence of difficult direct laryngoscopy reported by the studies considered, the positive predictive value ranged from 30.26% to 49.4%, while the negative predictive value ranged from 94.61% to 97.53%.

This implies that, despite good sensitivity and specificity, the SED appears to be more useful in the event of a negative result for identifying a patient who will not present with a DA (when the test is negative, the probability of an easy laryngoscopy is approximately 95% to 97%). Conversely, a positive result indicates a probability of 30% to 50% that the patient will be difficult to intubate [10].

Thus, although not found consistently in this study, and based on literature findings that a greater SED value is significantly associated with difficult laryngoscopy, it is believed that values >= 2.7 cm (with a SD of 0.19 cm) may play an important role in cases of doubt regarding potential difficulties (after considering other routinely applied tests). In such instances, it can help rule out DA when negative or suggest a prudent approach in case of a positive result [10].

In the conventional assessment group, out of the 66 patients evaluated, three presented with DI. None of these patients had a prior history of DI. Analyzing the clinical predictors assessed, all three patients presented with Mallampati Class III or IV on pre-operative clinical evaluation, and one presented with poor mandibular compliance (or limited mandibular mobility). Regarding the other clinical parameters assessed (inter-incisor distance, thyromental distance, sternomental distance, cervical extension, mandibular protrusion, neck circumference), no predictive findings of difficulty were observed in any of the three DI cases. A video laryngoscope was used in two of the three DI cases.

Analyzing the clinical parameters assessed in the 66 randomized patients in the conventional group, 24 presented with Mallampati Class III or IV, and one patient had a prior history of DI. Interestingly, more than half of the patients presented with Mallampati Class II. Within this group, 17 patients presented with predicted difficulty associated with the inter-incisor distance, 8 presented with a thyromental distance predictive of DI, 7 presented with a sternomental distance suggestive of difficulty, 35 presented with a neck circumference > 40 cm, and one patient presented with poor neck extension (or limited cervical extension). None of these patients experienced difficulty in intubation.

The study had limitations regarding the sample studied and the evaluation method used. For the evaluation of the conventional group + USG evaluation, the USG device available in the surgical center was used, which was unavailable due to maintenance during a period of the study, compromising the sample size. In addition, patients were evaluated by different professionals using the USG method, and although all were properly trained, it is known that USG is examiner-dependent, which can lead to different results. Another limitation found in the study was the data collection performed in electronic medical records, which is subject to filling errors and missing data. Another important point that must be highlighted, as in the eutrophic population, further studies are imperative for the association and definition of useful USG parameters in predicting DA. If well established, USG would be an easily accessible, manageable, and low-risk tool for defining DA. Thus, it would assist in the safer management of obese patients undergoing bariatric surgery, since they constitute a population at risk for this adverse event in anesthesia.

Conclusion

The prevalence of DA remains a challenge in anesthesiology. In our study with obese patients, the combination of conventional assessment and USG identified a higher rate of DI (18.9%) compared to the clinical assessment alone (4.5%). The ultrasonographic references derived from eutrophic patients did not differ statistically when applied to the obese population. A significant limitation was the impossibility of measuring the additional time required for USG assessment, which is relevant information for evaluating its impact on the pre-operative routine. Finally, it is important to combine clinical and ultrasonographic assessment in the pre-operative routine of obese patients, as this strategy not only improves the identification of DA risk but also allows for anatomical markings that can be decisive for preserving life in emergencies.

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