Early Identification of Patients at Risk for Difficult Intubation in the Intensive Care Unit. Development and Validation of the MACOCHA Score in a Multicenter Cohort Study AT A GLANCE COMMENTARY Scientific Knowledge on the Subject

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Early Identification of Patients at Risk for Difficult Intubation in the Intensive Care Unit
Development and Validation of the MACOCHA Score in a Multicenter Cohort Study

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Rationale: Difficult intubation in the intensive care unit (ICU) is a challenging issue.
 Objectives: To develop and validate a simplified score for identifying patients with difficult intubation in the ICU and to report related complications.
 Methods: Data collected in a prospective multicenter study from 1,000 consecutive intubations from 42 ICUs were used to develop a simplified score of difficult intubation, which was then validated externally in 400 consecutive intubation procedures from 18 other ICUs and internally by bootstrap on 1,000 iterations.
 Measurements and Main Results: In multivariate analysis, the main predictors of difficult intubation (incidence = 11.3%) were related to patient (Mallampati score III or IV, obstructive sleep apnea syndrome, reduced mobility of cervical spine, limited mouth opening); pathology (severe hypoxia, coma); and operator (nonanesthesiologist). From the β parameter, a seven-item simplified score (MACOCHA score) was built, with an area under the curve (AUC) of 0.89 (95% confidence interval [CI], 0.85–0.94). In the validation cohort (prevalence of difficult intubation = 8%), the AUC was 0.86 (95% CI, 0.76–0.96), with a sensitivity of 73%, a specificity of 89%, a negative predictive value of 98%, and a positive predictive value of 36%. After internal validation by bootstrap, the AUC was 0.89 (95% CI, 0.86–0.93). Seven critical items available in the ICU were identified as independent risk factors for difficult intubation and constitute the MACOCHA score.

What This Study Adds to the Field
Seven clinical items available in the ICU were identified as independent risk factors for difficult intubation and constitute the MACOCHA score. This study develops and validates a prediction score for difficult intubation in the ICU. This score demonstrated good performance in the original cohort, after external validation in a validation cohort and internal validation with bootstrap. Moreover, difficult intubation was strongly associated with moderate and severe life-threatening complications related to intubation.

Keywords: difficult intubation; score; critical care; complications; mortality

* A complete list of members may be found before the beginning of the REFERENCES.

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Author Contributions: A.D.J., study concept and design, site training, data analysis and interpretation, manuscript preparation, and drafting. N. Molinari, study design, statistical methods, statistical data analysis, and manuscript review. N.T., N. Mongardon, J.-M.A., C.G., B.A., C.P.-B., J.-M.C., J.-Y.L., M.I., L.P., K.A., N. Maziers, E.A., and C.P., acquisition of the data and manuscript critique and review. B.J., study concept and design, data analysis, and manuscript preparation. S.J., senior coordinator, study design and site, site training and recruitment, data analysis, and manuscript preparation. All authors approved the manuscript submitted.

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AT A GLANCE COMMENTARY
Scientific Knowledge on the Subject
Risk factors for difficult intubation are well described in anesthesia. However, in the intensive care unit (ICU), they have yet to be identified in prospective multicenter studies and no prediction score has been validated. Additionally, association between difficult intubation and related complications has not been studied in prospective studies.

What This Study Adds to the Field
Seven clinical items available in the ICU were identified as independent risk factors for difficult intubation and constituted the MACOCHA score. This study develops and validates a prediction score for difficult intubation in the ICU. This score demonstrated good performance in the original cohort, after external validation in a validation cohort and internal validation with bootstrap. Moreover, difficult intubation was strongly associated with moderate and severe life-threatening complications related to intubation.

Keywords: difficult intubation; score; critical care; complications; mortality
In the intensive care unit (ICU), intubation is a challenging issue (1–3) because it may be associated with life-threatening complications in up to one-third of cases (1, 2). Difficult intubation is known to be associated with life-threatening complications in the operating room (4) and in emergent conditions (5–7). Although several predictive risk factors and scores for difficult intubation were identified in anesthesia practice, to our knowledge none have been identified for ICU patients. Such patients differ from those undergoing elective surgery, with a high rate of acute respiratory or hemodynamic failure and with worse intubation conditions than in the operating room. Early identification of risk factors for difficult intubation could allow for anticipation and preparation of adequate material, use of an alternative intubation strategy, and call for additional assistance before intubation and thus reduce morbidity (5, 8).

Only retrospective studies (9, 10) have assessed the relationship between complications and difficult intubation. A study performed outside the operative room (9) reported that hypoxemia was sevenfold higher in case of difficult intubation in comparison with nondifficult intubation. Another study (10) in the emergency area showed that difficult intubation was associated with airway complication. Furthermore, the incidence of difficult intubation in the ICU is highly variable across studies, ranging from 1% to 23%, depending on the center and the definition of difficult intubation (10–13).

The main objective of this study was to identify specific risk factors for difficult ICU intubation so as to develop and validate a simplified score predicting difficult intubation. This score was intended to include items that are clinically easily identifiable, applicable at bedside, and simple and clear to use. The secondary objectives were to assess the relationship between difficult intubation and complications and to establish the incidence of difficult intubation in a representative sample of ICU patients.

METHODS

Study Design and Population

A prospective, observational, multicenter study was conducted in 42 ICUs to develop a predictive model for difficult intubation (original cohort), and in 18 ICUs to validate the model (validation cohort). All adult patients consecutively intubated in the ICU were included. Exclusion criteria were pregnancy, refusal to participate after information was provided, or age younger than 18 years. See the online supplement for more information.

Ethics and Consent

Because of the observational, noninvasive design of this study, the need for written consent was waived. The local ethics committee, Comité de Protection des Personnes Sud-Mediterranée III, approved the study design (code UF:8819, register:2011-A001122-39). See the online supplement for more information.

Data Collection

Clinical parameters were prospectively assessed before, during, and after intubation procedures (see the online supplement and tables).

Definition of Difficult Intubation and Complications

Difficult intubation was defined as three or more laryngoscopic attempts to place the endotracheal tube into the trachea or as lasting more than 10 minutes using conventional laryngoscopy (14). Severe life-threatening complications (1, 2) were defined as death; cardiac arrest; severe cardiovascular collapse, defined as systolic blood pressure less than 65 mm Hg recorded at least one time or less than 90 mm Hg that lasted 30 minutes despite 500–1,000 ml of fluid loading (crystalloids or colloids solutions) or requiring introduction of vasoactive support; or severe hypoxemia (decrease in oxygen saturation as measured by pulse oximetry <80% during attempts).

Mild to moderate complications (1, 2) were defined as esophageal intubation; aspiration of gastric contents (migration of stomach contents into the lung); supraventricular or ventricular arrhythmia (without pulseless rhythm) that required therapy; dangerous agitation (Richmond Agitation-Sedation Scale score >3); or dental injury.

Statistical Analysis

See the online supplement for more information. The number of subjects needed was calculated to obtain composite criteria of difficult intubation with a sensitivity of 80 ± 10% based on a 9% incidence of difficult intubation, resulting in an estimated 700 intubation procedures. We decided to include 1,000 intubation procedures to develop the model in the original cohort, taking into account missing data, and 400 intubation procedures to externally validate the model in the validation cohort.

A logistic regression was used to identify risk factors for difficult intubation in the original cohort. A multivariate model was established to predict difficult intubation. Variables were selected if P value was less than 0.20 in the univariate analysis and a stepwise procedure was used to select the final model. To establish a simplified score, we gave a score to each of the variables included in the final prediction model in relation to each one’s β parameter (regression coefficient) in that model (15). The discriminative ability of the score (sensitivity, specificity, positive predictive value, negative predictive value, positive and negative likelihood ratio) was estimated in both cohorts to externally validate the simplified score (15, 16), and receiver operating characteristic (ROC) curve was established to estimate the area under the curve (AUC) of the simplified score. We used the bootstrap to internally validate the simplified score by sampling with replacement for 1,000 iterations (17). A P value of less than or equal to 0.05 was considered statistically significant.

RESULTS

See the online supplement for more information. During the study period, 1,400 intubation procedures were studied in 1,360 patients. From September 1, 2011 to January 31, 2012, 1,000 intubation procedures performed in 972 patients from 42 centers were included in the original cohort. All the intubation procedures were included. Twenty-eight patients (0.28%) were intubated twice. The median (interquartile range) number of intubation procedures included by center was 15 (10–20). Then, from February 1, 2012 to April 1, 2012, 400 intubation procedures performed in 388 patients from 18 other centers were included in the validation cohort. Twelve patients were intubated twice. The median (interquartile range) number of intubation procedures included by center was 15 (11–28). The flow chart of the study is shown in Figure 1.

Incidence of difficult intubation was 11.3% (113 of 1,000 intubation procedures) in the original cohort and 8% (32 of 400 intubation procedures) in the validation cohort (P = 0.07).

Tables 1 and E1 show the characteristics of patients in original and validation cohorts according to the difficulty of intubation. In both cohorts, there were significantly more patients with body mass index (BMI) greater than or equal to 30 kg/m² in difficult intubation groups. In the original cohort, increased Simplified Acute Physiology Score II score and coma as a reason for intubation was significantly associated with difficult intubation.

The operator status and main variables obtained before intubation are reported in Tables 2 and E2 (see Table E2 in the online supplement). In the original cohort, preintubation saturation less than 80% was significantly associated with difficult intubation, whereas noninvasive ventilation (NIV) was associated with the absence of difficult intubation. The drugs used for intubation, in particular neuromuscular blockers, did not differ between groups (see Table E3). However, midazolam use was more frequent in case of difficult intubation. The main parameters observed before
**Table 1.** Patient characteristics and reasons for ICU admission and intubation in original and validation cohorts according to difficult intubation

|                  | Original Cohort Total | Difficult Intubation | No Difficult Intubation | P Value
|------------------|-----------------------|-----------------------|-------------------------|----------
|                  | (n = 1,000)           | (n = 113)             | (n = 887)               |          |
| **Age, yr**      | 62 (51–73)            | 61 (51–68)            | 62 (51–73)              | 0.09     |
| **Sex, male**    | 624/979 (64)          | 68/111 (61)           | 556/868 (64)            | 0.56     |
| **SAPS2**        | 48 (36–62)            | 53 (38–66)            | 47 (36–61)              | 0.05     |
| **SOFA**         | 6 (4–8)               | 6 (3–8)               | 6 (4–8)                 | 0.77     |
| **Weight, kg**   | 71 (60–85)            | 76 (63–90)            | 70 (60–85)              | 0.03     |
| **Height, cm**   | 169 (160–175)         | 170 (160–175)         | 169 (160–175)           | 0.97     |
| **Body mass index** | 219/933 (23)   | 37/110 (34)           | 182/823 (22)            | 0.007    |
| **Medical type of admission** | 734 (73) | 86 (76)               | 650 (73)               | 0.52     |
| **Reason for ICU admission** | Acute respiratory failure | 455 (46)               | 45 (40)               | 0.20     |
|                  | Trauma                | 42 (4)                | 6 (5)                   | 0.53     |
|                  | Postoperative         | 95 (10)               | 6 (5)                   | 0.11     |
|                  | Cardiac arrest        | 24 (2)                | 2 (2)                   | 1.00     |
|                  | Neurologic            | 250 (25)              | 37 (33)                 | 0.04     |
|                  | Shock                 | 264 (26)              | 33 (29)                 | 0.47     |
|                  | Acute renal failure   | 29 (3)                | 3 (2)                   | 1.00     |
|                  | Other                 | 95 (10)               | 9 (8)                   | 0.55     |
|                  | Total                 | 82 (8)                | 10 (9)                  | 0.79     |

|                  | Validation Cohort Total | Difficult Intubation | No Difficult Intubation | P Value
|------------------|-----------------------|-----------------------|-------------------------|----------
|                  | (n = 400)             | (n = 32)              | (n = 368)               |          |
| **Age, yr**      | 63 (48–74)            | 58 (45–69)            | 64 (49–74)              | 0.13     |
| **Sex, male**    | 262/397 (66)          | 20/32 (63)            | 242/365 (66)            | 0.66     |
| **SAPS2**        | 48 (36–61)            | 41 (31–56)            | 49 (36–62)              | 0.09     |
| **SOFA**         | 5 (3–8)               | 5 (3–7)               | 5 (3–8)                 | 0.58     |
| **Weight, kg**   | 70 (60–80)            | 70 (64–83)            | 70 (60–80)              | 0.41     |
| **Height, cm**   | 170 (163–175)         | 170 (160–175)         | 170 (163–175)           | 0.52     |
| **Body mass index** | 63/378 (17)          | 9/29 (31)             | 54/349 (15)             | 0.03     |
| **Medical type of admission** | 267 (67) | 21 (66)               | 246 (67)               | 0.88     |
| **Reason for ICU admission** | Acute respiratory failure | 209 (52)               | 18 (56)                | 0.44     |
|                  | Trauma                | 33 (8)                | 0 (0)                   | 0.08     |
|                  | Postoperative         | 58 (15)               | 4 (13)                  | 0.10     |
|                  | Cardiac arrest        | 10 (3)                | 2 (6)                   | 0.18     |
|                  | Neurologic            | 68 (17)               | 4 (13)                  | 0.48     |
|                  | Shock                 | 105 (26)              | 11 (34)                 | 0.28     |
|                  | Acute renal failure   | 29 (7)                | 4 (13)                  | 0.27     |
|                  | Other                 | 25 (6)                | 2 (6)                   | 1.00     |

Definition of abbreviations: ICU = intensive care unit; SAPS2 = Simplified Acute Physiologic Score; SOFA = Sequential Organ Failure Assessment.

Data are summarized as number (%) or median (interquartile range). One patient can have more than one reason for ICU admission or for intubation.
Five deaths, 0.5%; 274 severe collapses, 27.4%; 155 severe
complications varying with the definitions used, but generally ranging
between 20% (9) and 50% (13). Additionally, airway complications
occurred in 437 of 1,000 intubation procedures (43.7%),
with 381 (38.1%) severe complications (26 cardiac arrests, 2.6%;
five deaths, 0.5%; 274 severe collapses, 27.4%; 155 severe
hypoxemia, 15.5%) and 112 (11.2%) moderate complications
(15 agitations, 1.5%; 32 cardiac arrhythmias, 3.2%; 23 aspira-
tions, 2.3%; 48 esophageal intubations, 4.8%; six dental injuries, 0.6%).
Figures 3A and 3B show the detailed percentage of complications according
to the difficulty of intubation. Patients with difficult intubation in both (original and validation)
cohorts (Figures 3A and 3B) had significantly higher severe life-threatening complica-
tions than those who had nondifficult intubation.
Mortality was 299 (30%) of 982 in the original cohort and was
35 (32%) of 109 in the difficult intubation groups and 264 (30%)
of 873 in the nondifficult intubation groups (P = 0.69).

**DISCUSSION**

This is the first study to identify risk factors of difficult intubation in a large multicenter cohort of ICU patients. We developed and
validated internally and externally a score for difficult intubation in the ICU (MACOCHA score). This study shows that a simple
model easily applicable in clinical practice predicts absence of difficult intubation in the ICU. This study also reveals a high rate
of severe morbidity related to difficult intubation in the ICU.

Anticipating difficult intubation is a challenging issue: in the present study, the complications of intubation were higher when
intubation was difficult (65% vs. 41% overall, 51% vs. 36% con-
sidering severe life-threatening complications). As underlined by a recent report, 25% of major airway events in Great Britain
occur in the ICU, revealing a poor identification of patients at risk (5). Rates of complications in the present study were in
the range of previous studies, with the incidence of severe compli-
cations varying with the definitions used, but generally ranging
between 20% (9) and 50% (13). Additionally, airway complica-
tions in the report by Martin and coworkers (10) are comparable
with our study (~4%). Likewise, rates of difficult ICU intubation ranged from 1% (13) to 23% (11) according to the definition used, around 10% on average (13, 18), which is consistent with our results. This large range of difficult ICU intubation rates may also be explained by the operator skill, which is not accounted for in the different definitions used (19).

In this study, we attempted to create a pragmatic, predictive difficult-intubation scoring. To our knowledge, it is the first time that such a predictive score (MACOCHA score) has been developed and validated in the ICU. The final model of the logistic regression in the original cohort is robust and presents very good characteristics, with very high AUC and excellent goodness of fit (97% and 98% in the original and validation cohorts, respectively). However, the specificity (90% and 89%) and sensitivity (76% and 73% in the original and validation cohorts, respectively) and positive predictive values (48% and 36%) are lower, although improve with a threshold of four or greater (specificity of 93% and 92%, positive predictive value of 53% and 42%), whereas the negative predictive value remains very good (96% and 97%). At positivity thresholds of five or higher, sensitivity losses are pronounced whereas further specificity good (96% and 97%). At positivity thresholds of five or higher, the discriminative ability of the score is high. To reject difficult intubation with certainty, a cutoff of three or four is used, around 10% on average (13, 18), which is consistent with our results. This large range of difficult ICU intubation rates may also be explained by the operator skill, which is not accounted for in the different definitions used (19).

In this study, we attempted to create a pragmatic, predictive difficult-intubation scoring. To our knowledge, it is the first time that such a predictive score (MACOCHA score) has been developed and validated in the ICU. The final model of the logistic regression in the original cohort is robust and presents very good characteristics, with very high AUC and excellent goodness of fit (97% and 98% in the original and validation cohorts, respectively). However, the specificity (90% and 89%) and sensitivity (76% and 73% in the original and validation cohorts, respectively) and positive predictive values (48% and 36%) are lower, although improve with a threshold of four or greater (specificity of 93% and 92%, positive predictive value of 53% and 42%), whereas the negative predictive value remains very good (96% and 97%). At positivity thresholds of five or higher, sensitivity losses are pronounced whereas further specificity advances are marginal.

Because of the low prevalence of difficult intubation on average (8% in the validation cohort), positive predictive value is low despite a good specificity (20). Nevertheless, to reject difficult intubation with certainty, the main value of the score resides in the negative predictive value of the parameter. It is prudent to be prepared for a difficult intubation, even if the intubation is finally not difficult. We performed an external validation to show the generalizability of the model. External validation is necessary before implementing prediction models in clinical practice (21). Results are concordant between the original and validation cohorts, with very close discriminatory values. The internal validation by bootstrap confirmed those results.

The MACOCHA score has the advantage of being constituted with easily identifiable and clinically pertinent variables. Furthermore, the items used in the MACOCHA score are close to those identified in the operating room and include risk factors strongly associated with difficult intubation in multiple studies performed in anesthesiology (18, 22–25). Additionally, Hirnmath and coworkers (26) showed that patients known to be difficult to intubate should be screened for sleep apnea, a strong risk factor of difficult intubation in our study. However,
Mallampati score alone was less effective than MACOCHA score to predict difficult intubation. Two factors specific to ICU patients were recognized in this study and are included in the score: severe hypoxemia before intubation and coma (Glasgow score <8 as a reason for intubation). Severe hypoxemia as a risk factor can be explained by a shortness of time to be adequately prepared for the intubation and perhaps by increased stress for physicians performing the procedure. Likewise, patients intubated for coma often present increased oropharyngeal secretions, limiting view of the glottis.

Moreover, the simplified score contains a factor related to the operator: a formal anesthetic training of at least 24 months. Considering the link between anesthesiology formation and difficult intubation (1), previous studies were not powered enough to show this association. A recent study (13) performed in Scotland, where almost all operators had a formal anesthetic training greater than 24 months, revealed a very low rate of difficult intubation and complications, in accordance with our study. In previous studies, the presence of two operators to perform the intubation was found as a protective factor for complications related to intubation (1, 27). In our opinion, the standard of care changed in France more than 8 years after these studies: the increased number of operators when difficult intubation occurred in the current study was more a consequence of difficult intubation. It is noteworthy that BMI was assessed as a risk factor for difficult intubation in univariate analysis but not in multivariate analysis. This might be explained by the important clinical overlap of BMI with other risk factors more associated with difficult intubation in the final model, such as Mallampati score, mouth opening, OSAS, or severe hypoxemia before intubation. For example, in the study by Holmberg and coworkers (28), BMI greater than 40 kg/m² in prehospital tracheal intubation was associated with difficult intubation, but other risk factors for difficult intubation were not assessed. In fact, this might mean that the risk factors associated with obesity, rather than obesity itself, are probably associated with difficult intubation in this study, as Lundstrom and coworkers (23) revealed in the anesthesiology area, where high BMI was a weak predictor for difficult and failed tracheal intubation.

NIV failure was associated with a lower risk of difficult intubation in univariate analysis, but not in multivariate analysis. NIV before intubation has been demonstrated to prevent hypoxemia and was associated with less airway complications of intubation (2, 5). It is the first study to show that NIV is associated with a lower rate of difficult intubation, perhaps related to the greater duration before hypoxemia occurrence compared with other patients (3).

As expected, the patients with difficult intubation had a significantly higher IDS score (6 [4–8] vs. 1 [0–2]; P < 0.0001). It should be noted that IDS score is a surrogate of the difficulty of intubation a posteriori and not a predictive score, as the MACOCHA score validated in this study.

Capnography was used only in 46% of intubations, whereas it is recommended (8) to be always used after intubation to assess the endotracheal position of the tracheal tube. Recent studies also found a similar result, reporting capnography use between 25% (29) and 54% (13). Systematic use of capnography could reduce the rate of complications related to intubation (2).

The study has some limitations. First, because data collection and intubation were sometimes performed by the same person, the degree of difficulty of intubation could have been overestimated or underestimated. Second, the Mallampati score was only available in 77% of the original cohort. The reasons for this might be an ignorance of the score by some operators. Moreover, Mallampati score is sometimes difficult to assess in an emergency context (30). This could be explained by the risk factors of nonassessment of Mallampati score determined in this study by multivariate logistic regression. Indeed, the need to replace the endotracheal tube is often done in emergency conditions, leaving no time to assess Mallampati score. More often, limited mouth opening, head and neck disease, or coma do not allow Mallampati score assessment. Accordingly, the modest bias induced by the lack of Mallampati score data does not influence the main results of the study. The main message remains that

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**TABLE 5. MACOCHA SCORE CALCULATION WORKSHEET**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors related to patient</td>
<td></td>
</tr>
<tr>
<td>Mallampati score III or IV</td>
<td>5</td>
</tr>
<tr>
<td>Obstructive sleep apnea syndrome</td>
<td>2</td>
</tr>
<tr>
<td>Reduced mobility of cervical spine</td>
<td>1</td>
</tr>
<tr>
<td>Limited mouth opening &lt;3 cm</td>
<td>1</td>
</tr>
<tr>
<td>Factors related to pathology</td>
<td></td>
</tr>
<tr>
<td>Coma</td>
<td>1</td>
</tr>
<tr>
<td>Severe hypoxemia (&lt;80%)</td>
<td>1</td>
</tr>
<tr>
<td>Factor related to operator</td>
<td></td>
</tr>
<tr>
<td>Nonanesthesiologist</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

*Definition of abbreviation: MACOCHA = Mallampati score III or IV, Apnea syndrome (obstructive), Cervical spine limitation, Opening mouth <3 cm, Coma, Hypoxia, Anesthesiologist nontrained.*

Coded from 0 to 12: 0 = easy; 12 = very difficult.
Mallampati scores should be evaluated as often as possible. In our study, Mallampati score was assessed in recumbent patients. Performance of Mallampati score with a recumbent patient is at least as good as in a sitting position, according to previous studies (31–34). The only situation where such an assessment is not possible is when the patient presents a much altered consciousness, which is also a risk factor for difficult intubation according to the current study. Besides, other missing data were very low. Third, it is a multicenter study, which is a strength because the result can be better extrapolated to the general population, and a limit because of unequal distribution intubation numbers among centers. However, the center effect was assessed and not retained. Fourth, the external validation was performed in French ICUs and not in other countries, which could limit the extrapolation of the results. Fifth, a statistical model for repeated data was not used despite several intubation procedures for a same patient included in the analysis. Yet, the number of patients who have been intubated at least twice was low in both cohorts (<1%). As a consequence, the bias is very limited. Sixth, neck circumference was estimated rather than measured. This parameter has to be considered with caution. Finally, intubation is a procedure that depends greatly on the intrinsic quality of the operator, which is hardly assessable in clinical studies.

To conclude, this is the first study to develop and validate a score predicting the difficulty of intubation procedure in the ICU with a high discriminative ability. The MACOCHA score is very easy to perform and to memorize. However, if the score does not predict a difficult intubation, one should remain vigilant because there is still a small possibility that it will be difficult. Mallampati score is the highest predictor of difficult intubation and should be evaluated as often as possible before intubation in the ICU. Complications of intubation are strongly associated with difficult intubation. Further studies are needed to appreciate if applying the MACOCHA score in daily practice helps to anticipate and further reduce complications of intubation.

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