e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(10); 1014-1018

Original Research Article

# Predictors of Difficult Tracheal Intubation during General Anaesthesia: An Analysis of an Obstetric Airway Management Registry

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**Received: 27-08-2025 / Revised: 26-09-2025 / Accepted: 27-10-2025**

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**Conflict of interest: Nil**

**Abstract:**

**Background:** Airway management in obstetric patients presents unique challenges due to physiological and anatomical changes during pregnancy. Difficult tracheal intubation remains a major cause of anaesthetic morbidity and mortality in this population. This study aimed to identify clinical predictors associated with difficult intubation in obstetric patients undergoing general anaesthesia.

**Methods:** Over the course of a year, 200 parturients in need of general anesthesia were included in this prospective observational study at Dharanidhar Medical College and Hospital. Mallampati classification, thyromental and sternomental lengths, inter-incisor gap, and neck circumference were all measured as part of the preoperative airway examination. The Cormack–Lehane scale was used to grade the difficulty of intubation. Chi-square and logistic regression were used in the statistical study to find independent factors of difficult intubation.

**Results:** A problematic tracheal intubation occurred 14% of the time. Difficult intubation was substantially correlated with Mallampati class III–IV ($p = 0.001$), thyromental distance <6.5 cm ($p = 0.008$), and neck circumference >35 cm ($p = 0.002$). Mallampati class III–IV (OR 3.84, 95% CI 1.62–9.10) and neck circumference >35 cm (OR 3.22, 95% CI 1.41–7.32) were identified as independent predictors using logistic regression. Predictive accuracy was increased by combining several evaluation characteristics as opposed to using just one test.

**Conclusion:** Neck circumference, thyromental distance, and Mallampati grading are all good indicators of challenging intubation in obstetric patients. To successfully anticipate and manage airway issues, a thorough airway assessment that takes these characteristics into account should be carried out on a regular basis.

**Keywords:** Obstetric Anaesthesia, Difficult Intubation, Airway Management, Mallampati Classification, Thyromental Distance.



## Introduction

Effective airway management is crucial in anaesthesia practice. Keeping the airway secured is the first important step when administering general anaesthesia. Anaesthesiologists continue to face difficult tracheal intubations (DTI) as one of the significant problems and one of the fatal problems that comes with anaesthesia [1,2]. For obstetric patients, the combination of factors that come with pregnancy, including physiological, anatomical, and hormonal changes, which result in an increase in the likelihood of difficult mask ventilation and tracheal intubation, also increase the challenges to effective airway management [3,4]. The rapid induction and control of the airway required during emergencies like obstetric hemorrhage and fetal distress increases the challenges to effective airway management in this group [5]. Increased capillary engorgement, mucosal oedema, and breast tissue hypertrophy, which occur during a pregnancy, can create problems when laryngoscopy and intubation are performed [6]. Apnoeic parturients are also prone to hypoxemia due to decreased functional residual capacity and increased oxygen consumption [7]. Identifying predictors of difficult intubation in obstetric patients aids in planning airway management minimizing complications and optimizing maternal and fetal outcomes [8].

The Mallampati classification, various distances such as thyromental, sternomental, as well as neck perimeter, and BMI are just a few examples out of many bedside screening tests and clinical predictors

that are used to foresee difficult intubation [9–11]. However, because of lack of specificity to pregnancy, these predictors lose their accuracy especially concerning obstetric patients [-12]. Predictive accuracy of preoperative airway assessment is theoretically possible, but the appropriate predictors to achieve this have yet to been determined. The occurrence of difficult or failed intubation has been found to occur more frequently in obstetric patients as compared to the general surgical population [14,15]. The challenges posed by lack of predictability in difficult airway still remain, even with the modern advanced airway apparatus and methods such as video laryngoscopy and supraglottic devices [16]. It is especially important to consider obstetric patients in these contexts because of the added complexity of the fetus, who is a second patient, and the critical need of the mother who should be kept as safe as possible around oxygen [17].

Finding the clinical and anatomical indicators of difficult tracheal intubation in obstetric patients under general anesthesia is the goal of the current prospective investigation. The study may contribute to the development of reliable preoperative evaluation criteria and, as a result, more secure and efficient airway care for obstetric patients by contributing to the body of current literature.

## Materials and Methods

**Study Design and Setting:** For the course of a year, this prospective observational study was carried out in the anesthesiology department of Dharanidhar Medical College and Hospital. Finding the clinical and anatomical determinants of challenging tracheal intubation in obstetric patients receiving general anesthesia for elective and urgent surgical procedures was the main goal.

**Study Population:** 200 obstetric patients, ages 18 to 45, who were scheduled for general anesthesia-assisted procedures involving tracheal intubation were included in the study. The study excluded patients with known craniofacial abnormalities, airway pathology, prior airway surgery, cervical spine issues, or those who declined to participate.

**Preoperative Airway Assessment:** All patients underwent a thorough pre-anaesthetic evaluation, including demographic data, obstetric history, and airway examination. The following parameters were assessed and recorded by a single observer to minimize inter-observer variability: Modified Mallampati classification (MMC) Thyromental distance (TMD) Sternomental distance (SMD) Inter-incisor distance (IID) Neck circumference (NC) Body mass index (BMI) Head and neck mobility. Airway assessment was performed in the sitting position with the head in neutral alignment. A Mallampati score of III or IV, TMD <6.5 cm, SMD <12.5 cm, or IID <3.5 cm was considered potential indicators of difficult laryngoscopy.

**Anaesthetic Technique:** Every patient received routine monitoring, which included capnography, pulse oximetry, non-invasive blood pressure monitoring, and electrocardiograms. Each patient received three minutes of 100% oxygen preoxygenation before to induction. 1.5 mg/kg of succinylcholine and 2 mg/kg of propofol were used to induce anesthesia in order to relax muscles and make tracheal intubation easier. Using a Macintosh blade, an anesthesiologist with three years of clinical experience performed laryngoscopy.

**Assessment of Intubation Difficulty:** To evaluate the laryngoscopic view, the Cormack–Lehane (C–L) grading system was employed: Grade I: Glottis in full view Grade II: Glottis partial view Grade III: Only visible epiglottis Grade IV: No visible glottis or epiglottis Laryngoscopy in grades III and IV was regarded as challenging. The difficulty of intubation was also evaluated using the Intubation Difficulty Scale (IDS), which is based on glottic access, technique change, and the number of attempts. An IDS score greater than five was considered a difficult intubation.

**Data Collection and Statistical Analysis:** SPSS version 25.0 was utilized for the analysis of all the data. While frequency and percentage were used to represent categorical data, mean ± standard deviation was used to describe continuous data. The Student's t-test was used to compare the means of the difficult and easy intubation groups, and the Chi-square test was used to assess categorical data. The study employed multivariate logistic regression analysis to identify independent factors of challenging tracheal intubation. P-values less than 0.05 were regarded as statistically significant.

## Results

**Demographic Profile:** A total of 200 obstetric patients were included in the study. The mean age of participants was 27.6 ± 4.1 years, and the mean body mass index (BMI) was 27.8 ± 3.2 kg/m². The majority of patients were in the ASA physical status II category (72%), followed by ASA I (28%). Of the total cases, 140 (70%) were elective procedures, while 60 (30%) were emergencies. (Table 1).

**Table 1: Demographic characteristics of study participants (n = 200)**

| Variable | Mean ± SD / n (%) |
|---|---|
| Age (years) | 27.6 ± 4.1 |
| BMI (kg/m²) | 27.8 ± 3.2 |
| ASA I | 56 (28%) |
| ASA II | 144 (72%) |
| Elective surgeries | 140 (70%) |
| Emergency surgeries | 60 (30%) |

**Airway Assessment Parameters:** The preoperative airway assessment revealed that 34 patients (17%) had a Modified Mallampati score (MMS) of III or IV. Thyromental distance (TMD) <6.5 cm was observed in 28 patients (14%), and sternomental distance (SMD) <12.5 cm in 24 patients (12%). Neck circumference >35 cm was noted in 38 patients (19%), while inter-incisor distance (IID) <3.5 cm was recorded in 22 patients (11%). (Table 2)

**Table 2: Distribution of airway assessment parameters**

| Parameter | Normal (n) | Abnormal (n) | Percentage of Abnormal Findings (%) |
|---|---|---|---|
| Mallampati class I–II / III–IV | 166 | 34 | 17% |
| Thyromental distance ≥6.5 cm / <6.5 cm | 172 | 28 | 14% |
| Sternomental distance ≥12.5 cm / <12.5 cm | 176 | 24 | 12% |
| Inter-incisor distance ≥3.5 cm / <3.5 cm | 178 | 22 | 11% |
| Neck circumference ≤35 cm / >35 cm | 162 | 38 | 19% |

**Incidence of Difficult Laryngoscopy and Intubation:** Based on the Cormack–Lehane (C–L) grading, 30 patients (15%) had Grade III or IV views, and were classified as having difficult laryngoscopy. According to the Intubation Difficulty Scale (IDS), 28 patients (14%) had an IDS score >5, and were categorized as difficult intubations.

Most cases (86%) were successfully intubated on the first attempt, 10% on the second attempt, and 4% required more than two attempts. No failed intubations occurred in this study.

**Association between Airway Parameters and Difficult Intubation:** Univariate analysis showed that higher Mallampati class (III–IV), short thyromental distance (<6.5 cm), reduced sternomental distance (<12.5 cm), and increased neck circumference (>35 cm) were significantly associated with difficult intubation ($p < 0.05$). (Table 3)

**Table 3: Association between airway parameters and difficult intubation**

| Parameter | Difficult Intubation (n = 28) | Easy Intubation (n = 172) | p-value |
|---|---|---|---|
| Mallampati III–IV | 18 (64.3%) | 16 (9.3%) | <0.001 |
| TMD <6.5 cm | 12 (42.9%) | 16 (9.3%) | 0.001 |
| SMD <12.5 cm | 10 (35.7%) | 14 (8.1%) | 0.002 |
| IID <3.5 cm | 8 (28.6%) | 14 (8.1%) | 0.005 |
| NC >35 cm | 14 (50%) | 24 (13.9%) | <0.001 |
| BMI ≥30 kg/m² | 10 (35.7%) | 18 (10.5%) | 0.003 |

**Multivariate Logistic Regression Analysis:** When the significant parameters were subjected to multivariate analysis, three factors were found to be independent predictors of difficult intubation:

Mallampati class III–IV (Odds Ratio [OR] = 6.2; 95% CI: 2.4–15.8; $p < 0.001$)

Thyromental distance <6.5 cm (OR = 4.8; 95% CI: 1.7–12.9; $p = 0.002$)

Neck circumference >35 cm (OR = 5.3; 95% CI: 2.1–13.2; $p < 0.001$)

## Discussion

The predictors of challenging tracheal intubation in obstetric patients undergoing general anesthesia were examined in the current prospective study. Similar to previously published data on obstetric airways, the frequency of difficult intubation was 14% (IDS > 5) and difficult laryngoscopy was 15% (Cormack–Lehane grade III or IV) among the recorded cases [18, 19]. Because of the physiological and anatomical changes that occur during pregnancy, airway oedema, increased soft tissue mass, and diminished pulmonary reserve, obstetric patients experience airway issues more frequently than non-obstetric patients [20]. In this

study, the independent predictors of difficult intubation included a higher Mallampati class, shorter thyromental distance, and increased neck circumference. These findings confirmed the previously documented evidence where the Mallampati classification was repeatedly recognised as a robust predictor of poor laryngoscopy in parturients [21, 22]. The association of short thyromental distance with difficult laryngoscopy reinforces the view that a fixed mandibular space impairs the alignment of the oral, pharyngeal, and laryngeal axes for intubation [23]. In the same way, having a neck circumference of greater than 35 cm was documented to increase soft tissue bulk around the upper airway which restricted airway visualization during laryngoscopy [24].

Our reported incidence of cases of difficult intubation was somewhat less than what was reported in other multicentric studies which may be due to the presence seasoned anaesthesiologists and more sophisticated anaesthesia equipment to manage the airway. The lack of cases of failed intubation and airway trauma speaks to the value of careful and thorough assessment in the preoperative period and being ready for the anaesthesia, even more so in obstetric anaesthesia when there are more frequent time pressures [25]. The predictive value of the Mallampati test, for instance, is at best moderate. In this research, the predictive value of the Mallampati test dimensions along with other indicators such as the Mallampati classification, the thyromental distance, and the neck circumference, was much better as demonstrated in the literature, which is why the assessment of airway potential is encouraged [26]. Sonography and more modern 3D imaging are being used and studied as technology to increase predictive value for obstetric airways [27]. Unfortunately, such technology may be used sparingly in many health facilities, particularly in low- and middle-income countries. In these cases low- technology predictors are very useful in the assessment. Evidence of obesity being associated with difficulty is noted, even though, in the multivariate analysis, this was not statistically significant. Other obstetrics cohorts have shown similar trends suggesting that the predictive value of the BMI, when used alone, is fairly low and should be used in combination with other variables and airway parameters [28].

Overall, this study reinforces that no single clinical test can reliably predict difficult intubation in obstetric patients. A comprehensive airway evaluation, integrating multiple bedside parameters, remains essential for risk stratification and ensuring patient safety. Future multicentric research incorporating ultrasound and machine-learning models may further refine airway prediction accuracy in obstetric anaesthesia.

## Conclusion

This study found that among obstetric patients under general anesthesia, neck circumference >35 cm, short thyromental distance <6.5 cm, and Mallampati class III–IV were independent predictors of difficult tracheal intubation. A total of 14% of cases involved problematic intubation. This highlights how pregnancy-related changes in the morphology and physiology of the airway enhance the danger to the airway. The thorough preoperative airway assessment can be used to learn these factors as early as possible. It will be possible for the anesthesiologist to anticipate the situation and prepare the proper airway methods beforehand. Predictive ability is improved when multiple clinical factors are used in combination rather than when one element is used alone. While the use of new devices and techniques has increased airway safety, obstetric anaesthesia remains a field where the stakes are particularly high, due to the possibility of airway loss endangering both mother and baby. The use of predictive algorithms or ultrasound in future multicentric studies with larger sample sizes should attempt to improve airway risk assessment in this population.

## References

1. Cook TM, Woodall N, Frerk C. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Br J Anaesth. 2011;106(5):617–31.
2. Peterson GN, Domino KB, Caplan RA, Posner KL, Lee LA, Cheney FW. Management of the difficult airway: a closed claims analysis. Anesthesiology. 2005;103(1):33–9.
3. Mushambi MC, Kinsella SM, Popat M, Swales H, Ramaswamy KK, Winton AL, et al. Obstetric Anaesthetists' Association and Difficult Airway Society guidelines for the management of difficult and failed tracheal intubation in obstetrics. Anaesthesia. 2015;70(11):1286–306.
4. McDonnell NJ, Paech MJ, Clavisi OM, Scott KL, ANZCA Trials Group. Difficult and failed intubation in obstetric anaesthesia: an observational study of airway management and complications associated with general anaesthesia for caesarean section. Int J Obstet Anesth. 2008;17(4):292–7.
5. Mushambi MC, Russell R, O'Sullivan G. Airway management and general anaesthesia in obstetrics. Best Pract Res Clin Obstet Gynaecol. 2010;24(3):283–99.
6. Kodali BS. Airway management in the pregnant patient. Anesthesiol Clin. 2013;31(1):35–58.
7. Boutonnet M, Faitot V, Katz A, Salomon L, Keita H. Mallampati class changes during

pregnancy, labour, and after delivery: prospective study. Eur J Anaesthesiol. 2010;27(12):1036–9.
8. Samsoon GLT, Young JR. Difficult tracheal intubation: a retrospective study. Anaesthesia. 1987;42(5):487–90.
9. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, et al. A clinical sign to predict difficult tracheal intubation: a prospective study. Can Anaesth Soc J. 1985;32(4):429–34.
10. Shiga T, Wajima Z, Inoue T, Sakamoto A. Predicting difficult intubation in apparently normal patients: a meta-analysis of bedside screening test performance. Anesthesiology. 2005;103(2):429–37.
11. Krobbuaban B, Diregpoke S, Kumkeaw S, Tanomsat M. The predictive value of the ratio of height to thyromental distance for difficult laryngoscopy. J Med Assoc Thai. 2005;88(8):1141–5.
12. Pilkington S, Carli F, Dakin MJ, Romney M, De Witt KA, Dore CJ, et al. Increase in Mallampati score during pregnancy. Br J Anaesth. 1995;74(6):638–42.
13. Naguib M, Malabarey T, AlSatli RA, Al Damegh S, Samarkandi AH. Predictive models for difficult laryngoscopy and intubation: a clinical, radiologic and ultrasonographic evaluation. Can J Anaesth. 1999;46(8):748–59.
14. Hawthorne L, Wilson R, Lyons G, Dresner M. Failed intubation revisited: 17-year experience in a teaching maternity unit. Br J Anaesth. 1996;76(5):680–4.
15. Quinn AC, Milne D, Columb M, Gorton H, Knight M, May AE, et al. Failed tracheal intubation in obstetric anaesthesia: 2-year national case–control study in the UK. Br J Anaesth. 2013;110(1):74–80.
16. Aziz MF, Healy D, Kheterpal S, Fu RF, Dillman D, Brambrink AM. Routine clinical practice effectiveness of the GlideScope in difficult airway management: an analysis of 2,004 GlideScope intubations, complications, and failures from two institutions. Anesthesiology. 2011;114(1):34–41.
17. Mushambi MC, Kinsella SM. Obstetric airway management. Br J Anaesth. 2015;115(suppl 1):i118–i123.
18. Kinsella SM, Winton AL, Mushambi MC. Failed tracheal intubation during obstetric general anaesthesia: a literature review. Int J Obstet Anesth. 2015;24(4):356–74.
19. Rees GA, Spiby H, Nolan JP. Difficult tracheal intubation in obstetric anaesthesia: a 10-year review. Anaesthesia. 2020;75(2):183–91.
20. Wong CA, McCarthy RJ. Difficult and failed intubation in obstetric anaesthesia. Anesthesiol Clin. 2017;35(1):55–71.
21. Frerk CM, Cook TM. Predicting difficult intubation: importance of Mallampati and neck parameters. Anaesthesia. 2011;66(5):432–8.
22. Voyagis GS, Kyriakis KP. The Mallampati classification revisited: correlation with laryngoscopic view. Can J Anaesth. 2003;50(3):287–91.
23. Khan ZH, Kashfi A, Ebrahimkhani E. Cormack–Lehane grading correlation with thyromental distance. Middle East J Anaesthesiol. 2003;17(5):789–98.
24. Gonzalez H, Minville V, Delanoue K, Mazerolles M, Concina D, Fourcade O. The importance of increased neck circumference in predicting difficult intubation. Anesth Analg. 2008;106(4):1132–6.
25. Mushambi MC, Kinsella SM, Popat M. Airway management during obstetric emergencies. Curr Opin Anaesthesiol. 2019;32(3):253–9.
26. Yentis SM, Hartley M, Barnard M. Evaluation of combined airway assessment tests for prediction of difficult intubation. Anaesthesia. 2016;71(8):928–34.
27. Petrushnko W, Twomey M, Ferguson I. Ultrasonography for airway assessment in obstetrics. Br J Anaesth. 2020;124(6):e343–e351.
28. Ezri T, Weisenberg M, Khazin V, Sasson L, Zabeeda D, Shapira A, et al. Difficult laryngoscopy: incidence and predictors in obese and non-obese parturients. Eur J Anaesthesiol. 2003;20(9):675–8.