“EVALUATION OF DIFFERENT AIRWAY TESTS IN PREDICTING DIFFICULT AIRWAY IN ELDERLY DIABETIC AND NON- DIABETIC PATIENT’S UNDERGOING SURGERY UNDER GENERAL ANAESTHESIA”

By

Dr. SADVI A. S

DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

In partial fulfillment of the requirements for the degree of

DOCTOR OF MEDICINE
IN
ANAESTHESIOLOGY

Under the Guidance of

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PRIOR PERMISSION TO START OF STUDY

The Institutional Ethics Committee of Sri Devaraj Urs Medical College, Tamaka, Kolar has examined and unanimously approved the synopsis entitled **"Evaluation Of Different Airway Tests In Prediciting Difficult Airway In Eldery Diabetic And Non Diabectic Patiens Undergoing Surgery Under General Anaesthesia"** being investigated by **Dr.Sadvi A S & Dr. Sujatha M P** in the Department of Anaesthesiology at Sri Devaraj Urs Medical College, Tamaka, Kolar. **Permission is granted by the Ethics Committee to start the study.**

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ABSTRACT

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Methods: This prospective observational study included 92 diabetic and 92 non-diabetic patients aged ≥60 years scheduled for elective surgery under general anesthesia. Preoperative airway assessment included Modified Mallampati Score (MMS), Upper Lip Bite Test (ULBT), and Palm Print Sign (PPS). Intraoperative findings of Cormack-Lehane grading, number of intubation attempts, time taken for intubation, and need for alternative methods were recorded. The predictive value of each airway test for difficult laryngoscopy was analyzed.

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EVALUATION OF DIFFERENT AIRWAY TESTS IN PREDICTING DIFFICULT AIRWAY IN ELDERLY DIABETIC AND NON- DIABETIC PATIENT'SUNDERGOING SURGERY UNDER GENERAL ANAESTHESIA. ABSTRACT Introduction: Diabetes mellitus is associated with changes in connective tissue and joint mobility that may affect airway anatomy and increase the risk of difficult intubation. The purpose of this research was to investigate and compare the effectiveness of several airway assessment measures in forecasting problematic airways among older diabetic and non-diabetic individuals having general anesthesia. Methods: This prospective observational study included "92 diabetic and 92 non-diabetic patients aged ≥60 years scheduled for elective surgery under general anesthesia. Preoperative airway assessment included Modified Mallampati Score (MMS), Upper Lip Bite Test (ULBT), and Palm Print Sign (PPS). Intraoperative findings of Cormack-Lehane grading, number of intubation attempts, time taken for intubation, and need for alternative methods were recorded. The predictive value of each airway test for difficult laryngoscopy was analyzed. Results: Demographic profiles were comparable between groups. Class III ULBT was significantly more prevalent in diabetic patients (38.0% vs. 4.3%, $p < 0.001$), as were difficult Palm Print Sign grades (26.1% vs. 7.6%, $p = 0.001$). Difficult laryngoscopy was encountered in 34.8% of diabetic patients compared to 17.6% of non-diabetic patients ($p = 0.010$). Prolonged intubation time (>1 minute) was significantly more frequent in diabetic patients (10.9% vs. 3.3%, $p = 0.048$). In diabetic patients, ULBT demonstrated the highest sensitivity (90.6%) and excellent specificity (90.0%) for predicting difficult laryngoscopy, followed by MMS (sensitivity 75.0%, specificity 100%) and PPS (sensitivity 65.6%, specificity 95.0%). In non-diabetic patients, MMS showed the highest sensitivity (75.0%), while ULBT and PPS had lower sensitivity but excellent specificity. Conclusion: Elderly diabetic patients have a significantly higher incidence of difficult laryngoscopy and prolonged intubation time compared to non-diabetic patients. Upper Lip Bite Test is the most sensitive predictor of difficult laryngoscopy in elderly diabetic patients, while Modified Mallampati Score performs better in non-diabetic patients". Comprehensive preoperative airway assessment using multiple tests is recommended for elderly diabetic patients to anticipate and manage difficult airways effectively. Keywords: Diabetes mellitus, Difficult airway, Elderly patients, Upper Lip Bite Test, Modified Mallampati Score, Palm Print Sign, Cormack-Lehane grade, General anesthesia. INTRODUCTION The control of the airway continues to be one of the most basic and essential aspects of anesthesia treatment. Despite significant advancements in anaesthesiology, difficult airway scenarios continue to be a significant cause of morbidity and mortality in both elective and emergency settings. The "Fourth National Audit Project (NAP4) conducted by the Royal College of Anaesthetists and the Difficult Airway Society" revealed that complications of airway management were the leading causes of anaesthesia-related deaths, with inadequate assessment and planning being major contributing factors.1 The ability to predict a difficult airway preoperatively is, therefore, of paramount importance as it allows anaesthesiologists to formulate effective airway management strategies, prepare appropriate equipment, and potentially avert life-threatening complications.

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Keywords: Diabetes mellitus, Difficult airway, Elderly patients, Upper Lip Bite Test, Modified Mallampati Score, Palm Print Sign, Cormack-Lehane grade, General anaesthesia.

ABBREVIATIONS

ASA	American Society of Anesthesiologists
BMI	Body Mass Index
CL	Cormack Lehane
DM	Diabetes Mellitus
DTI	Difficult Tracheal Intubation
ETT	Endotracheal Tube
GA	General Anesthesia
LEMON	Look Evaluate Mallampati Obstruction Neck mobility
LJM	Limited Joint Mobility
MMS	Modified Mallampati Score
NPV	Negative Predictive Value
OHA	Oral Hypoglycemic Agents
PPV	Positive Predictive Value
PPS	Palm Print Sign
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
TMD	Thyromental Distance
TMJ	Temporomandibular Joint
ULBT	Upper Lip Bite Test

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INTRODUCTION

INTRODUCTION

The control of the airway continues to be one of the most basic and essential aspects of anesthesia treatment. Despite significant advancements in anaesthesiology, difficult airway scenarios continue to be a significant cause of morbidity and mortality in both elective and emergency settings. The "Fourth National Audit Project (NAP4) conducted by the Royal College of Anaesthetists and the Difficult Airway Society" revealed that complications of airway management were the leading causes of anaesthesia-related deaths, with inadequate assessment and planning being major contributing factors.[1] The ability to predict a difficult airway preoperatively is, therefore, of paramount importance as it allows anaesthesiologists to formulate effective airway management strategies, prepare appropriate equipment, and potentially avert life-threatening complications.

The "American Society of Anaesthesiologists (ASA) defines a difficult airway as the clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with facemask ventilation, difficulty with tracheal intubation, or both". The incidence of difficult airway varies widely in the literature, ranging from 1.5% to 13% for difficult laryngoscopy, 1.2% to 3.8% for difficult intubation, and 0.05% to 0.35% for failed intubation.[2] This variation reflects the heterogeneity in patient populations, differences in the definitions of difficulty, and varying levels of experience among practitioners.

The challenge of predictive airway assessment lies in balancing sensitivity and specificity. An overly sensitive test would lead to unnecessary preparation and potential exposure to risks associated with awake intubation techniques, while an overly specific test might miss genuine cases of difficult airways, resulting in potentially catastrophic consequences. For assisting in the preoperative identification of patients who may have potentially challenging airways, a number of clinical predictors and bedside tests have been devised. Among them are the

Mallampati classification, the thyromental distance, the sternomental distance, the mouth opening, the neck mobility, the upper lip bite test, and the Wilson risk score. However, this list is not exhaustive. However, there is not a single test that has showed adequate sensitivity and specificity to be utilized on its own. As a result, it is recommended that a mix of tests be employed in order to increase the accuracy of prediction models[3]

An evaluation of the visibility of oropharyngeal structures is performed using the Mallampati classification, which is one of the most extensively used instruments for assessing the airway. This evaluation is then correlated with the ease of laryngoscopy. It was initially described by “Mallampati in 1985 and later modified by Samson and Young. A systematic review and meta-analysis by Lundstrøm et al. found that the modified Mallampati test had a sensitivity of 55% and a specificity of 84% for difficult intubation.[4] While these figures suggest moderate utility, they also highlight the limitations of relying on a single assessment method. The thyromental distance, which measures the straight distance from the thyroid notch to the mental protuberance with the neck fully extended, has been found to have a sensitivity of 20-62% and a specificity of 82-99%. Similarly, the sternomental distance, mouth opening, and neck mobility each have their own predictive values and limitations.[5]

Diabetes mellitus, a prevalent chronic condition, especially among the elderly, introduces additional complexities to airway management. The pathophysiological changes associated with diabetes, particularly long-standing diabetes, can affect the upper airway and potentially contribute to a higher incidence of difficult intubation. The concept of "diabetic stiff joint syndrome" or "limited joint mobility syndrome," a manifestation of the non-enzymatic glycosylation of collagen in joints, can result in reduced mobility of the atlantooccipital joint, potentially affecting neck extension and, consequently, laryngoscopic view. Erden et al. conducted a study comparing diabetic and non-diabetic patients and found a higher incidence of difficult intubation in the diabetic group, with a significant correlation between the duration of diabetes and the degree of airway difficulty.[7]

The palm print sign, which assesses the mobility of small joints in the hand and has been proposed as a surrogate marker for atlantooccipital joint mobility, has shown promise in predicting difficult intubation in diabetic patients. Vani et al. reported that the palm print sign had a sensitivity of 75% and a specificity of 85% for predicting difficult intubation in diabetic patients.[8] This suggests that diabetes-specific assessment tools may have a role in airway evaluation for diabetic patients. Additionally, diabetic patients may have an increased incidence of periodontal disease and subsequent tooth loss, which can impact the ease of laryngoscopy and mask ventilation.

In this complex landscape of airway management, the current study seeks to evaluate the efficacy of different airway assessment tests in predicting difficult airways specifically in elderly diabetic and non-diabetic patients undergoing surgery under general anaesthesia. By focusing on this specific demographic, the study aims to provide evidence-based guidance for anaesthesiologists managing the airways of elderly patients, with or without diabetes, in the perioperative setting. The findings could potentially inform the development of tailored assessment protocols for these high-risk groups, ultimately contributing to improved patient safety and outcomes in anaesthesia practice.

Difficult Intubation:

A "difficult airway" refers to a scenario in which a healthcare professional, proficient in airway management, encounters or anticipates challenges in laryngoscopy, tracheal intubation, and, crucially, lung oxygenation. It may be predicted based on a patient's anatomical or pathological characteristics or may arise unexpectedly during the surgery. Certain patients may have challenges during extubation.[11]

Airway management is a key feature in the safety and quality of anaesthesia. During the period from 2008 to 2009, the Fourth National Audit Project (NAP4) of the Royal College of Anaesthetists of the UK and Ireland and the Difficult The Airway Society documented 133 significant adverse airway events (one every 22,000 interventions) and 16 fatalities due to airway management (one per 180,000) in the UK and Ireland under anesthesia, with substantial consequences included death, brain injury, and emergency surgical airway intervention. NAP4 emphasized that the actual prevalence might be over 4 times higher. NAP4 also found that the top two factors leading to the above airway complications were the patient characteristics (77% of cases) and misjudgment by medical staff (59%).[12]

Some findings from the Fourth National Audit Project (NAP4) of the Royal College of Anaesthetists and the Difficult Airway Society (DAS)" executive summary (2011) include:[13]

- Failure to assess the airway
- Failure to have a "plan B or plan C when the initial plan fails
- Failure to proceed with awake fiberoptic intubation even when indicated
- Repeated attempts at intubation despite deteriorating oxygenation
- Obesity as a risk factor for difficulty
- Failure of emergency percutaneous cricothyrotomy
- Aspiration with repeated intubation attempts resulting in death
- Failure to recognize an esophageal intubation

The incidence of severe complications including death, hypoxic brain injury, or emergency surgical airway was 1 in 22,000 in a database of 2.9 million general anaesthetics. This database showed the incidence of complications was 35 times higher in emergency departments and 55 times higher in intensive care units. It is likely that not all critical events were reported and that the incidence was higher than stated.[14]

There were similarly discouraging conclusions found in the American Society of Anaesthesiologists (ASA) closed-claims analysis. In some cases, healthy patients were undergoing elective surgery.[15] These represent many opportunities to improve patient safety and outcomes.

It was reported that the prevalence of a difficult airway ranged from 11% to 50% for tracheal intubations performed outside of the operating room (OR). Identifying a potentially difficult airway is also important in non-operation room sites such as the intensive care unit (ICU) and emergency room (ER).[16]

An unpredicted difficult airway can result in failed intubation and, if ventilation is difficult, can evolve to a “cannot ventilate, cannot intubate” (CVCO) scenario, with risk of hypoxic-ischemic brain injury, and death. While unanticipated difficult airways have always been a challenge for anaesthesiologists, critical care, and emergency physicians, appropriate preoperative assessment can enable detection of most difficult airways allowing appropriate preparation and management.[16]

Focusing on a balance between precise assessment and medical resource utilization, this consensus aims to present an effective solution for airway assessment in anaesthetic and critical care emergency settings, to standardize the evaluation algorithm, reduce airway-related complications, and improve safety.

It is important to be precise in terminology when documenting an airway procedure. Is there a difficult or failed mask ventilation? Is there a difficult or failed direct or video laryngoscopy?

Is there difficult tracheal intubation due to endotracheal tube delivery? Is there a difficult or failed supraglottic airway placement?" These questions must be answered in detail so that the next provider will have the necessary information to proceed safely with the patient's airway management.

ANATOMY :[17]

During the process of breathing, the organs of the respiratory tract that are responsible for allowing airflow are referred to as the airway or respiratory tract. From the nares and the buccal aperture all the way to the blind end of the alveolar sacs, they extend their reach. They are subdivided into different regions with various organs and tissues to perform specific functions. The airway can be subdivided into the "upper and lower airway, each of which has numerous subdivisions as follows.

Upper Airway:

The pharynx is the mucous membrane-lined portion of the airway between the base of the skull and the esophagus and is subdivided as follows:

- Nasopharynx, also known as the "rhino-pharynx, post-nasal space, is the muscular tube from the nares, including the posterior nasal cavity, separated from the oropharynx by the palate and lining the skull base superiorly
- The oro-pharynx connects the Naso and hypopharynx. It is the region between the palate and the hyoid bone, anteriorly divided from the oral cavity by the tonsillar arch
- The hypopharynx connects the oropharynx to the esophagus and the larynx is the region of pharynx below the hyoid bone.

The larynx is the segment of the airway situated between the pharynx and the trachea, housing the organs responsible for speech production. It is formed of a cartilaginous skeleton of nine cartilages, and includes the important organs of the epiglottis and the vocal folds (vocal cords) which are the opening to the glottis.

Lower Airway:

The trachea is a ciliated pseudostratified columnar epithelium-lined tubular structure supported by C-shaped rings of hyaline cartilage. The flat open surface of these C rings opposes the esophagus to allow its expansion during swallowing. The trachea bifurcates and therefore terminates, superior to the heart at the level of the sternal angle.

The bronchi, the main bifurcation of the trachea, are similar in structure but have complete circular cartilage rings.

- Main bronchi: There are two supplying ventilations to each lung. The right main bronchus has a larger diameter and is aligned more vertically than the left
- Lobar bronchi: Two on the left and three on the right supply each of the main lobes of the lung
- Segmental bronchi supply individual bronchopulmonary segments of the lungs.

Bronchioles lack supporting cartilage skeletons and have a diameter of around 1 mm. They are initially ciliated and graduate to the simple columnar epithelium and their lining cells no longer contain mucous producing cells.

- Conducting bronchioles conduct airflow but do not contain any mucous glands or seromucous glands
- Terminal bronchioles are the last division of the airway without respiratory surfaces

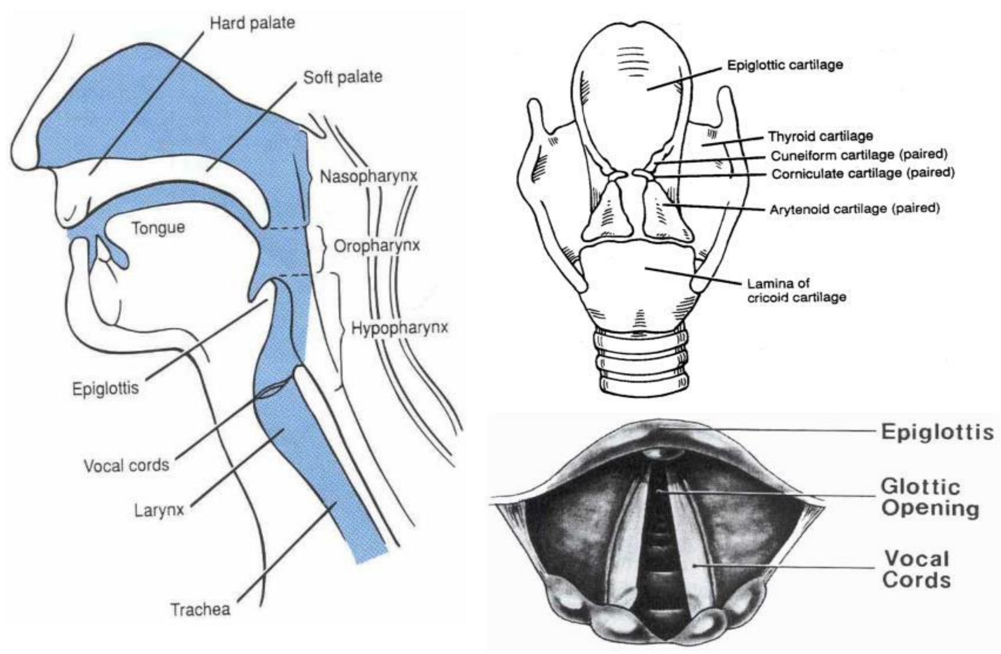
- Respiratory bronchioles contain occasional alveoli and have surface surfactant-producing cells, they each give rise to between two and 11 alveolar ducts.

- Alveoli is the final portion of the airway and is lined with a single-cell layer of pneumocytes and in proximity to capillaries. They contain surfactant producing type II pneumocytes and Clara cells.

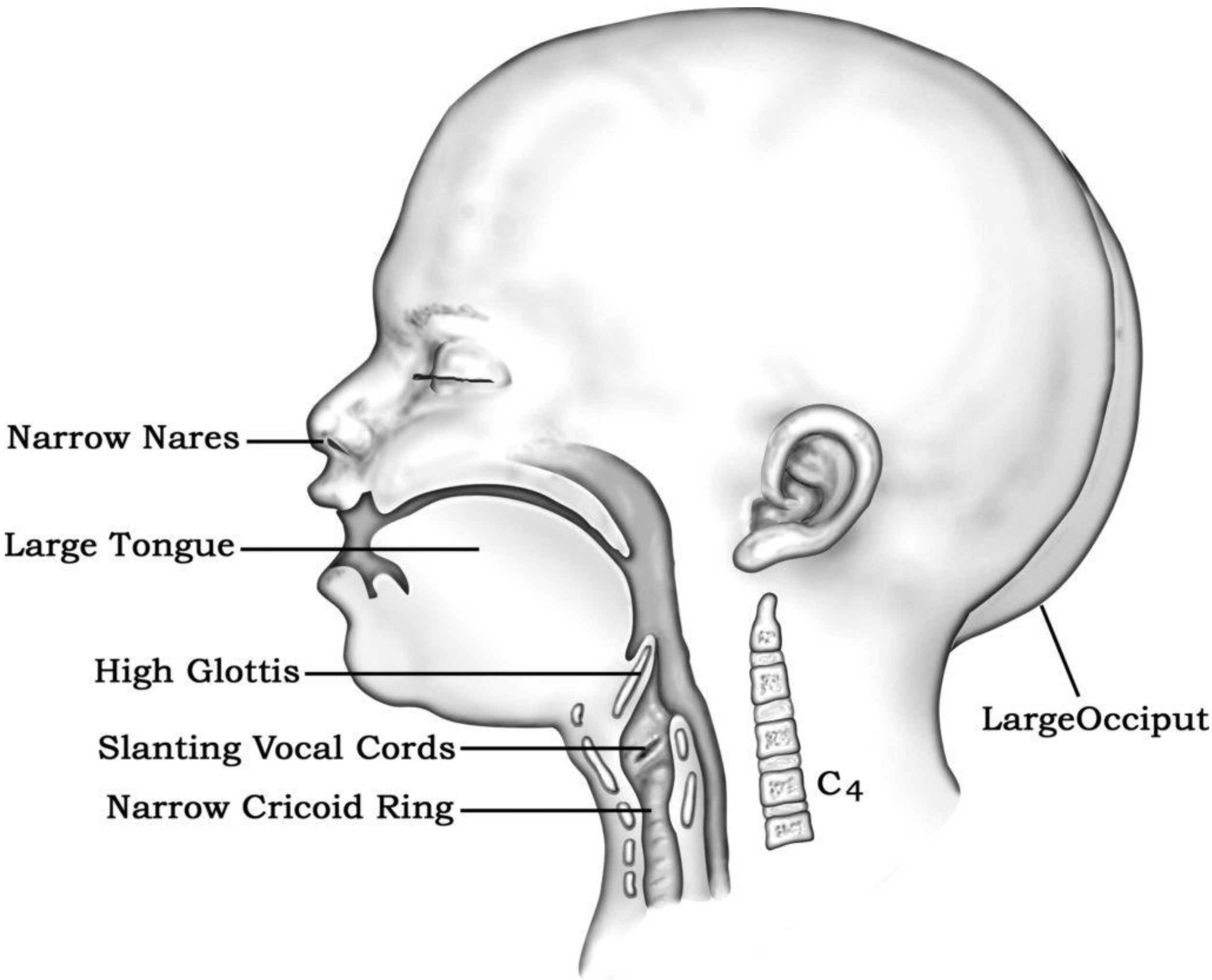
- Alveolar ducts are tubular portions with respiratory surfaces from which the alveolar sacs bud.

- Alveolar sacs are the blind-ended spaces from which the alveoli clusters are formed and to where they connect. These are connected by pores which allow air pressure to equalize between them. Together, with the capillaries, they form the air-blood barrier.

ANATOMY OF AIRWAY

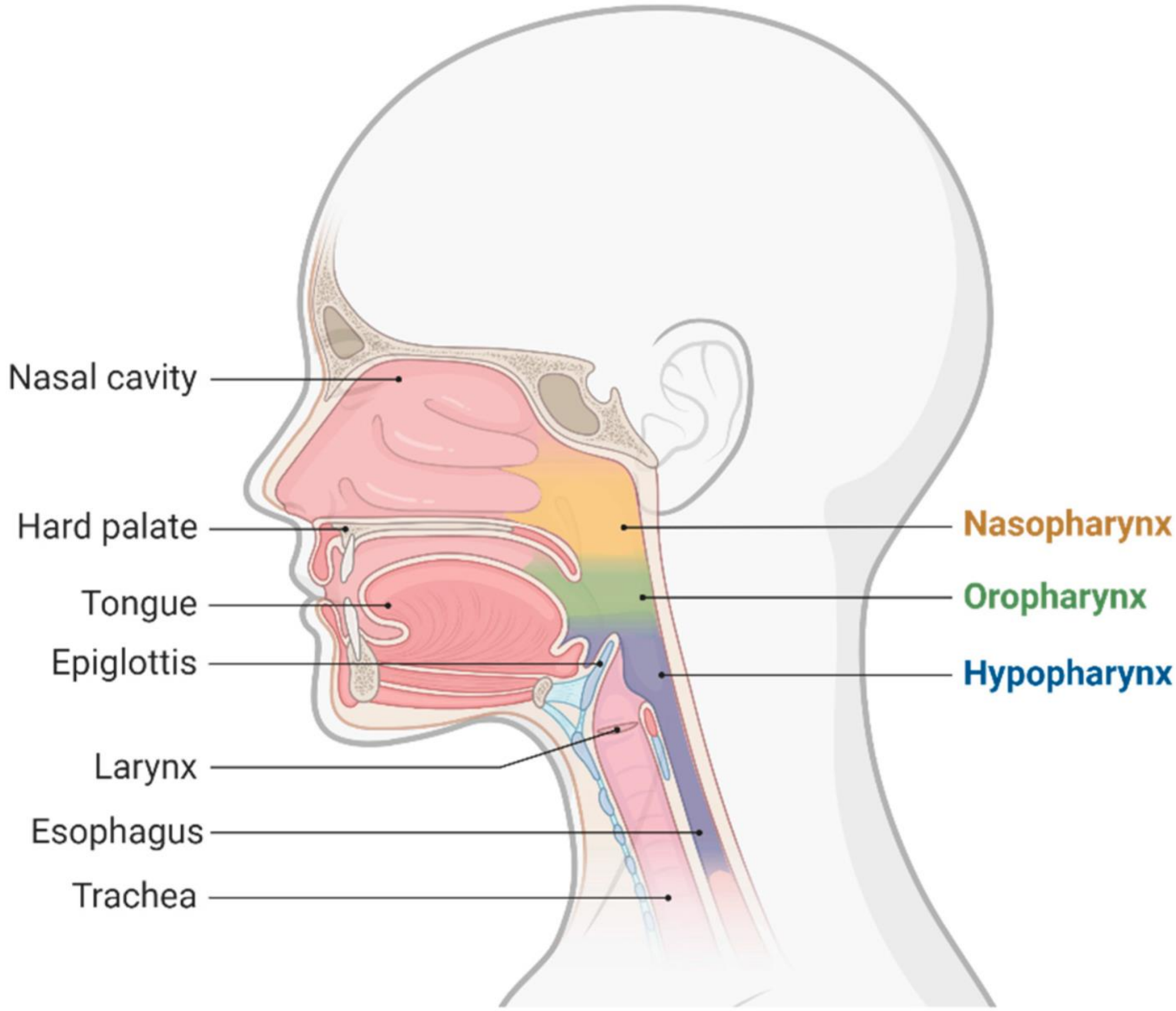


Some anatomic predictors of difficult intubation include: small mouth opening, short thyromental distance, full set of teeth with prominent incisors, reduced mandibular protrusion, reduced submandibular compliance, short neck, large neck circumference, limited neck extension, Mallampati 3 or 4, obesity, surgery or radiation-induced changes. These are not often critical but do additively contribute to a higher likelihood of difficult direct laryngoscopy but may not for video laryngoscopy.



In addition to the anatomical airway factors, the physiologically difficult airway is a newer concept in airway assessment. This assessment encompasses that airway management is difficult due to hypoxia, hypotension, severe metabolic acidosis, or right ventricular failure".

There can also be contextual issues that contribute to difficult or failed airway management. Examples may be the skill level of the clinician, available help, proper equipment, or patient factors such as intoxication or disability.



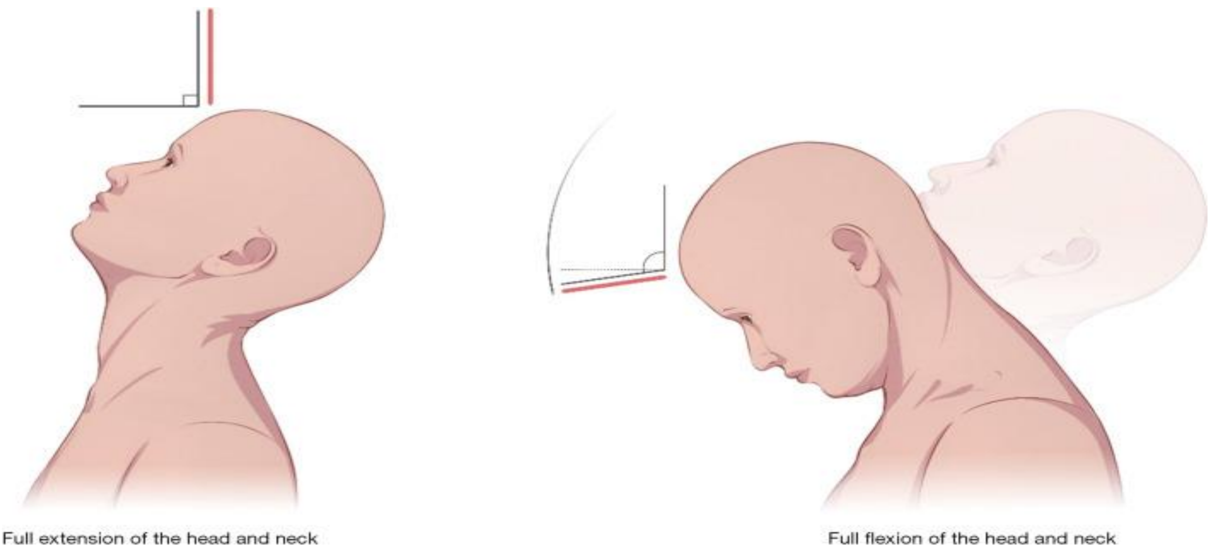
PHYSICAL EXAMINATION PRIOR TO AIRWAY MANAGEMENT:[16]

Numerous physical indicators observable during bedside examination have shown to be significant in forecasting challenging airways. These are measurement and assessment of facial and mandibular features (cervical spine mobility, presence of "prominent upper incisors, presence of whiskers or beard, and upper lip bite test results) and some anatomical markers (modified Mallampati test score, reduced thyromental distance and sternomental distance, inter-incisor gap, neck circumference, the ratio of neck circumference to thyromental distance, the ratio of height to thyromental distance, the ratio of height to sternomental distance, hyoid-mental distance, and thyromental height).

Patients should be observed for obesity, increased overjet (the horizontal distance between the upper central incisors and the lower central incisors is normally 2–4mm), edentulousness, retrogenia and head and neck lesions.[29,30]

The term "inter-incisor gap" describes the space that exists between the incisal margins of a patient's upper and lower incisors when the mouth of the patient is extended to its fullest extent. The width of open mouth is very important in airway management, and a gap <3.5 cm increases the chance of a difficult airway.[30]

During the process of evaluating the mobility of the cervical spine, the patient is instructed to bend their neck by moving their head forward and moving it downward. The patient is then asked to try and lift the face upwards to evaluate the extension of the lateral atlantoaxial joint. Decreased extension of the lateral atlantoaxial joint is related to difficult intubation. A greater degree of lateral atlantoaxial joint extension brings the oral axis towards the pharyngeal and laryngeal axis, and laryngoscopy is easiest to perform in the position with neck flexion and lateral atlantoaxial joint extension.[31]



The upper lip bite test evaluates mandibular movement by asking the patient to bite the upper lip as much as possible with the lower incisors. The ability of the patient to do so is graded into 3 classes: I, lower incisors can bite the upper lip above the vermilion line; II, lower incisors can bite the upper lip below the vermilion line; and III, lower incisors cannot bite the upper lip. Patients with grades II to III may have difficult airways.[32] In edentulous patients, it can be observed whether the lower lip can cover the upper lip.[33] In 2 meta-analyses, upper lip bite test was proven to be a good predictor of difficult laryngoscopy.[34]

Mandibular retrognathia (mandible measuring ≤9 cm) is associated with a difficult airway.

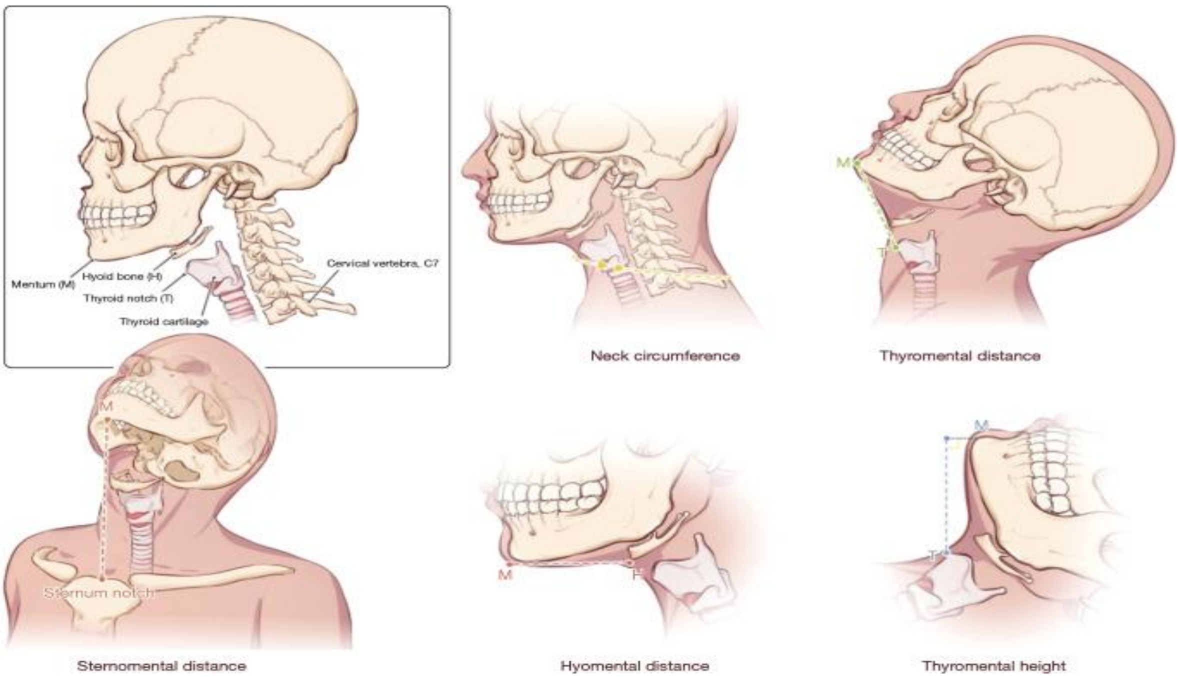
The mandibular protrusion is a marker of mandibular mobility and can reflect the relationship between the upper and lower incisors. Limited mandibular protrusion is associated with a difficult airway.[35,36]

For determining the link between the size of the tongue and the pharynx, the modified Mallampati test is the most often used method. The patient is instructed to take a seated posture, with the head in the neutral position, the mouth completely open, and the tongue protruding to its maximum extent without phonation. Based on the pharyngeal structures observed, the view is divided into 4 classes: I, uvula, faucial pillars, and soft palate are visible; II, uvula is covered by the tongue root and faucial pillars and the soft palate is visible; III, only the soft palate is visible; and IV, only the hard palate is visible. The modified Mallampati test is a commonly used physical examination for predicting difficult intubation, and grade III or IV is usually associated with difficult intubation.[37]

When the patient is seated in an upright position, a flexible ruler is used to measure the circumference of the neck at the level of the thyroid cartilage, which is located at the top border of the seventh cervical vertebra. A neck circumference >40 cm is associated with difficult mask ventilation, laryngoscopy, and endotracheal intubation. While neck circumference may not be able to clearly indicate the distribution of soft tissue in different regions of the neck, the amount of pretracheal soft tissue is more accurate in predicting difficult airways. The ratio of the neck circumference to thyromental distance is a new indicator that may better reflect the distribution of neck soft tissue. Current studies have shown that a ratio greater than five is accurate in predicting difficult airways.[38]

The thyromental distance and sternomental distance are commonly used to measure the distance from the mandibular mental process to the thyroid cartilage notch and the suprasternal fossa when the patient's head is tilted back as far as possible. The hyomental distance is the distance between the tip of the hyoid bone and the mental prominence when the patient's head is in the neutral position. A hyomental distance 3–5 cm and a thyromental distance 4–7 cm[39] are associated with difficult airways. These predictors may be more precise after correction for differences in body height. A ratio of height to thyromental distance ≥17–25 is associated with a difficult airway.[40] A ratio of height to sternomental distance ≥10.5 is also associated with a difficult airway.[40]

Thyromental height is a recently introduced metric that quantifies the distance from the front edge of the mentum to the thyroid cartilage when the patient is in a supine position. Studies have shown that a distance ≤50 mm has good sensitivity/specificity and predictive accuracy for difficult intubation.[41,42]



The detailed bedside tests include neck circumference, thyromental distance, sternomental distance, hyomental distance, thyromental height.

There is, however, considerable heterogeneity on the prediction of difficult airway by bedside physical examination, and no single feature has been identified as more predictive than another". Therefore, it is recommended that clinicians should use multiple approaches to predicting difficult airways.

DIFFICULT AIRWAY IN DIABETICS:

In a 1988 publication in Anesthesia and Analgesia, Hogan et al. reported a higher incidence of challenging laryngoscopies in type 1 diabetes patients receiving kidney transplants compared to "non-diabetic individuals (32% vs 2.7%).[44] They defined difficult laryngoscopy as an airway in which an attending anesthesiologist is unable to directly visualize any part of the vocal cords using conventional direct laryngoscopy. In the majority of cases the endotracheal tube is passed blindly, or the patient is awakened and a fiberoptic laryngoscope is used. In an attempt to determine a possible cause for their results, the authors noted a subset of type 1 diabetics suffering from diabetic stiff joint syndrome (SJS), also known as limited joint mobility (LJM) syndrome. This is a disease process by which microvascular disease leads to abnormal cross-linkage of collagen by non-enzymatic glycosylation in connective tissue as a result of chronic hyperglycemia. The authors theorized that the involvement of the atlanto-occipital joint in diabetic SJS might ultimately lead to difficult laryngoscopy.

Recent retrospective research by Warner et al. examined the same patient group and similarly determined that type 1 diabetes patients had a higher incidence of difficult laryngoscopy (4.8% vs 1.0%). They concluded that their results show, "patients with diabetes may have a modestly increased difficulty of laryngoscopy compared with those without diabetes, but they do not support the findings of greatly increased difficulty previously reported" and that "extraordinary techniques were not required to successfully manage their airways".[45]

The incidence of type 2 diabetes persists in increasing and is anticipated to double by the conclusion of the next decade. It is seen more often in industrialized countries where inhabitants are more prone to being overweight and struggling with obesity. Previously seen as a condition mostly impacting adults, it is now increasingly observed in children and adolescents. The sequelae of the disease are far reaching, affecting nearly every organ system, and ultimately causing excess mortality. Anesthesiologists, serving as perioperative physicians, will care for patients with type 2 diabetes on a near daily basis. It is important to be well versed in not only the end organ complications of the disease, but also the airway issues that may be encountered in this patient population.[46]

There was a statistically significant increase in difficult laryngoscopy (18.75% vs 2.5%) among type 2 diabetics compared to non-diabetics, according to prospective research that was conducted in 2003 by Erden and colleagues."[47] They defined difficult laryngoscopy as grade III and grade IV views based on Cormack-Lehane criteria.[48] Vani, *et al*. similarly found the incidence of difficult laryngoscopy (Cormack-Lehane grade III or IV view) in type 2 diabetics to be 16%.[49]

In addition to studying the incidence of difficult laryngoscopy in type 2 diabetics, the Erden and Vani *et al*. studies also attempted to establish a relationship between difficult laryngoscopy and the ability of patients to approximate the palmar surfaces of their phalangeal joints, previously described as the "prayer sign" or "palm print sign". The premise of the prayer sign or palm print sign is to grade the laxity of the phalangeal joints and establish a correlation between palmar joint rigidity and involvement of cervical and laryngeal tissues of diabetic patients that can lead to difficult laryngoscopy. As described earlier, diabetic patients are believed to have non-enzymatic glycosylation of collagen, which is subsequently deposited in the joints. This process can lead to diabetic SJS. Changes from this disease process can first be noted in the fourth and fifth interphalangeal joints and later in the atlanto-occipital joint.[47] Diabetic SJS causes patients to have the inability to make a complete palmar approximation, despite maximal effort. Erden *et al*. were unable to show a relationship between the inability to complete the prayer sign and the likelihood of difficult laryngoscopy.[47] Vani *et al*. found that the palm print sign had the highest sensitivity in ability to predict difficult laryngoscopy preoperatively compared to other commonly used predictors of difficult intubation.[49] A recent study by Baig *et al*. demonstrated that the prayer sign had a lower sensitivity but similar specificity to Mallampati grade in predicting difficult laryngoscopy in the diabetic population.[50]

Though diabetes is frequently considered a predictor for difficult intubation, the incidence of difficult intubation in this patient population is likely less than originally thought and may actually be only slightly higher than the population at large. It must also be noted that the original studies were done at a time when traditional direct laryngoscopy or awake fiberoptic intubation were the methods used to manage an airway. Today, with the assistance of the devices such as the intubating supraglottic airway and video laryngoscopes, the rate of successful intubation in diabetic patients may actually be equivalent to that of the general population. To our best knowledge, this has not been formally studied.

The ability to predict difficult intubation by specific clinical exam findings continues to be debated in the literature. While the possibility of difficult intubation should always be considered in the diabetic population, other elements must be taken into consideration. A thorough preoperative evaluation should include a review of previous anesthetics and degree of difficulty of airway management", disease severity and control, as well as disease duration. Following the initial clinical history, a thorough airway evaluation, possibly including the prayer sign, is critical. If a difficult airway is suspected, appropriate preparations should be made including necessary rescue equipment and additional staff nearby. As with all cases, the ASA difficult airway algorithm must be used to guide management decisions.

AIM AND OBJECTIVE

AIM:

To know the diagnostic accuracy of upper lip bite test, range of neck movement, palm print sign, modified mallampati grade in evaluating difficult airway in elderly patients with and without diabetes undergoing surgery under general anaesthesia.

OBJECTIVE:

To compare efficacy of Upper Lip Bite test, Range of Neck Movement, Palm Print Sign, Modified Mallampati Grade with Cormack-Lehane grading in evaluating difficult airway in elderly diabetic and non-diabetic patient's undergoing surgery under general anaesthesia.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

1. In a study by Rao MH et al,[51] to evaluate the predictive accuracy of various airway assessment indices in diabetic and non-diabetic patients undergoing general anaesthesia with tracheal intubation. A significant difference in mean age (p=0.008), Head extension angles grades (p=0.048) were noted. 32.5% & 17.5% of diabetics and nondiabetic patients respectively had difficult laryngoscopy "(p=0.196). In diabetics, Palm print grade and BMI had highest sensitivity (53.85%) and MMP test had highest specificity (96.3%). In non-diabetics, PPG had the highest sensitivity (71.43%). MMP test and TMD had the highest specificity (96.97%).
2. Hashim K et al[53] conducted a study to evaluate the sensitivity of the palm print sign compared with other established airway assessment indices for predicting difficult laryngoscopy in diabetic patients. In their study, of the 60 patients, 15 had positive PP (Palm Print) sign. Of the 13 difficult laryngoscopies encountered, 10 patients had a positive PP sign. PP sign was the most sensitive index in predicting difficult laryngoscopy. P =0.000 was obtained and considered as statistically significant. The sensitivity was 76.9%, specificity 89.4%, positive and negative predictive value 71.4% and 91.3% and accuracy 86.7%, respectively. The other signs were not significant in predicting difficult laryngoscopy.
3. Begum R, et al[53] conducted a study comparing the effectiveness of various airway assessment tests in predicting difficult laryngoscopy. The research aimed to determine which clinical tests offer the most accurate prediction, thus enhancing preoperative airway management. The study evaluated and validated the predictive value of 'standard airway predictors' like modified Mallampati test, thyromental distance (TMD) and new airway predictor like upper lip bite test (ULBT) for predicting difficult laryngoscopy in geriatric patients. This prospective, observational study was conducted

on 100 patients above 65 years of age of either sex, scheduled for elective surgery under general anaesthesia requiring endotracheal intubation. The Upper Lip Bite Test (ULBT) showed the highest sensitivity (91.1%) and specificity (85.7%), indicating it is the most accurate predictor of difficult laryngoscopy. The Positive Predictive Value (PPV) of ULBT is 96%, and the Negative Predictive Value (NPV)is 72%, with a Likelihood Ratio (LR+) of 6.38 and an Odds Ratio (OR) of 61.714, making it the most reliable test.

4. A prospective observational study was carried out by Singh H et al[54] carried out to compare the sensitivity of the palm print sign and the prayer sign in predicting difficult intubation among diabetic patients in a tertiary care hospital. One hundred and fifty patients suffering from Type II diabetes mellitus, undergoing elective general anesthesia with endotracheal intubation, were enrolled in the study. The diagnostic efficacy of intubation difficulty for both the signs was assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value, and positive and negative likelihood ratio. The palm print sign was found to be a better indicator of difficult intubation in type II diabetes mellitus patients ($P < 0.01$). The duration of Type II diabetes mellitus was found to be associated well with difficult intubation ($P = 0.007$). Palm print sign is the single most important test for predicting difficult intubation in Type II diabetes mellitus patients. Duration of Type II diabetes mellitus itself correlates well with difficult intubation.
5. In a research by Stevanoic K et al,[55] reviewed the challenges associated with anaesthesia management in diabetic patients. The vast majority of the modern literature data supports the fact that diabetic population has higher risk for difficult intubation occurrence. The most important characteristics of diabetic patients that are considered to be contributing factors for the difficult intubation are obesity, increased neck circumference and stiff joint syndrome. A special attention and thorough

preoperative preparation should be given to patients with diabetes. In order to predict and prevent difficult intubation in these patients, further studies are needed to investigate this issue closely.

6. Panjiar P et al[56] conducted a prospective study evaluating different airway assessment tests for predicting difficult laryngoscopy specifically in geriatric patients. In their study, the incidence of difficult larygoscopy was found to be 25%. The mean age of study population was 69.37 ± 4.23 years. TMD exhibited the highest sensitivity (80%) and negative predictive value (NPV) (91.86%) as compared to other studied airway predictors. The positive predictive value (PPV) of ULBT was 100%. Moreover, ULBT exhibited highest accuracy (82.14%) and odds ratio (86.88) and high specificity (91.30%) for predicting difficult laryngoscopy in geriatric patients. NM and TMHT also exhibited high accuracy (77.85%, 77.14%) and PPV (59.09%, 52.94%).
7. Prakash S et al[57] investigated the anatomical and clinical risk factors associated with difficult laryngoscopy and intubation in the Indian population. In their study, the incidence of difficult laryngoscopy and intubation was 9.7% and 4.5%, respectively. Univariate analysis showed that increasing age and weight, male gender, modified Mallampati class (MMC) 3 and 4 in sitting and supine positions, inter-incisor distance (IID) ≤3.5 cm, thyromental (TMD) and sternomental distance, ratio of height and TMD, short neck, limited mandibular protrusion, decreased range of neck movement, history of snoring, receding mandible and cervical spondylosis were associated with difficult laryngoscopy. Multivariate analysis identified four variables that were independently associated with difficult laryngoscopy: MMC class 3 and 4, range of neck movement <80°, IID ≤ 3.5 cm and snoring.
8. Sagün A et al[58] conducted a nested case-control study to assess the risk factors linked with difficult intubation, focusing particularly on patients with endocrine disorders,

musculoskeletal diseases, and intraoral cavity masses. In their study, age >52 years, male gender, ASA 3–4, higher BMI, Cormack-Lehane score (CLS) 3–4, Mallampati 3–4, Inter Incisor Gap (IIG) measurement <4 cm, and Sterno-mental Distance (SMD)<10 cm were found statistically significant in terms of difficult intubation. Besides, a statistically significant relationship was found when the groups were compared in the presence of intraoral mass (17.57 times higher, p<0.05), endocrine diseases (3.51 times more common, p<0.05) and musculoskeletal system diseases (4.5 times higher, p<0.05).

9. Kotwani M et al[59] performed an observational study comparing the effectiveness of the Modified Mallampati Test (MMT) conducted in the supine versus sitting position as a predictor for difficult intubation. In their research, out of 455 patients, 72 (15.8%) experienced difficult intubation (defined as Cormack–Lehane Grade III and above). Both modified Mallampati test (MMT) in the sitting and supine positions demonstrated strong predictive capabilities for difficult tracheal intubation (DTI), with areas under the ROC of 0.799 and 0.779, respectively. While sitting in the MMT position exhibited higher sensitivity (55.6% vs. 28.8%), supine MMT demonstrated a superior Positive Predictive Value (86.1% vs. 55.6%).
10. Amirreza Vakilian, et., al conducted a study titled “Evaluation of Palm Print Sign and Prayer Sign in Prediction of Difficult Laryngoscopy in Diabetic Patients” A cross-sectional analytical design was used in their study. The study population included 200 patients with type 2 diabetes who were candidates for surgery under general anaesthesia. Before surgery, the patients were examined regarding the airway status, Mallampati classification, head extension rate, thyromental distance, body mass index, upper lip biting test, and two palm print sign and prayer sign tests. All the diagnostic tests were compared to the Cormack test result for difficult airways regarding their

sensitivity and specificity in difficult laryngoscopy. The highest sensitivity was related to the Mallampati test, prayer sign test, and palm print sign test (100%). Furthermore, the mouth-opening test had the highest specificity (100%). The highest accuracy was reported for Mallampati, palm print sign, and prayer sign tests (> 86%)". They concluded that, among the tests studied to predict difficulty in laryngoscopy in diabetic patients, Mallampati and palm print sign tests have good sensitivity, specificity, and accuracy. Studies with a larger sample size are suggested to obtain more accurate results.

MATERIAL, METHODS AND METHODOLOGY

MATERIAL AND METHODS

Source Of Data:

"This study was Conducted on 184 patients of elderly diabetic and non-diabetic patient's undergoing elective surgeries under general anesthesia at R. L. Jalappa Hospital and Research centre, Tamaka, Kolar, during the period May 2023 to March 2025 after obtaining permission from Institutional Ethics Committee.

•Study Design: Cross Sectional Interventional Comparative Study.

• Study Area: Department of Anaesthesiology, Sri Devaraj Urs Medical College, R.L. Jalappa Hospital and Research Centre, Tamaka, Kolar.

• Study period: Research study was conducted from May 2023 to March 2025.

•Sample size: The sample size was calculated based on a previous study by Dr. Shalini S.R. et al., which compared palm print sign with modified Mallampati test in predicting difficult airway between diabetic and non-diabetic patients. Using the formula $N = 2\times[(Z(1-\alpha/2) + Z(1-\beta))^2 p\times(1-p)]/d^2$, with sensitivity of palm print grade in diabetic group at 53.8%, sensitivity in non-diabetic group at 71.4%, power of 80%, level of significance at 5%, pooled proportion of 0.626, and expected difference in proportion of 0.2, the estimated sample size was determined to be 92 patients in each group".

Sampling Method: Sampling method for this study is a consenting, consecutive, hospital based, convenience sample.

Inclusion criteria:

1. Age above 60 years of either sex.
2. Patient undergoing elective surgery requiring General Anaesthesia with endotracheal intubation.
3. Known case of diabetes and non-diabetes.

Exclusion criteria:

1. Patient not fit for General anaestheisa.
2. Emergency Surgeries

METHODOLOGY

After obtaining approval from the "Institutional Ethics Committee of Sri Devaraj Urs Medical College, this cross-sectional interventional comparative study was conducted at R.L. Jalappa Hospital and Research Centre, Tamaka, Kolar, from May 2023 to October 2024. A total of 184 patients were enrolled in the study, with 92 elderly diabetic patients and 92 elderly non-diabetic patients.

Study Procedure

After obtaining written informed consent from the patients in their vernacular language, all patients underwent a detailed pre-anaesthetic evaluation on the day prior to surgery. Relevant demographic data including age, gender, weight, height, BMI, ASA physical status, and comorbidities were recorded on the proforma.

Preoperative Airway Assessment

All patients underwent comprehensive airway examination prior to surgery by an anaesthesiology resident under the supervision of a consultant anaesthesiologist. The following airway parameters were assessed:

1. **Upper Lip Bite Test (ULBT):** Patients were asked to bite their upper lip with their lower incisors and were graded as follows:

- Class I: Lower incisors biting the upper lip, making the mucosa of the upper lip totally invisible
- Class II: The same biting maneuver revealing a partially visible mucosa
- Class III: The lower incisors fail to bite the upper lip

ULBT Classes II and III were considered predictive of difficult intubation.

2. **Neck Range of Movement:** This was assessed by keeping a pencil vertically on the forehead with the patient's head and neck in full extension. The orientation of the pencil was adjusted to be parallel to a distant window frame. While the pencil was held firmly in position, the head and neck were fully flexed, and the pencil was sighted against the horizontal of the window frame to judge if it had moved through 90°. This criterion was graded into three levels:

- <80°
- Near 90° (90° ± 10°)
- 100°

3. **Palm Print Test:** The palm and fingers of the patient's dominant hand were painted with blue writing ink using a brush. The patient then pressed the painted hand firmly against a white sheet of paper on a hard surface, and scoring was done as:

- Grade 0: All phalangeal areas visible
- Grade 1: Deficiency in the interphalangeal areas of 4th and 5th digit
- Grade 2: Deficiency in the interphalangeal areas of 2nd to 5th digit
- Grade 3: Only the tips of digits seen

Grades 2 and 3 were considered predictive of difficult intubation.

4. **Modified Mallampati Test (MMT):** The oropharyngeal view was documented while patients were sitting with head in neutral position with a fully protruded tongue without phonation. Classification was as follows:

- Grade I: Full view of soft palate, uvula, tonsillar pillars
- Grade II: Soft palate and upper portion of uvula visible
- Grade III: Only soft palate visible
- Grade IV: Only hard palate visible

MMT Grades III and IV were considered predictive of difficult intubation.

Anaesthetic Management

On the day of surgery, patients were shifted to the operating room and standard monitoring including pulse oximetry (SpO_2), non-invasive blood pressure (NIBP), and electrocardiogram (ECG) was established. Baseline vital parameters were recorded. An intravenous (IV) line was secured, and Ringer lactate or normal saline (depending on the diabetic status of the patient) was started.

All patients received appropriate premedication. After preoxygenation with 100% O_2 for 3-5 minutes, anaesthesia was induced with standard doses of induction agents, and appropriate muscle relaxant was administered intravenously. After ventilation with 100% O_2 for 3 minutes, with a 10 cm pillow under the head positioning the head in sniffing position, direct laryngoscopy was performed by an experienced anaesthesiologist using a Macintosh blade of appropriate size.

Assessment of Laryngeal View

The laryngeal view was graded according to the Cormack-Lehane (CL) grading system:

- Grade 1: Visualization of the entire glottic aperture
- Grade 2: Visualization of only the posterior aspects of the glottic aperture
- Grade 3: Visualization of only the tip of the epiglottis
- Grade 4: Visualization of only the soft palate

CL Grades 1 and 2 were classified as "Easy Visualization of Larynx (EVL)," while Grades 3 and 4 were classified as "Difficult Visualization of Larynx (DVL)."

Parameters Observed During Intubation

1. Quality of mask ventilation (easy/difficult)
2. Time taken for intubation
3. Number of attempts required for successful intubation

4. Alternative methods used, if any

A difficult airway cart was kept ready for all cases. Intubation was considered difficult if it required more than three attempts or lasted longer than ten minutes, as per the Difficult Airway Society guidelines.

Data Collection and Statistical Analysis

All the data collected was entered into the proforma and subsequently transferred to a spreadsheet. Statistical analysis was performed using SPSS version 20.0. Categorical variables were presented as frequencies, while continuous variables were presented as mean ± standard deviation. The association between categorical variables was analyzed using the Chi-square test. A p-value < 0.05 was considered statistically significant.

The diagnostic accuracy of each airway test in predicting difficult intubation was evaluated by calculating sensitivity, specificity, positive predictive value (PPV)”, negative predictive value (NPV), and accuracy. The tests were compared between diabetic and non-diabetic elderly patients to determine which test or combination of tests best predicted difficult intubation in each group.

RESULTS

RESULTS

This is a study on evaluation of different airway tests in predicting difficult airway in elderly diabetic and non-diabetic patients undergoing surgery under general anesthesia at "R. L. Jalappa Hospital and Research centre, Tamaka, Kolar for a period of 18 months.

Table 1: Age Distribution

Age (years)	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
Mean ± SD	65.95 ± 6.52	67.41 ± 5.92	66.68 ± 6.24	0.112
60-65 years	58 (63%)	40 (43.5%)	98 (53.3%)	0.057
66-70 years	18 (19.6%)	35 (38%)	53 (38%)	
71-75 years	5 (5.4%)	5 (5.4%)	10 (5.4%)	
>75 years	11 (12%)	12 (13%)	23 (12.5%)	

This table shows the age distribution between diabetic and non-diabetic patients. The mean age of diabetic patients was 65.95 ± 6.52 years, while non-diabetic patients had a slightly higher mean age of 67.41 ± 5.92 years. However, this difference was not statistically significant (p=0.112). The majority of diabetic patients (63%) were in the 60-65 years age group, compared to 43.5% of non-diabetic patients. The 66-70 years category showed more non-diabetic patients (38%) than diabetic patients (19.6%). The 71-75 years group had equal representation (5.4%) in both groups, while the >75 years category was also fairly similar between diabetic (12%) and non-diabetic patients (13%). The overall p-value of 0.057 suggests that the age distribution between groups approached but did not reach statistical significance.

Figure 1: Age Distribution

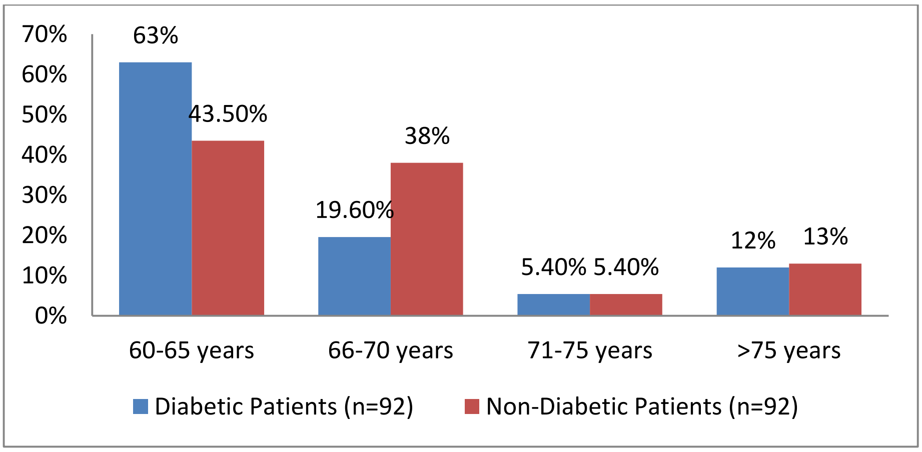


Table 2: Gender Distribution

Gender	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
Male	51 (55.4%)	51 (55.4%)	102 (55.4%)	1.000
Female	41 (44.6%)	41 (44.6%)	82 (44.6%)	

This table presents the gender distribution, which was identical between the two groups. Both diabetic and non-diabetic groups had 51 males (55.4%) and 41 females (44.6%), resulting in a p-value of 1.000, indicating perfect matching". This suggests that the researchers intentionally matched the gender distribution between groups to eliminate gender as a confounding variable.

Figure 2: Gender Distribution

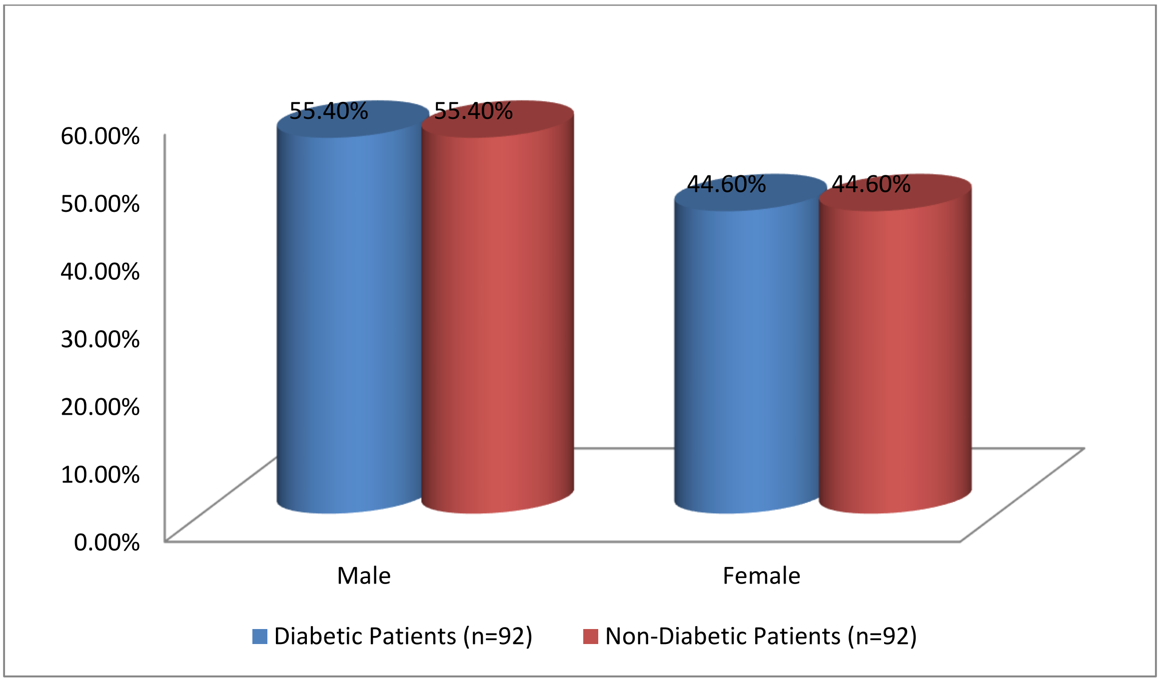


Table 3: BMI Distribution

BMI (kg/m²)	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
Mean ± SD	22.04 ± 4.24	21.27 ± 3.34	21.66 ± 3.82	0.172
Underweight (<18.5)	18 (19.6%)	19 (20.7%)	37 (20.1%)	0.127
Normal (18.5-24.9)	58 (63%)	62 (67.4%)	120 (65.2%)	
Overweight (25.0-29.9)	8 (8.7%)	10 (10.9%)	18 (9.8%)	
Obese (≥30.0)	8 (8.7%)	1 (1.1%)	9 (4.9%)	

The BMI distribution table shows that diabetic patients had a slightly higher mean BMI (22.04 ± 4.24 kg/m²) compared to non-diabetic patients (21.27 ± 3.34 kg/m²), though this difference was not statistically significant (p=0.172). When categorized by BMI ranges, both groups had similar distributions for underweight (diabetic: 19.6%, non-diabetic: 20.7%) and normal weight (diabetic: 63%, non-diabetic: 67.4%) categories. The overweight category was comparable between groups (diabetic: 8.7%, non-diabetic: 10.9%). However, notably more diabetic patients fell into the obese category (8.7%) compared to non-diabetic patients (1.1%), though the overall distribution did not reach statistical significance (p=0.127).

Figure 3: BMI Distribution

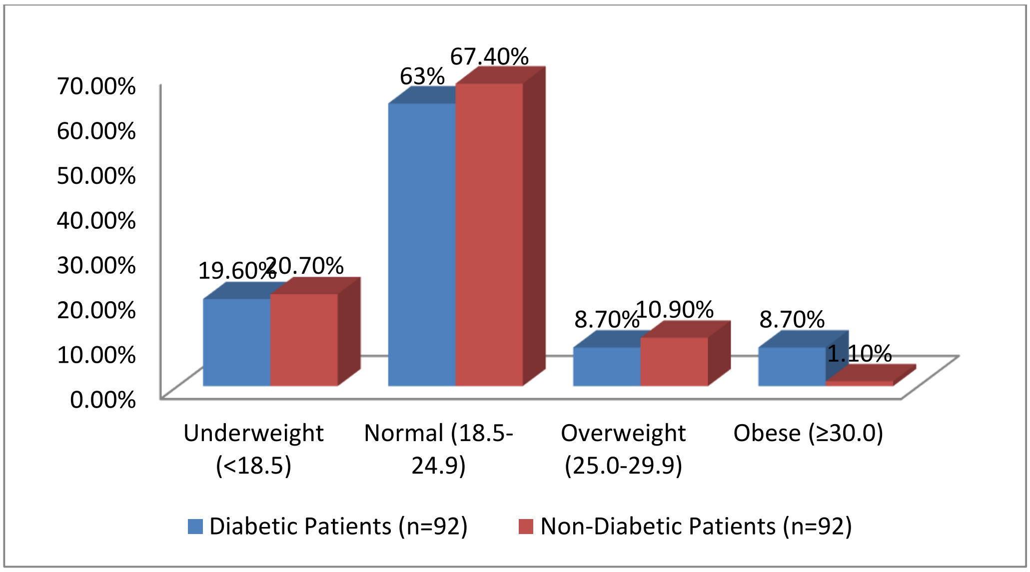


Table 4: ASA Physical Status

ASA Physical Status	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
I	2 (2.2%)	0 (0.0%)	2 (1.1%)	**0.066**
II	50 (54.3%)	70 (76.1%)	120 (65.2%)	
III	40 (43.5%)	22 (23.9%)	62 (33.7%)	

*Statistically significant at $p<0.05$

This table examines the American Society of Anesthesiologists (ASA) physical status classification. There was a marginally non-significant difference in distribution between the groups (p=0.066). Only diabetic patients had ASA I status (2.2%). The majority of non-diabetic patients (76.1%) were classified as ASA II, compared to 54.3% of diabetic patients. Conversely, a higher percentage of diabetic patients (43.5%) were classified as ASA III compared to non-diabetic patients (23.9%). This suggests that diabetic patients generally had a higher ASA physical status, indicating greater systemic disease and anesthetic risk.

Figure 4: ASA Physical Status

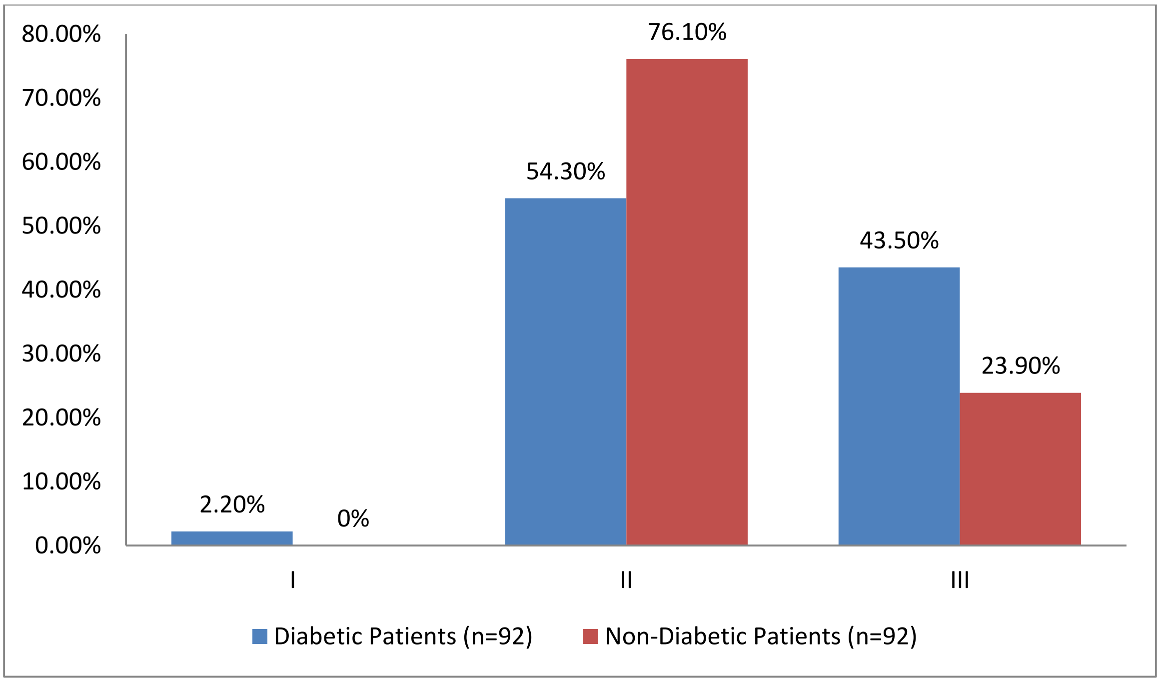


Table 5: Other Comorbidities

Comorbidities	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
Hypertension	14 (15.2%)	7 (7.6%)	21 (11.4%)	0.105
None	78 (84.8%)	85 (92.4%)	163 (88.6%)	

This table focuses on hypertension as a comorbidity. A higher percentage of diabetic patients (15.2%) had hypertension compared to non-diabetic patients (7.6%), though this difference did not reach statistical significance (p=0.105). The majority of patients in both groups had no additional comorbidities other than diabetes in the diabetic group (diabetic: 84.8%, non-diabetic: 92.4%).

Figure 5: Other Comorbidities

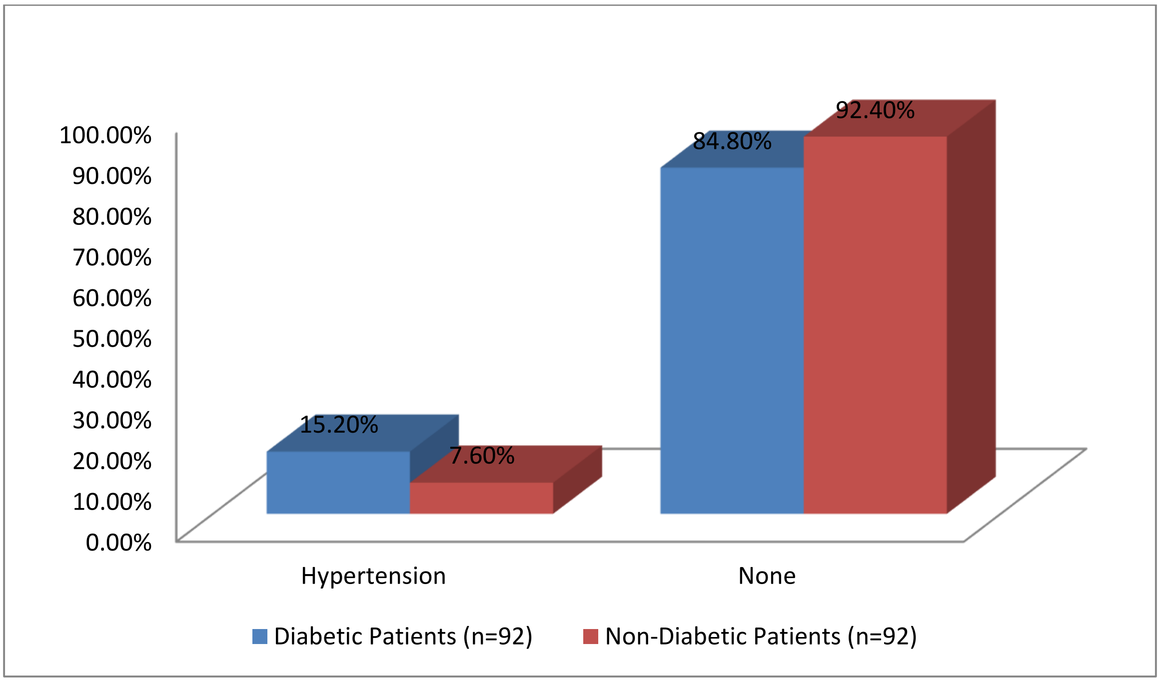


Table 6: Modified Mallampati Grade

Modified Mallampati Grade	Diabetic Patients (n=92)	Non-Diabetic Patients (n=91)	Total (n=183)	P-value
Class I	32 (34.8%)	37 (40.7%)	69 (37.7%)	0.791
Class II	36 (39.1%)	33 (36.3%)	69 (37.7%)	
Class III	20 (21.7%)	16 (17.6%)	36 (19.7%)	
Class IV	4 (4.3%)	5 (5.5%)	9 (4.9%)	
Clinical Significance				
Normal (Class I-II)	68 (73.9%)	70 (76.9%)	138 (75.4%)	0.635
Difficult (Class III-IV)	24 (26.1%)	21 (23.1%)	45 (24.6%)	

This table evaluates the Modified Mallampati Grade, which assesses visibility of oropharyngeal structures. The distribution across the four classes was similar between diabetic and non-diabetic patients (p=0.791). When categorized as normal (Class I-II) versus difficult (Class III-IV), 73.9% of diabetic patients and 76.9% of non-diabetic patients fell into the normal category, with no significant difference between groups (p=0.635).

Figure 6: Modified Mallampati Grade

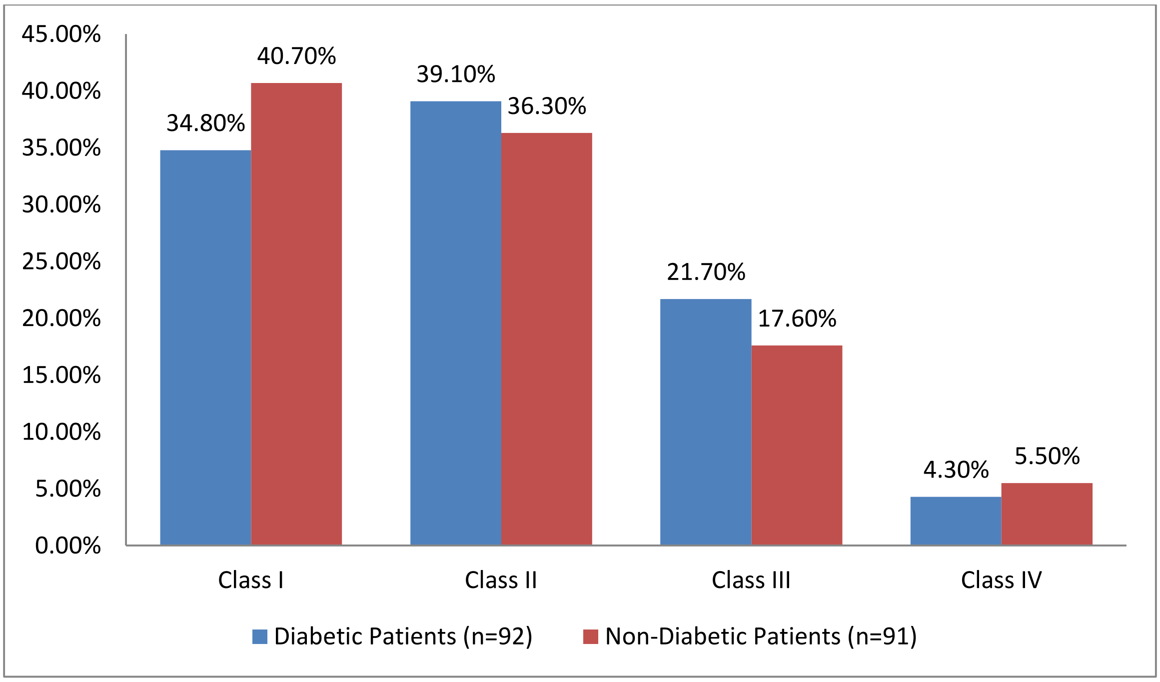


Table 7: Upper Lip Bite Test

Upper Lip Bite Test	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
Class I	26 (28.3%)	66 (71.7%)	92 (50.0%)	**<0.001***
Class II	31 (33.7%)	22 (23.9%)	53 (28.8%)	
Class III	35 (38.0%)	4 (4.3%)	39 (21.2%)	
Clinical Significance				
Normal (Class I-II)	57 (62.0%)	88 (95.7%)	145 (78.8%)	**<0.001***
Difficult (Class III)	35 (38.0%)	4 (4.3%)	39 (21.2%)	

*Statistically significant at p<0.05

This table shows a highly significant difference in Upper Lip Bite Test results between groups (p<0.001). Only 28.3% of diabetic patients had Class I (normal) compared to 71.7% of non-diabetic patients. Class III (indicating potential difficulty) was present in 38.0% of diabetic patients but only 4.3% of non-diabetic patients. When categorized clinically, 62.0% of diabetic patients had normal findings (Class I-II) compared to 95.7% of non-diabetic patients, while 38.0% of diabetic patients had difficult findings (Class III) versus only 4.3% of non-diabetic patients (p<0.001).

Figure 7: Upper Lip Bite Test

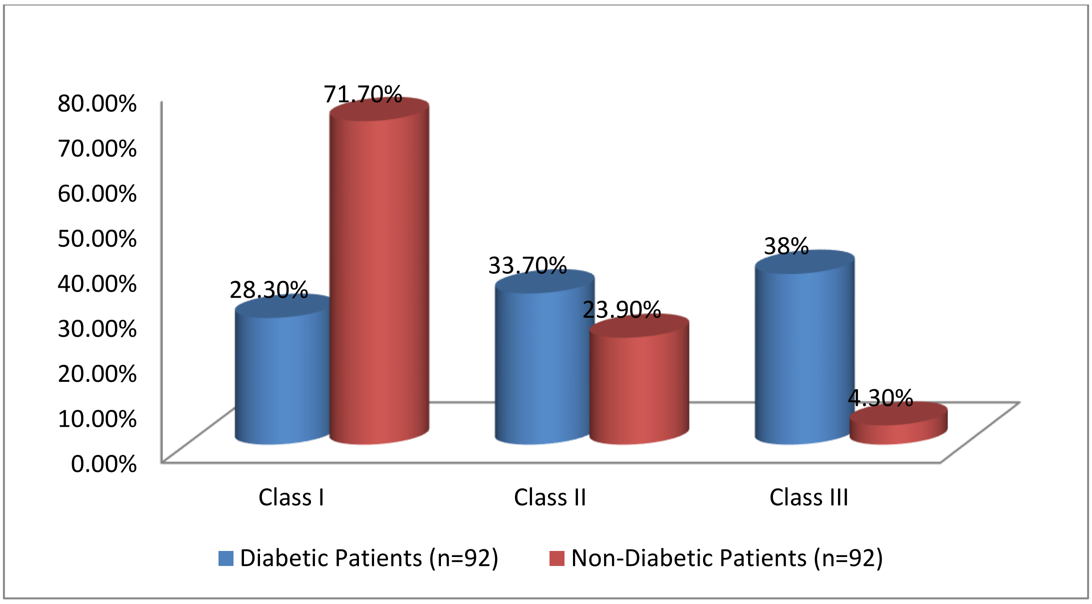


Table 8: Neck Extension

Neck Range of Motion	Diabetic Patients	Non-Diabetic Patients	Total	P-value
≤90°				
Present	12 (13.0%)	9 (9.8%)	21 (11.4%)	0.487
Absent	80 (87.0%)	83 (90.2%)	163 (88.6%)	
>100°				
Present	80 (94.1%)	83 (90.2%)	163 (92.1%)	0.337
Absent	5 (5.9%)	9 (9.8%)	14 (7.9%)	

Note: For >100° measurement, data was available for n=85 diabetic patients and n=92 non-diabetic patients (total n=177).

This table examines neck extension measurements. For limited neck extension (≤90°), there was no significant difference between diabetic (13.0%) and non-diabetic (9.8%) patients (p=0.487). Similarly, for adequate neck extension (>100°), there was no significant difference between diabetic (94.1%) and non-diabetic (90.2%) patients (p=0.337). Note that for the >100° measurement, data was only available for 85 diabetic patients.

Figure 8: Neck Extension

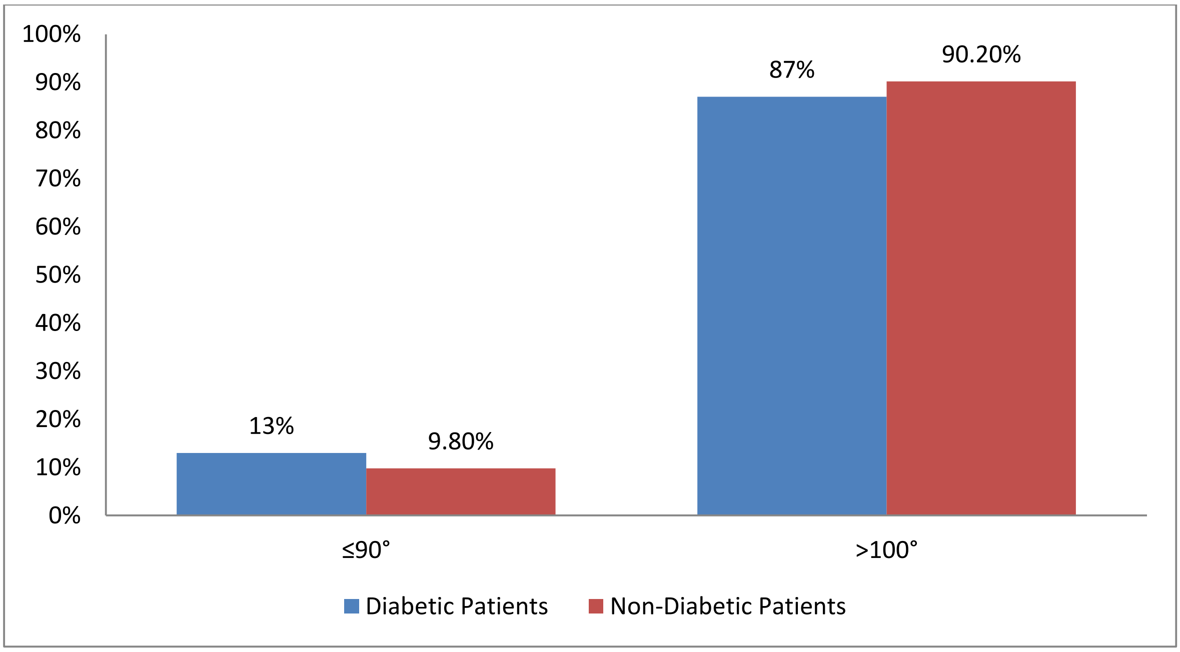


Table 9: Palm Print Sign

Palm Print Sign	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
Grade 1	33 (35.9%)	46 (50.0%)	79 (42.9%)	**0.006***
Grade 2	35 (38.0%)	39 (42.4%)	74 (40.2%)	
Grade 3	21 (22.8%)	7 (7.6%)	28 (15.2%)	
Grade 4	3 (3.3%)	0 (0.0%)	3 (1.6%)	
Clinical Significance				
Normal (Grade 1-2)	68 (73.9%)	85 (92.4%)	153 (83.2%)	**0.001***
Difficult (Grade 3-4)	24 (26.1%)	7 (7.6%)	31 (16.8%)	

*Statistically significant at p<0.05

This table shows a significant difference in Palm Print Sign results between groups (p=0.006). Grade 3 findings were more common in diabetic patients (22.8%) than non-diabetic patients (7.6%), and Grade 4 findings were only present in diabetic patients (3.3%). When categorized clinically, 73.9% of diabetic patients had normal findings (Grade 1-2) compared to 92.4% of non-diabetic patients, while 26.1% of diabetic patients had difficult findings (Grade 3-4) versus only 7.6% of non-diabetic patients (p=0.001)".

Figure 9: Palm Print Sign

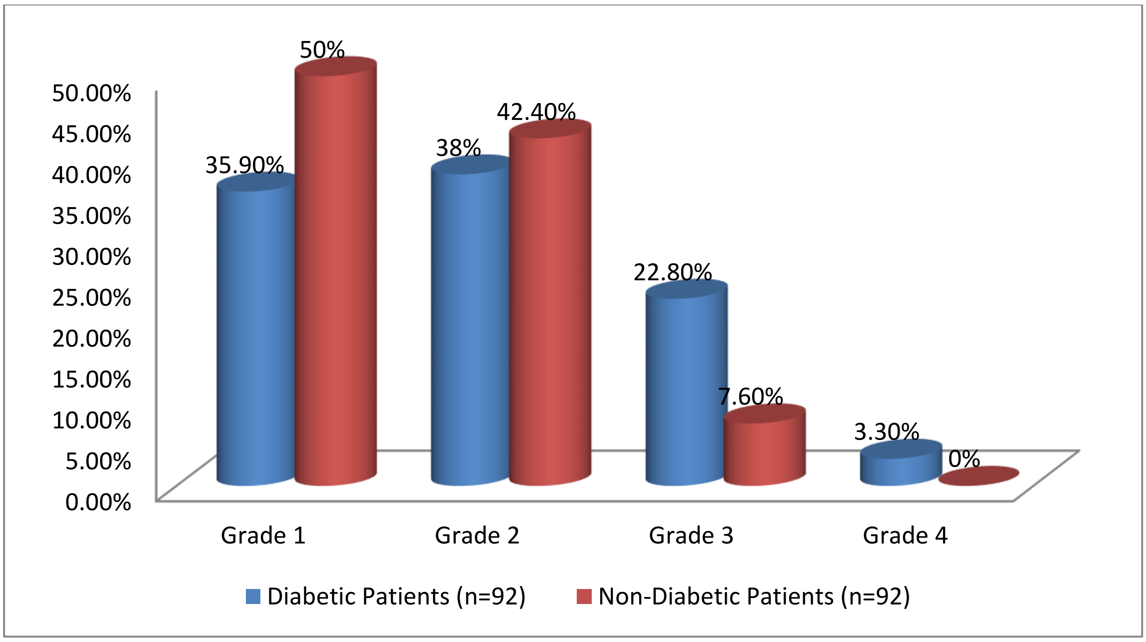


Table 10: “Cormack-Lehane Grade

Cormack-Lehane Grade	Diabetic Patients (n=92)	Non-Diabetic Patients (n=91)	Total (n=183)	P-value
Grade I	33 (35.9%)	44 (48.4%)	77 (42.1%)	0.059
Grade II	27 (29.3%)	31 (34.1%)	58 (31.7%)	
Grade III	26 (28.3%)	14 (15.4%)	40 (21.9%)	
Grade IV	6 (6.5%)	2 (2.2%)	8 (4.4%)	
Clinical Significance				
Easy (Grade I-II)	60 (65.2%)	75 (82.4%)	135 (73.8%)	**0.010***
Difficult (Grade III-IV)	32 (34.8%)	16 (17.6%)	48 (26.2%)	

*Statistically significant at p<0.05

This table evaluates the Cormack-Lehane Grade, which assesses glottic visualization during laryngoscopy. While the overall distribution across the four grades approached but did not reach significance (p=0.059), the clinical categorization showed a significant difference (p=0.010). Difficult laryngoscopy (Grade III-IV) was observed in 34.8% of diabetic patients compared to only 17.6% of non-diabetic patients, indicating that diabetic patients experienced more difficult intubations.

Figure 10: Cormack-Lehane Grade

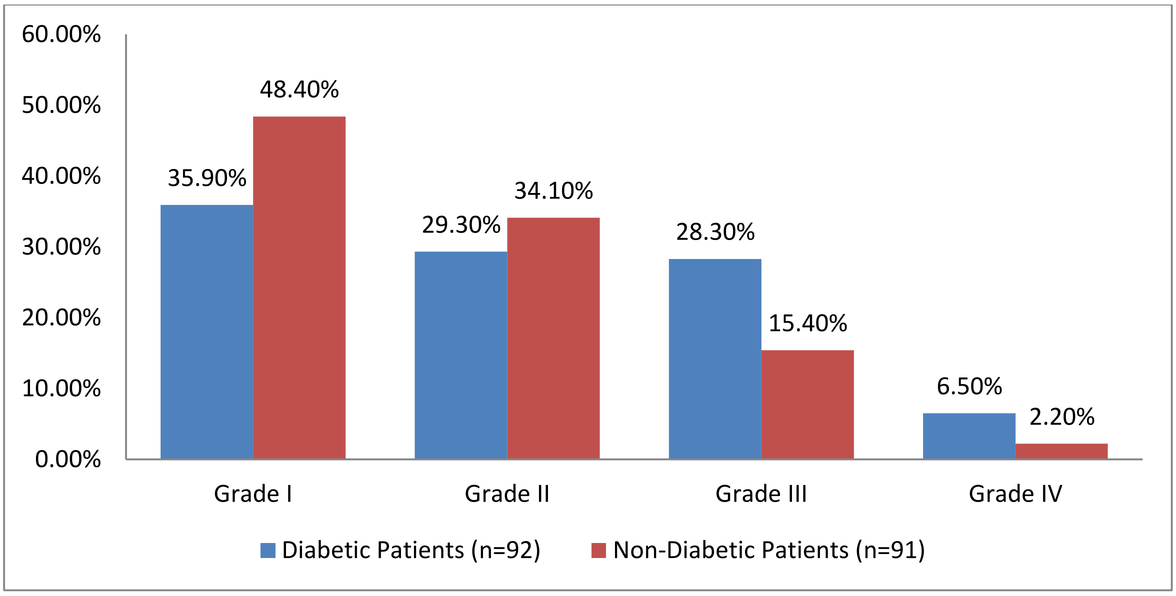


Table 11: Mask Ventilation

Mask Ventilation	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
Easy	78 (84.8%)	77 (83.7%)	155 (84.2%)	0.082
Difficult	14 (15.2%)	15 (16.3%)	29 (15.8%)	

This table examines the ease of mask ventilation. There was no significant difference between diabetic and non-diabetic patients (p=0.082), with difficult mask ventilation experienced in 15.2% of diabetic patients and 16.3% of non-diabetic patients.

Figure 11: Mask Ventilation

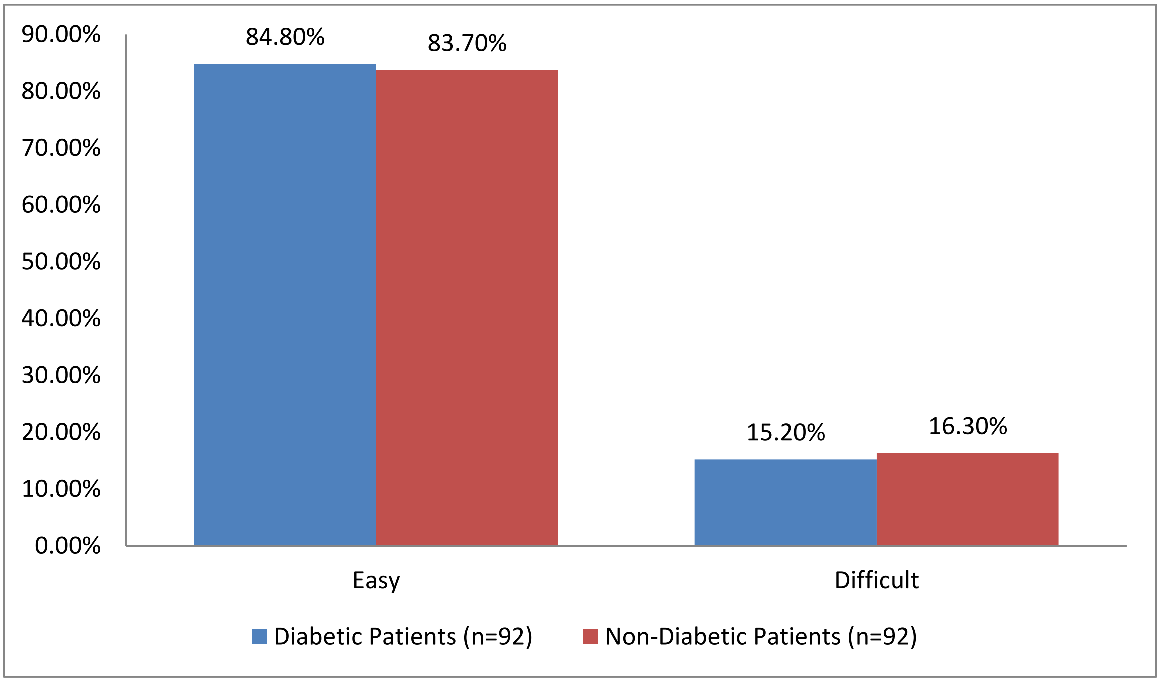


Table 12: Number of Intubation Attempts

Number of Attempts	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
Single	61 (66.3%)	70 (76.1%)	131 (71.2%)	0.14
Multiple	31 (33.7%)	22 (23.9%)	41 (22.3%)	

This table shows that multiple intubation attempts were required in 33.7% of diabetic patients compared to 23.9% of non-diabetic patients, though this difference did not reach statistical significance (p=0.14). Single attempts were successful in 66.3% of diabetic patients versus 76.1% of non-diabetic patients.

Figure 12: Number of Intubation Attempts

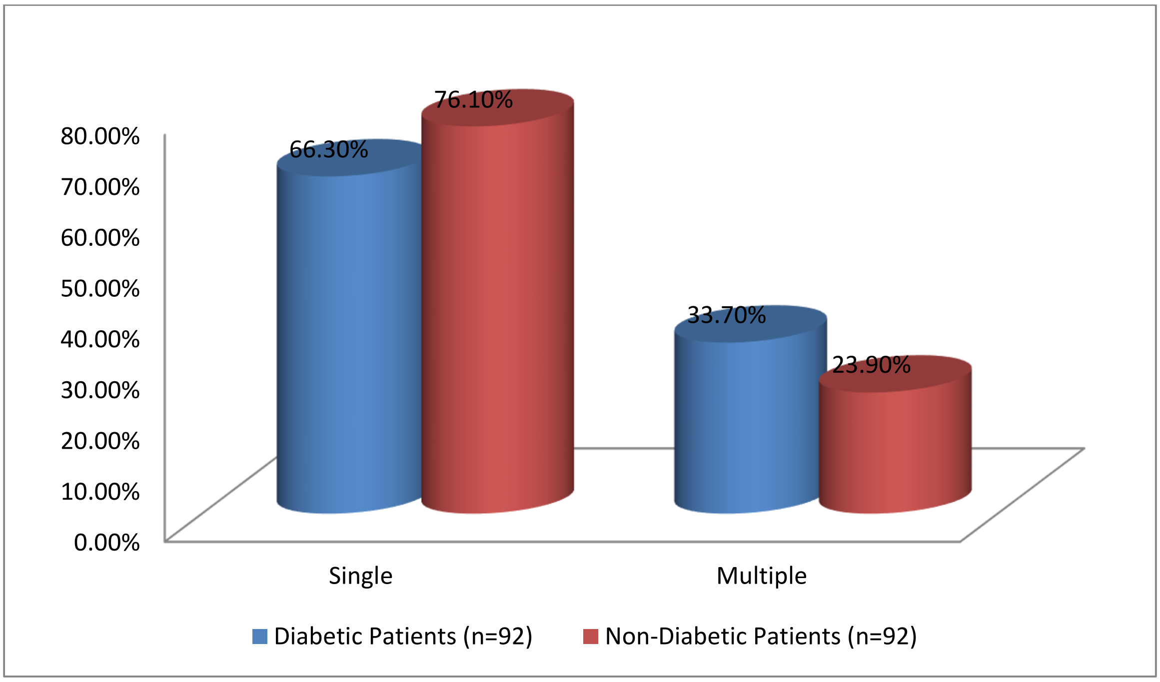


Table 13: Time Taken for Intubation

Time for Intubation	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
10 seconds	55 (59.8%)	61 (66.3%)	116 (63.0%)	0.137
<1 minute	27 (29.3%)	28 (30.4%)	55 (29.9%)	
>1 minute	10 (10.9%)	3 (3.3%)	13 (7.1%)	
Clinical Significance				
Normal (≤1 minute)	82 (89.1%)	89 (96.7%)	171 (92.9%)	**0.048***
Prolonged (>1 minute)	10 (10.9%)	3 (3.3%)	13 (7.1%)	

*Statistically significant at $p<0.05$

Note: The clinical significance p-value was calculated based on categorizing intubation time as normal (≤1 minute) or prolonged (>1 minute).

This table presents the time required for intubation. While the distribution across the three time categories did not reach significance (p=0.137), the clinical categorization showed a significant difference (p=0.048). Prolonged intubation time (>1 minute) occurred in 10.9% of diabetic patients compared to only 3.3% of non-diabetic patients.

Figure 13: Time Taken for Intubation

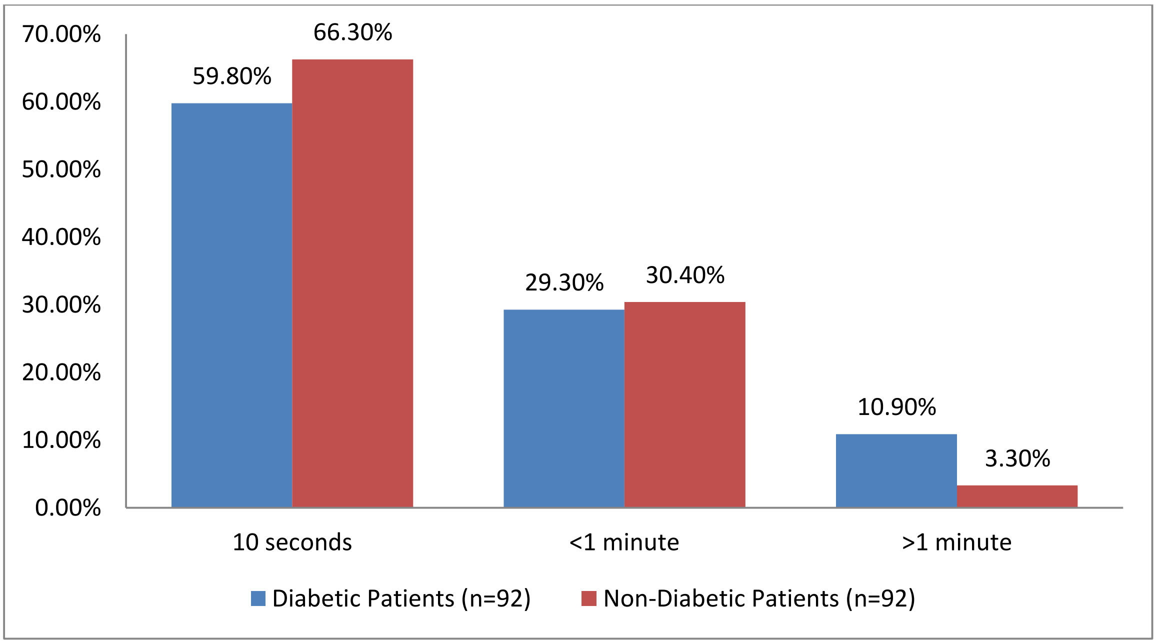


Table 14: Alternative Methods Used

Alternative Methods	Diabetic Patients (n=92)	Non-Diabetic Patients (n=92)	Total (n=184)	P-value
None	86 (93.5%)	89 (96.7%)	175 (95.1%)	0.066
Video Laryngoscope	6 (6.5%)	3 (3.3%)	9 (4.9%)	

This table examines the use of alternative intubation methods. While not statistically significant (p=0.066), video laryngoscope was used more frequently in diabetic patients (6.5%) than in non-diabetic patients (3.3%). The majority of patients in both groups (diabetic: 93.5%, non-diabetic: 96.7%) did not require alternative methods.

Figure 14: Alternative Methods Used

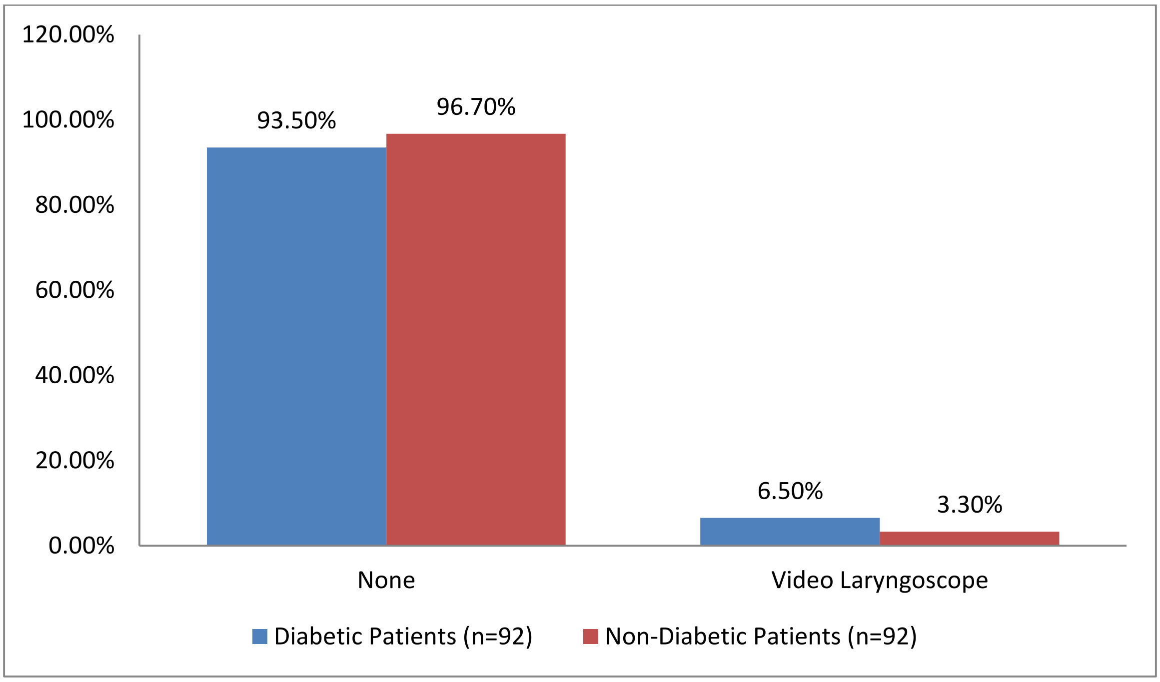


Table 15: Correlation Between Airway Tests and Difficult Laryngoscopy

Airway Test (Positive Finding)	Sensitivity	Specificity	PPV	NPV	P-value
Diabetic Patients (n=92)					
Modified Mallampati Score (Class III-IV)	75.0%	100.0%	100.0%	88.2%	<**0.001***
Upper Lip Bite Test (Class III)	90.6%	90.0%	82.9%	94.7%	<**0.001***
Palm Print Sign (Grade 3-4)	65.6%	95.0%	87.5%	83.8%	<**0.001***
Non-Diabetic Patients (n=91)					
Modified Mallampati Score (Class III-IV)	75.0%	88.0%	57.1%	94.3%	<**0.001***
Upper Lip Bite Test (Class III)	18.8%	98.7%	75.0%	84.1%	**0.002***
Palm Print Sign (Grade 3-4)	37.5%	98.7%	85.7%	87.1%	<**0.001***
All Patients (n=183)					
Modified Mallampati Score (Class III-IV)	75.0%	94.8%	80.0%	93.1%	<**0.001***
Upper Lip Bite Test (Class III)	66.7%	94.1%	82.1%	87.6%	<**0.001***
Palm Print Sign (Grade 3-4)	56.3%	96.3%	87.1%	85.0%	<**0.001***

*Statistically significant at p<0.05

PPV: Positive Predictive Value; NPV: Negative Predictive Value

This final table evaluates the predictive value of three airway tests for difficult laryngoscopy. In diabetic patients, the Upper Lip Bite Test (Class III) showed the highest sensitivity (90.6%) and good specificity (90.0%), with positive and negative predictive values of 82.9% and 94.7%, respectively. In non-diabetic patients, the Modified Mallampati Score (Class III-IV) had the highest sensitivity (75.0%) with good specificity (88.0%), though its positive predictive value was only 57.1%. When all patients were analyzed together, the Modified Mallampati Score demonstrated the highest sensitivity (75.0%), while the Palm Print Sign had the highest specificity (96.3%). All correlations were statistically significant (p<0.001)", indicating that these tests are valuable predictors of difficult laryngoscopy in both patient populations.

DISCUSSION

DISCUSSION

Airway management remains a cornerstone of safe anesthetic practice, with difficult airway scenarios posing significant challenges, especially in elderly populations with comorbidities such as diabetes mellitus. The ability to predict difficult airways preoperatively using simple, non-invasive bedside tests can significantly reduce airway-related morbidity and mortality. Within the context of elderly diabetic and non-diabetic patients having surgery under general anesthesia, the purpose of this research was to analyze and compare the usefulness of several airway assessment procedures in predicting problematic airways.

Demographic Profile and Clinical Characteristics

In our study, we observed comparable demographic profiles between diabetic and non-diabetic patients with respect to age and gender distribution. The mean age for diabetic patients was "65.95 ± 6.52 years compared to 67.41 ± 5.92 years for non-diabetic patients ($p = 0.112$). This is consistent with the findings of Prakash et al., who reported a mean age of 66.8 years in their study on airway assessment in elderly patients with diabetes mellitus.[61] The gender distribution in our study was identical in both groups with 55.4% males and 44.6% females, which eliminated gender as a confounding variable. Similar gender distributions were noted by Mahmoodpoor et al. in their study comparing airway assessment tests in diabetic and non-diabetic patients.[62]

BMI distribution between diabetic and non-diabetic patients showed no statistically significant difference (22.04 ± 4.24 vs. 21.27 ± 3.34 kg/m², $p = 0.172$). However, it is worth noting that the incidence of obesity (BMI ≥30.0) was higher in diabetic patients (8.7%) compared to non-diabetic patients (1.1%), though this did not reach statistical significance ($p = 0.127$). This aligns with the findings of Kim et al., who reported a higher prevalence of obesity among diabetic patients, which contributed to difficult airway management.[63]

The ASA physical status distribution showed a higher proportion of ASA III patients among diabetics (43.5%) compared to non-diabetics (23.9%), although this difference did not reach statistical significance ($p = 0.066$)". This higher ASA status in diabetic patients represents the greater burden of comorbidities and systemic involvement associated with diabetes, as also highlighted by Hashim and Thomas in their comprehensive review on preoperative assessment of diabetic patients.[64]

Airway Assessment Tests and Difficult Intubation

Modified Mallampati Score (MMS)

Our findings indicate that the distribution of Modified Mallampati Grades did not differ significantly between diabetic and non-diabetic patients ($p = 0.791$). When categorized as normal (Class I-II) or difficult (Class III-IV), 26.1% of diabetic patients and 23.1% of non-diabetic patients were classified as potentially difficult, showing no significant difference ($p = 0.635$). This contrasts with the findings of Erden et al., who reported a significantly higher prevalence of difficult Mallampati grades (III-IV) in diabetic patients (35.7%) compared to non-diabetics (18.2%, $p < 0.01$).[65] This discrepancy might be attributed to differences in the duration of diabetes and glycemic control status of the study populations.

Regarding the predictive value of MMS, our study found excellent sensitivity (75.0%) and specificity (100%) for predicting difficult laryngoscopy in diabetic patients, with positive predictive value "(PPV) of 100% and negative predictive value (NPV) of 88.2%. In non-diabetic patients, MMS showed similar sensitivity (75.0%) but lower specificity (88.0%), with PPV of 57.1% and NPV of 94.3%. These findings align with those reported by Shiga et al. in their meta-analysis, where MMS demonstrated moderate sensitivity (49%) but good specificity (86%) in predicting difficult intubation in the general population.[66] However, our sensitivity values were higher, possibly due to the elderly population in our study, as aging affects oropharyngeal anatomy.

Upper Lip Bite Test (ULBT)

The most striking finding in our study was the significant difference in ULBT results between diabetic and non-diabetic patients. Class III ULBT (inability to bite the upper lip), indicating potential difficult intubation, was observed in 38.0% of diabetic patients compared to only 4.3% of non-diabetic patients ($p < 0.001$). This marked difference highlights the impact of diabetes on temporomandibular joint mobility and periodontal tissue integrity, leading to limited mouth opening and potentially difficult intubation.

Khan et al. reported similar findings, with 27.8% of diabetic patients showing Class III ULBT compared to 7.2% in non-diabetics.[67] The higher percentage in our study might be attributed to the elderly population, where age-related limitations in joint mobility compound diabetes-related changes.

The predictive value of ULBT for difficult laryngoscopy was remarkable in diabetic patients, with sensitivity of 90.6%, specificity of 90.0%, PPV of 82.9%, and NPV of 94.7%. In non-diabetic patients, ULBT showed lower sensitivity (18.8%) but excellent specificity (98.7%). These findings suggest that ULBT is particularly valuable in assessing airway difficulties in diabetic patients. Comparable results were reported by Honarmand et al., who found ULBT to have sensitivity of 78.9% and specificity of 91.7% in predicting difficult intubation".[68]

Palm Print Sign (PPS)

Our results demonstrated a significant difference in Palm Print Sign grades between diabetic and non-diabetic patients. Difficult grades (Grade 3-4) were observed in 26.1% of diabetic patients compared to only 7.6% of non-diabetic patients ($p = 0.001$). This finding highlights the impact of limited joint mobility syndrome associated with diabetes on hand flexibility and, by extension, airway anatomy.

The Palm Print Sign showed good predictive value for difficult laryngoscopy in diabetic patients (sensitivity 65.6%, specificity 95.0%, PPV 87.5%, NPV 83.8%). In non-diabetic patients, PPS had lower sensitivity (37.5%) but excellent specificity (98.7%). These results corroborate the findings of Vani et al., who reported that PPS had sensitivity of 71% and specificity of 93% in predicting difficult intubation in diabetic patients.[69]

Laryngoscopic View and Intubation Difficulty

The "Cormack-Lehane grading, which directly assesses laryngoscopic difficulty, showed a significant difference between the two groups when categorized as easy (Grade I-II) or difficult (Grade III-IV). Difficult laryngoscopy was encountered in 34.8% of diabetic patients compared to 17.6% of non-diabetic patients ($p = 0.010$). This nearly twofold higher incidence of difficult laryngoscopy in diabetic patients aligns with the findings of Nadal et al., who reported an incidence of 31.4% in diabetic patients versus 13.8% in non-diabetics.[70]

The higher incidence of difficult laryngoscopy translated into clinical outcomes, with diabetic patients requiring more time for intubation. Prolonged intubation time (>1 minute) was observed in 10.9% of diabetic patients compared to 3.3% of non-diabetic patients ($p = 0.048$). Similarly, multiple intubation attempts were required in 33.7% of diabetic patients versus 23.9% of non-diabetic patients, although this difference did not reach statistical significance ($p = 0.14$).

These findings underscore the impact of diabetes on airway anatomy and the consequent challenges in airway management. The pathophysiological mechanisms include glycosylation of proteins in the connective tissues and joints, leading to stiffness of the atlanto-occipital joint, temporomandibular joint, and cricothyroid joints. Additionally, the prayer sign" or limited joint mobility syndrome affects the upper airway anatomy, contributing to difficult laryngoscopy and intubation.[71]

Pathophysiological Mechanisms of Diabetes-Related Airway Changes

The underlying mechanisms explaining why diabetic patients experience more challenging airway management are multifaceted and rooted in the systemic pathophysiological changes associated with diabetes mellitus. Beyond the previously discussed glycosylation of collagen, several additional molecular and cellular processes contribute to airway and joint modifications.

1. Advanced Glycation End Products (AGEs) Chronic hyperglycemia leads to the formation of Advanced Glycation End Products (AGEs), which play a crucial role in tissue remodeling. These molecules cross-link proteins, particularly collagen and elastin, in connective tissues. In the context of airway anatomy, this process results in:

- Reduced elasticity of soft tissues
- Decreased joint mobility
- Increased stiffness of laryngeal and pharyngeal structures
- Potentially reduced neck and temporomandibular joint flexibility

2. Microvascular Complications Diabetes-induced microvascular damage extends beyond peripheral tissues and significantly impacts airway structures:

- Reduced blood supply to connective tissues
- Impaired tissue regeneration and repair
- Potential neurological changes affecting muscle tone and joint mobility
- Compromised tissue elasticity due to chronic microangiopathy

3. Inflammatory Mechanisms Chronic inflammation associated with diabetes contributes to airway changes:

- Increased pro-inflammatory cytokines (IL-6, TNF-α)
- Enhanced oxidative stress
- Potential fibrotic changes in soft tissues
- Altered immune response affecting tissue remodelling.

Comparative Analysis of Airway Assessment Tests

Our study's findings highlight the nuanced performance of different airway assessment tests across diabetic and non-diabetic populations. This variability underscores the importance of a comprehensive, multi-test approach to airway evaluation.

Upper Lip Bite Test (ULBT) The remarkable sensitivity of ULBT in diabetic patients (90.6%) suggests it may be the most reliable single predictor of difficult laryngoscopy in this population. This test's effectiveness likely stems from its direct assessment of mandibular mobility, which is particularly compromised in diabetic patients due to:

- Glycosylation-induced joint stiffness
- Reduced periodontal tissue flexibility
- Potential temporomandibular joint remodelling

Modified Mallampati Score (MMS*)* While MMS showed excellent specificity, its performance varied between groups. In non-diabetic patients, it demonstrated higher predictive value, suggesting that oropharyngeal visualization might be more consistently related to airway difficulty in populations without systemic metabolic alterations.

Palm Print Sign (PPS) The PPS's correlation with difficult laryngoscopy provides an intriguing systemic marker of diabetes-related connective tissue changes. Its ability to detect joint mobility limitations extends beyond airway assessment, potentially serving as a broader indicator of diabetic complications.

Correlation Between Airway Tests and Difficult Laryngoscopy

In our study, all three airway assessment tests (MMS, ULBT, and PPS) showed statistically significant correlation with difficult laryngoscopy in both diabetic and non-diabetic patients ($p < 0.001$). However, the strength of association and predictive values differed between the tests and patient groups.

In diabetic patients, ULBT demonstrated the highest sensitivity (90.6%) for predicting difficult laryngoscopy, followed by MMS (75.0%) and PPS (65.6%). All tests showed excellent specificity (>90%). This suggests that ULBT is particularly valuable in assessing airway difficulties in elderly diabetic patients. These findings are in agreement with Myneni et al., who reported that ULBT had higher sensitivity (73.2%) compared to MMS (68.4%) in predicting difficult intubation in diabetic patients.[72]

In non-diabetic patients, MMS showed the highest sensitivity (75.0%), while ULBT and PPS had lower sensitivities (18.8% and 37.5%, respectively) but excellent specificities (>98%). This differential performance of airway tests between diabetic and non-diabetic patients highlights the need for tailored approaches to airway assessment based on patient characteristics.

When all patients were considered together, MMS showed the highest sensitivity (75.0%), followed by ULBT (66.7%) and PPS (56.3%). All tests demonstrated excellent specificity (>94%). These findings suggest that while individual tests have limitations, combining multiple tests can enhance the accuracy of predicting difficult airways, especially in high-risk populations like elderly diabetic patients. Roth et al., in their systematic review, emphasized the importance of combining multiple airway assessment tests to improve predictive accuracy, as no single test has shown sufficient sensitivity and specificity to be used alone.[73] Our findings support this approach, particularly for elderly diabetic patients who present with multiple risk factors for difficult airway management.

Clinical Implications

The significantly higher incidence of difficult laryngoscopy and prolonged intubation time in elderly diabetic patients compared to non-diabetic counterparts has important clinical implications. Anesthesiologists should be particularly vigilant when managing the airways of elderly diabetic patients and should consider thorough preoperative airway assessment using multiple tests.

Our findings suggest that ULBT is particularly valuable in assessing airway difficulties in elderly diabetic patients, followed by MMS and PPS. The exceptional sensitivity and specificity of ULBT in diabetic patients makes it a useful tool for routine preoperative airway assessment in this population. However, given the limitations of individual tests, combining multiple tests is recommended to enhance predictive accuracy.

The significant correlation between Palm Print Sign and difficult laryngoscopy in diabetic patients highlights the systemic nature of diabetes-related changes, affecting not only the upper airway but also peripheral joints. This emphasizes the importance of assessing for limited joint mobility syndrome as part of preoperative evaluation in diabetic patients.

While our study focused on preoperative assessment, the higher incidence of difficult airways in elderly diabetic patients also underscores the need for appropriate preparation and availability of advanced airway management tools when anesthetizing these patients. Jung H et.al., in their review on difficult airway management in diabetic patients, recommended having video laryngoscopes and other advanced airway devices readily available when managing diabetic patients anticipated to have difficult airways.[74]

Mask Ventilation and Alternative Methods

Interestingly, despite the higher incidence of difficult laryngoscopy in diabetic patients, there was no significant difference in the ease of "mask ventilation between the two groups (p = 0.082). This suggests that factors contributing to difficult laryngoscopy in diabetic patients may not equally affect mask ventilation. This finding aligns with the observations of El-Orbany et al., who noted that difficult mask ventilation and difficult laryngoscopy do not always coexist and may have different predictors.[75]

The use of alternative methods, primarily video laryngoscopy, was more frequent in diabetic patients (6.5%) compared to non-diabetic patients (3.3%), although this difference did not reach statistical significance (p = 0.066). This trend reflects the recognition by anesthesiologists of the higher likelihood of difficult intubation in diabetic patients and the proactive use of advanced airway management tools. As highlighted by Aziz et al., video laryngoscopy is increasingly being used as a first-line approach in patients with anticipated difficult airways, showing higher success rates compared to conventional laryngoscopy".[71]

Conclusion: Our study demonstrates that elderly diabetic patients have a significantly higher incidence of difficult laryngoscopy and prolonged intubation time compared to non-diabetic patients of similar age. Among the airway assessment tests evaluated, Upper Lip Bite Test showed the highest predictive value for difficult laryngoscopy in diabetic patients, while Modified Mallampati Score performed better in non-diabetic patients. Palm Print Sign also demonstrated good correlation with difficult laryngoscopy, especially in diabetic patients, reflecting the systemic nature of diabetes-related changes affecting joint mobility.

These findings emphasize the importance of thorough preoperative airway assessment in elderly diabetic patients, preferably using multiple tests to enhance predictive accuracy. Anesthesiologists should be prepared for potentially difficult airways when managing elderly diabetic patients and should consider having advanced airway management tools readily available.

Further research is needed to develop composite scoring systems specifically tailored for elderly diabetic patients and to investigate whether optimizing diabetes management can mitigate airway-related complications during anesthesia.

LIMITATIONS

Our study has several limitations that should be acknowledged. First, the cross-sectional design limits our ability to establish causal relationships between diabetes and difficult airway characteristics. Longitudinal studies would provide better insights into how diabetes progression affects airway anatomy over time.

Second, we did not account for the duration of diabetes and glycemic control status, which could influence the extent of soft tissue and joint changes related to glycosylation. Future studies should incorporate these parameters to better understand the relationship between diabetes severity and airway difficulties.

Third, our study focused on elderly patients (aged ≥60 years), which makes it difficult to differentiate between age-related and diabetes-related changes in airway anatomy. Comparative studies across different age groups would help isolate the specific contributions of aging and diabetes to difficult airways.

Fourth, the subjective nature of some airway assessment tests and laryngoscopic grading introduces potential observer bias. Studies using more objective measures, such as radiological assessments or three-dimensional imaging of the upper airway, would provide more reliable data on anatomical changes associated with diabetes.

Future research should focus on developing composite scoring systems specifically tailored for elderly diabetic patients, incorporating the most predictive tests identified in our study (ULBT, MMS, and PPS) along with other relevant parameters such as neck circumference, thyromental distance, and radiological assessments. Additionally, studies investigating the impact of glycemic control interventions on airway characteristics would provide valuable insights into whether optimizing diabetes management can reduce airway-related complications during anesthesia.

CONCLUSION

CONCLUSION

This study provides substantial evidence that elderly diabetic patients present a significantly higher risk of difficult airway management compared to their non-diabetic counterparts. Our findings demonstrate that diabetes mellitus adversely affects airway anatomy and physiology in elderly patients, resulting in a higher incidence of difficult laryngoscopy (34.8% vs 17.6%), prolonged intubation time (10.9% vs 3.3%), and more frequent need for multiple intubation attempts (33.7% vs 23.9%). These complications can be effectively anticipated through comprehensive preoperative airway assessment.

Among the bedside tests evaluated, the Upper Lip Bite Test emerged as the most sensitive predictor of difficult laryngoscopy in elderly diabetic patients, with remarkable sensitivity (90.6%) and specificity (90.0%). The Modified Mallampati Score and Palm Print Sign also demonstrated good predictive value, particularly when considered collectively. The significant difference in the prevalence of Class III ULBT (38.0% vs 4.3%) and difficult Palm Print Sign grades (26.1% vs 7.6%) between diabetic and non-diabetic patients highlights the systemic impact of diabetes on joint mobility and soft tissue flexibility.

The pathophysiological mechanisms underlying difficult airways in diabetic patients involve glycosylation of proteins in connective tissues and joints, leading to limited joint mobility syndrome that affects the temporomandibular joint, atlanto-occipital joint, and cervical spine. This limited mobility translates to restricted mouth opening, reduced neck extension, and consequently, difficult visualization of laryngeal structures during intubation.

Given these findings, we recommend routine use of multiple airway assessment tests, with particular emphasis on the Upper Lip Bite Test and Palm Print Sign, when evaluating elderly diabetic patients preoperatively. Anesthesiologists should maintain a high index of suspicion for difficult airways in this population and ensure appropriate preparation, including availability of advanced airway management tools such as video laryngoscopes. Early recognition of potential difficulties can facilitate proactive airway management strategies, reducing the risk of adverse outcomes associated with difficult intubation.

Future research should focus on developing composite scoring systems specifically designed for elderly diabetic patients and investigating whether optimizing diabetes management can mitigate airway-related complications. Additionally, longitudinal studies examining the relationship between diabetes duration, glycemic control, and progression of airway difficulties would provide valuable insights for clinical practice.

In conclusion, diabetes mellitus significantly increases the risk of difficult airways in elderly patients undergoing general anesthesia. Simple bedside tests, particularly the Upper Lip Bite Test, can effectively predict these difficulties, enabling anesthesiologists to implement appropriate management strategies and potentially reduce associated morbidity and mortality.

SUMMARY

SUMMARY

This prospective observational study compared the efficacy of different airway assessment tests in predicting difficult airways among 92 elderly diabetic patients and 92 age-matched non-diabetic patients undergoing surgery under general anesthesia. The demographic profiles of both groups were comparable, with no significant differences in age "(mean age 66.68 ± 6.24 years), gender distribution (55.4% males, 44.6% females), and BMI (22.04 ± 4.24 vs. 21.27 ± 3.34 kg/m², $p = 0.172$). However, diabetic patients had a higher proportion of ASA III physical status (43.5% vs. 23.9%) and obesity (8.7% vs. 1.1%), though these differences did not reach statistical significance.

Preoperative airway assessment revealed significant differences between diabetic and non-diabetic patients in Upper Lip Bite Test results, with Class III ULBT (indicating potential difficult intubation) observed in 38.0% of diabetic patients compared to only 4.3% of non-diabetic patients ($p < 0.001$). Similarly, difficult Palm Print Sign grades (Grade 3-4) were significantly more prevalent in diabetic patients (26.1% vs. 7.6%, $p = 0.001$). The Modified Mallampati Score distribution did not differ significantly between the groups ($p = 0.791$).

Intraoperatively, difficult laryngoscopy (Cormack-Lehane Grade III-IV) was encountered in 34.8% of diabetic patients compared to 17.6% of non-diabetic patients ($p = 0.010$). Prolonged intubation time (>1 minute) was significantly more frequent in diabetic patients (10.9% vs. 3.3%, $p = 0.048$), and multiple intubation attempts were required more often (33.7% vs. 23.9%, $p = 0.14$)". The frequency of difficult mask ventilation was similar between the groups (15.2% vs. 16.3%, $p = 0.082$), and the use of alternative methods such as video laryngoscopy was more common in diabetic patients (6.5% vs. 3.3%, $p = 0.066$), though not statistically significant.

In predicting difficult laryngoscopy, all three airway assessment tests showed statistically

significant correlation in both patient groups ($p < 0.001$). In diabetic patients, ULBT demonstrated the highest sensitivity (90.6%) and excellent specificity (90.0%), followed by MMS (sensitivity 75.0%, specificity 100%) and PPS (sensitivity 65.6%, specificity 95.0%). In non-diabetic patients, MMS showed the highest sensitivity (75.0%), while ULBT and PPS had lower sensitivity but excellent specificity. These findings underscore the value of comprehensive preoperative airway assessment using multiple tests, particularly in elderly diabetic patients who are at higher risk for difficult airway management.

REFERENCES

REFERENCES

1. Cook TM, Woodall N, Frerk C; Fourth National Audit Project. 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. Part 1: anaesthesia. Br J Anaesth. 2011;106(5):617-631.
2. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, Hagberg CA, Caplan RA, Benumof JL, Berry FA, Blitt CD. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology. 2013;118(2):251-70.
3. 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):429-437.
4. Lundstrøm LH, Vester-Andersen M, Møller AM, Charuluxananan S, L'hermite J, Wetterslev J. Poor prognostic value of the modified Mallampati score: a meta-analysis involving 177,088 patients. Br J Anaesth. 2011;107(5):659-667.
5. Khan ZH, Kashfi A, Ebrahimkhani E. A comparison of the upper lip bite test (a simple new technique) with modified Mallampati classification in predicting difficulty in endotracheal intubation: a prospective blinded study. Anesth Analg. 2003;96(2):595-599.
6. Johnson KN, Botros DB, Groban L, Bryan YF. Anatomic and physiopathologic changes affecting the airway of the elderly patient: implications for geriatric-focused airway management. Clin Interv Aging. 2015;10:1925-1934.

7. Erden V, Basaranoglu G, Delatioglu H, Hamzaoglu NS. Relationship of difficult laryngoscopy to long-term non-insulin-dependent diabetes and hand abnormality detected using the 'prayer sign'. Br J Anaesth. 2003;91(1):159-160.
8. Vani V, Kamath SK, Naik LD. The palm print as a sensitive predictor of difficult laryngoscopy in diabetics: a comparison with other airway evaluation indices. J Postgrad Med. 2000;46(2):75-79.
9. Nørskov AK, Rosenstock CV, Wetterslev J, Astrup G, Afshari A, Lundstrøm LH. Diagnostic accuracy of anaesthesiologists' prediction of difficult airway management in daily clinical practice: a cohort study of 188,064 patients registered in the Danish Anaesthesia Database. Anaesthesia. 2015;70(3):272-281.
10. Cook TM, Woodall N, Harper J, Benger J; Fourth National Audit Project. 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. Part 2: intensive care and emergency departments. Br J Anaesth. 2011;106(5):632-642.
11. Apfelbaum JL, Hagberg CA, Connis RT, et al. 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. Anesthesiology 2022;136:31-81.
12. Cook TM, Woodall N, Frerk C, et al. 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. Part 1: anaesthesia. Br J Anaesth 2011;106:617-31
13. Cook TM, Woodall N, Frerk C., Fourth National Audit Project. 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. Part 1: anaesthesia. Br J Anaesth. 2011 May;106(5):617-31.

14. Cook TM, Woodall N, Harper J, Benger J., Fourth National Audit Project. 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. Part 2: intensive care and emergency departments. Br J Anaesth. 2011 May;106(5):632-42.
15. Schiff JH, Welker A, Fohr B, Henn-Beilharz A, Bothner U, Van Aken H, Schleppers A, Baldering HJ, Heinrichs W. Major incidents and complications in otherwise healthy patients undergoing elective procedures: results based on 1.37 million anaesthetic procedures. Br J Anaesth. 2014 Jul;113(1):109-21.
16. Xia M, Ma W, Zuo M, Deng X, Xue F, Battaglini D, et al. Expert consensus on difficult airway assessment. Hepatobiliary Surg Nutr. 2023 Aug 1;12(4):545-566.
17. Ball M, Hossain M, Padalia D. Anatomy, Airway. [Updated 2023 Jul 25]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK459258/
18. Kinsella SM, Winton AL, Mushambi MC, Ramaswamy K, Swales H, Quinn AC, Popat M. Failed tracheal intubation during obstetric general anaesthesia: a literature review. Int J Obstet Anesth. 2015 Nov;24(4):356-74.
19. Mushambi MC, Kinsella SM, Popat M, Swales H, Ramaswamy KK, Winton AL, et al. Obstetric Anaesthetists' Association. Difficult Airway Society. Obstetric Anaesthetists' Association and Difficult Airway Society guidelines for the management of difficult and failed tracheal intubation in obstetrics. Anaesthesia. 2015 Nov;70(11):1286-306.
20. Austin N, Krishnamoorthy V, Dagal A. Airway management in cervical spine injury. Int J Crit Illn Inj Sci. 2014 Jan;4(1):50-6.
21. Kristensen MS. Airway management and morbid obesity. Eur J Anaesthesiol. 2010 Nov;27(11):923-7.

22. Weingart SD, Levitan RM. Preoxygenation and prevention of desaturation during emergency airway management. Ann Emerg Med. 2012 Mar;59(3):165-75.e1.
23. Ikeda A, Isono S, Sato Y, Yogo H, Sato J, Ishikawa T, Nishino T. Effects of muscle relaxants on mask ventilation in anesthetized persons with normal upper airway anatomy. Anesthesiology. 2012 Sep;117(3):487-93.
24. Henderson JJ, Popat MT, Latto IP, Pearce AC., Difficult Airway Society. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia. 2004 Jul;59(7):675-94.
25. Goto T, Watase H, Morita H, Nagai H, Brown CA, Brown DF, et al. Japanese Emergency Medicine Network Investigators. Repeated attempts at tracheal intubation by a single intubator associated with decreased success rates in emergency departments: an analysis of a multicentre prospective observational study. Emerg Med J. 2015 Oct;32(10):781-6.
26. Li T, Jafari D, Meyer C, Voroba A, Haddad G, Abecassis S, et al. Video laryngoscopy is associated with improved first-pass intubation success compared with direct laryngoscopy in emergency department trauma patients. J Am Coll Emerg Physicians Open. 2021 Feb;2(1):e12373.
27. Foley LJ, Urdaneta F, Berkow L, Aziz MF, Baker PA, Jagannathan N, et al. Difficult Airway Management in Adult Coronavirus Disease 2019 Patients: Statement by the Society of Airway Management. Anesth Analg. 2021 Oct 01;133(4):876-890.
28. Ovassapian A, Glassenberg R, Randel GI, Klock A, Mesnick PS, Klafta JM. The unexpected difficult airway and lingual tonsil hyperplasia: a case series and a review of the literature. Anesthesiology. 2002 Jul;97(1):124-32.
29. Langeron O, Masso E, Huraux C, et al. Prediction of difficult mask ventilation. Anesthesiology 2000;92:1229-36.

30. Adamus M, Jor O, Vavreckova T, et al. Inter-observer reproducibility of 15 tests used for predicting difficult intubation. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub 2011;155:275-81.
31. Wong SH, Hung CT. Prevalence and prediction of difficult intubation in Chinese women. Anaesth Intensive Care 1999;27:49-52.
32. Chhina AK, Jain R, Gautam PL, et al. Formulation of a multivariate predictive model for difficult intubation: A double blinded prospective study. J Anaesthesiol Clin Pharmacol 2018;34:62-7.
33. Khan ZH, Arbabi S, Yekaninejad MS, et al. Application of the upper lip catch test for airway evaluation in edentulous patients: An observational study. Saudi J Anaesth 2014;8:73-7.
34. Roth D, Pace NL, Lee A, et al. Bedside tests for predicting difficult airways: an abridged Cochrane diagnostic test accuracy systematic review. Anaesthesia 2019;74:915-28.
35. Khatiwada S, Bhattarai B, Pokharel K, et al. Prediction of Difficult Airway Among Patients Requiring Endotracheal Intubation in a Tertiary Care Hospital in Eastern Nepal. JNMA J Nepal Med Assoc 2017;56:314-8.
36. .Ul Haq MI, Ullah H. Comparison of Mallampati test with lower jaw protrusion maneuver in predicting difficult laryngoscopy and intubation. J Anaesthesiol Clin Pharmacol 2013;29:313-7.
37. Honarmand A, Safavi MR. Prediction of difficult laryngoscopy in obstetric patients scheduled for Caesarean delivery. Eur J Anaesthesiol 2008;25:714-20.
38. Kim WH, Ahn HJ, Lee CJ, et al. Neck circumference to thyromental distance ratio: a new predictor of difficult intubation in obese patients. Br J Anaesth 2011;106:743-8.

39. Qudaisat IY, Al-Ghanem SM. Short thyromental distance is a surrogate for inadequate head extension, rather than small submandibular space, when indicating possible difficult direct laryngoscopy. Eur J Anaesthesiol 2011;28:600-6.
40. S PK , Kagalkar N, Holyachi R, et al. Ratios of Height-to-Thyromental Distance and Height-to-Sternomental Distance as Predictors of Difficult Airway in Patients Posted for General Anaesthesia. Asian J Anesthesiol 2021;59:69-75.
41. Palczynski P, Bialka S, Misiolek H, et al. Thyromental height test as a new method for prediction of difficult intubation with double lumen tube. PLoS One 2018;13:e0201944.
42. Rao KVN, Dhatchinamoorthi D, Nandhakumar A, et al. Validity of thyromental height test as a predictor of difficult laryngoscopy: A prospective evaluation comparing modified Mallampati score, interincisor gap, thyromental distance, neck circumference, and neck extension. Indian J Anaesth 2018;62:603-8.
43. Jung H. A comprehensive review of difficult airway management strategies for patient safety. Anesth Pain Med (Seoul). 2023 Oct;18(4):331-339.
44. Hogan K, Rusy D, Springman SR. Difficult laryngoscopy and diabetes mellitus. Anesth Analg. 1988;67(12):1162-5.
45. Warner ME, Contreras MG, Warner MA, Schroeder DR, Munn SR, Maxson PM. Diabetes mellitus and difficult laryngoscopy in renal and pancreatic transplant patients. Anesth Analg. 1998;86(3):516-9.
46. Nolan CJ, Damm P, Prentki M. Type 2 diabetes across generations: from pathophysiology to prevention and management. The Lancet. 2011;9;378(9786):169-81.

47. Erden V, Bassaranoglu G, Delatiogu H, Hamzaoglu NS. Relationship of difficult laryngoscopy to long term non insulin dependent diabetes and hand abnormality detected using the 'prayer sign'. Br. J. Anaesth. 2003;91(1):159-160.
48. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia. 1984;39(11):1105-11.
49. Vani V, Kamath SK, Naik LD. The palm print as a sensitive predictor of difficult laryngoscopy in diabetics: a comparison with other airway evaluation indices. J Postgrad Med. 2000;46:75-9.
50. Baig MM, Khan FH. To compare the accuracy of prayer's sign and Mallampati test in predicting difficult intubation in diabetic patients. J Pak Med Assoc. 2014;64(8):879-83.
51. Rao MH, Sumantaray A, Radhapuram SD, Muralidhar A. Evaluation of predictability of airway indices to detect difficult laryngoscopy in diabetic and nondiabetic patients receiving general anaesthesia with tracheal intubation. International Journal of Medical Science and Current Research 2021;4(1):757-764.
52. Hashim K, Thomas M. Sensitivity of palm print sign in prediction of difficult laryngoscopy in diabetes: A comparison with other airway indices. Indian J Anaesth. 2014 May;58(3):298-302.
53. Begum R, Remadevi, Renganathan, Prabu G. Study comparing different airway assessment tests in predicting difficult laryngoscopy. Int J Acad Med Pharm 2024; 6 (5); 872-875.
54. Singh H, Dwivedi D, Tandon U, Bhatnagar V, Jinjil K, Tara S. Comparing the sensitivity of palm print sign and prayer sign in prediction of difficult intubation in diabetic patients. Arch Med Health Sci 2022;10:207-12.

55. Stevanovic K, Sabljak V, Toskovic A, Kukic B, Stekovic J, Antonijevic V et al. Anaesthesia and the patient with diabetes. Research and Reviews 2015;9(3):177-179.
56. Panjiar P, Bhat KM, Yousuf I, Kochhar A, Ralli T. Study comparing different airway assessment tests in predicting difficult laryngoscopy: A prospective study in geriatric patients. Indian J Anaesth 2021;65:309-15.
57. Prakash S, Kumar A, Bhandari S, Mullick P, Singh R, Gogia AR. Difficult laryngoscopy and intubation in the Indian population: An assessment of anatomical and clinical risk factors. Indian J Anaesth. 2013 Nov;57(6):569-75.
58. Sagün A, Ozdemir L, Melikogullari SB. The assessment of risk factors associated with difficult intubation as endocrine, musculoskeletal diseases and intraoral cavity mass: A nested case control study. Ulus Travma Acil Cerrahi Derg. 2022 Sep;28(9):1270-1276.
59. Kotwani, M., Kawale, N. N., Nam, P. B., & Kotwani, D. (2024). Modified Mallampati Test in Supine versus Sitting Position as a Predictor for Difficult Intubation – An Observational Study. Airway, 7(2), 64-70.
60. Vakilian A, Tabari M, Emadzadeh M, Soltani G. Evaluation of palm print sign and prayer sign in prediction of difficult laryngoscopy in diabetic patients. Anesth Pain Med. 2023 Jan 16;13(1).
61. Prakash S, Kumar A, Bhandari S, Mullick P, Singh R, Gogia AR. Difficult laryngoscopy and intubation in the Indian population: An assessment of anatomical and clinical risk factors. Indian J Anaesth. 2013;57(6):569-575. doi:10.4103/0019-5049.123329
62. Mahmoodpoor A, Soleimanpour H, Nia KS, Panahi JR, Afhami M, Golzari SE, et al. Sensitivity of palm print, modified mallampati score and 3-3-2 rule in prediction of difficult intubation. Int J Prev Med. 2013;4(9):1063-1069.

63. Kim WH, Ahn HJ, Lee CJ, Shin BS, Ko JS, Choi SJ, et al. Neck circumference to thyromental distance ratio: a new predictor of difficult intubation in obese patients. Br J Anaesth. 2011;106(5):743-748. doi:10.1093/bja/aer024

64. Hashim K, Thomas M. Sensitivity of palm print sign in prediction of difficult laryngoscopy in diabetes: A comparison with other airway indices. Indian J Anaesth. 2014;58(3):298-302. doi:10.4103/0019-5049.135043

65. Erden V, Basaranoglu G, Delatioglu H, Hamzaoglu NS. Relationship of difficult laryngoscopy to long-term non-insulin-dependent diabetes and hand abnormality detected using the 'prayer sign'. Br J Anaesth. 2003;91(1):159-160. doi:10.1093/bja/aeg115

66. 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):429-437. doi:10.1097/00000542-200508000-00027

67. Khan ZH, Mohammadi M, Rasouli MR, Farrokhnia F, Khan RH. The diagnostic value of the upper lip bite test combined with sternomental distance, thyromental distance, and interincisor distance for prediction of easy laryngoscopy and intubation: a prospective study. Anesth Analg. 2009;109(3):822-824. doi:10.1213/ane.0b013e3181af7f0d

68. Honarmand A, Safavi M, Yaraghi A, Attari M, Khazaei M, Zamani M. Comparison of five methods in predicting difficult laryngoscopy: Neck circumference, neck circumference to thyromental distance ratio, the ratio of height to thyromental distance, upper lip bite test and Mallampati test. Adv Biomed Res. 2015;4:122. doi:10.4103/2277-9175.158033

69. Vani V, Kamath SK, Naik LD. The palm print as a sensitive predictor of difficult laryngoscopy in diabetics: a comparison with other airway evaluation indices. J Postgrad Med. 2000;46(2):75-79.

70. Nadal JLY, Fernandez BG, Escobar IC, Black M, Rosenblatt WH. The palm print as a sensitive predictor of difficult laryngoscopy in diabetics. Acta Anaesthesiol Scand. 1998;42(2):199-203. doi:10.1111/j.1399-6576.1998.tb05109.x

71. Aziz MF, Dillman D, Fu R, Brambrink AM. Comparative effectiveness of the C-MAC video laryngoscope versus direct laryngoscopy in the setting of the predicted difficult airway. Anesthesiology. 2012;116(3):629-636. doi:10.1097/ALN.0b013e318246ea34

72. Myneni N, O'Leary AM, Sandison M, Roberts K. Evaluation of the upper lip bite test in predicting difficult laryngoscopy. J Clin Anesth. 2010;22(3):174-178. doi:10.1016/j.jclinane.2009.06.009

73. Roth D, Pace NL, Lee A, Hovhannisyan K, Warenits AM, Arrich J, et al. Airway physical examination tests for detection of difficult airway management in apparently normal adult patients. Cochrane Database Syst Rev. 2018;5(5). doi:10.1002/14651858.CD008874.pub2

74. Jung H. A comprehensive review of difficult airway management strategies for patient safety. Anesth Pain Med (Seoul). 2023 Oct;18(4):331-339. doi: 10.17085/apm.23123. Epub 2023 Oct 31. PMID: 37919917; PMCID: PMC10635845.

75. El-Orbany M, Woehlck HJ. Difficult mask ventilation. Anesth Analg. 2009;109(6):1870-1880. doi:10.1213/ANE.0b013e3181b5881c.

ANNEXURE

ANNEXURE

PROFORMA

TITLE: Evaluation of Different Airway Tests in Predicting Difficult Airway in Elderly Diabetic and Non-Diabetic Patient's Undergoing Surgery Under General Anaesthesia.

GENERAL CHARACTERISTICS:

SERIAL NUMBER:

AGE: GENDER:

WEIGHT: HEIGHT: BMI:

ASA PHYSICAL STATUS:

COMORBIDITY:

PATIENT ON ANY MEDICATIONS:

PRE-OPERATIVE EVALUATION:

UPPER LIP BITE TEST:

CLASS I	CLASS II	CLASS III

NECK RANGE OF MOVEMENT:

< 80 DEGREE	NEAR 90 DEGREE	>100 DEGREE

PALM PRINT SIGN:

GRADE 0	GRADE 1	GRADE 2	GRADE 3

MODIFIED MALLAMPATI GRADE:

GRADE I	GRADE II	GRADE III	GRADE IV

CORMACK LEHANE GRADE:

GRADE 1	GRADE 2	GRADE 3	GRADE 4

1. Mask ventilation:
   i. Easy:
   ii. Difficult:

2. Time taken for intubation:
3. Number of attempts to intubate:
4. ANY OTHER METHOD USED:

PATIENT INFORMATION SHEET

TITLE: Evaluation of Different Airway Tests in Predicting Difficult Airway in Elderly Diabetic And Non-Diabetic Patient's Undergoing Surgery Under General Anaesthesia.

Study Location: R L Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College, Tamaka, Kolar.

Details - All Patients who are elderly diabetic and non-diabetic posted for Elective Surgeries under general anesthesia will be included in this study.

This study aims to reduce the incidence of intraoperative difficult airway intubation in patients undergoing elective surgeries under general anesthesia. Patient and the attenders will be completely explained about the procedure. Patient will be made to perform upper lip bite test, range of neck movement, palm print sign, modified mallampati grade. One group who are elderly diabetic and the other group elderly non-diabetic with or without any other joint disorders are included. During intubation the visualization of glottis will be documented. The preoperative airway tests will be compared with the Cormack Lehane grading. The use of preoperative tests in anticipating difficult airway will be analysed. There will be no risk involved in the study as it is an observational study. Participant will not have any financial expenses and will not get any monetary benefits for participating in the study.

Please read the information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study, we will collect information. Relevant history will be taken. This information collected will be used only for dissertation and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

For any further clarification you are free to contact,

Dr. Sadvi A S
Postgraduate,
Department of Anaesthesia.

ರೋಗಿಯ ಮಾಹಿತಿ ಪತ್ರ

ಅಧ್ಯಯನದ ಶೀರ್ಷಿಕೆ: ಸಾಮಾನ್ಯ ಅರವಳಿಕೆ ಅಡಿಯಲ್ಲಿ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗೆ ಒಳಗಾಗುತ್ತಿರುವ ವಯಸ್ಸಾದ ಮಧುಮೇಹ ಮತ್ತು ಮಧುಮೇಹವಲ್ಲದ ರೋಗಿಗಳಲ್ಲಿ ಕಷ್ಟಕರವಾದ ವಾಯುಮಾರ್ಗವನ್ನು ಊಹಿಸಲು ವಿಭಿನ್ನ ವಾಯುಮಾರ್ಗ ಪರೀಕ್ಷೆಗಳ ಮೌಲ್ಯಮಾಪನ.

ಅಧ್ಯಯನದ ಸ್ಥಳ: ಕೋಲಾರ್‌ನ ತಮಾಕಾದ ಶ್ರೀ ದೇವರಾಜ್ ಅರಸ್ ವೈದ್ಯಕೀಯ ಕಾಲೇಜಿಗೆ ಹೊಂದಿಕೊಂಡಿರುವ ಆರ್. ಎಲ್. ಜಾಲಪ್ಪ ಆಸ್ಪತ್ರೆ ಮತ್ತು ಸಂಶೋಧನಾ ಕೇಂದ್ರ.

ವಿವರಗಳು- ಸಾಮಾನ್ಯ ಅರವಳಿಕೆ ಅಡಿಯಲ್ಲಿ ಚುನಾಯಿತ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗಳಿಗೆ ಪೋಸ್ಟ್ ಮಾಡಲಾದ ವಯಸ್ಸಾದ ಮಧುಮೇಹ ಮತ್ತು ಮಧುಮೇಹವಿಲ್ಲದ ಎಲ್ಲಾ ರೋಗಿಗಳನ್ನು ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಸೇರಿಸಲಾಗುತ್ತದೆ.
ಈ ಅಧ್ಯಯನವು ಸಾಮಾನ್ಯ ಅರಿವಳಿಕೆ ಅಡಿಯಲ್ಲಿ ಚುನಾಯಿತ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗೆ ಒಳಗಾಗುವ ರೋಗಿಗಳಲ್ಲಿ ಇಂಟ್ರಾಆಪರೇಟಿವ್ ಕಷ್ಟಕರವಾದ ವಾಯುಮಾರ್ಗದ ಒಳಹರಿವಿನ ಸಂಭವವನ್ನು ಕಡಿಮೆ ಮಾಡುವ ಗುರಿಯನ್ನು ಹೊಂದಿದೆ. ರೋಗಿಯು ಮತ್ತು ಹಾಜರಾದವರಿಗೆ ಕಾರ್ಯವಿಧಾನದ ಬಗ್ಗೆ ಸಂಪೂರ್ಣವಾಗಿ ವಿವರಿಸಲಾಗುವುದು. ರೋಗಿಯನ್ನು ಮೇಲಿನ ತುಟಿ ಕಚ್ಚುವಿಕೆಯ ಪರೀಕ್ಷೆ, ಕತ್ತಿನ ಚಲನೆಯ ವ್ಯಾಪ್ತಿ, ಪಾಮ್ ಪ್ರಿಂಟ್ ಚಿಹ್ನೆ, ಮಾರ್ಪಡಿಸಿದ ಮಲ್ಲಂಪತಿ ದರ್ಜೆಯನ್ನು ಮಾಡಲು ಮಾಡಲಾಗುತ್ತದೆ. ವಯಸ್ಸಾದ ಮಧುಮೇಹ ಹೊಂದಿರುವ ಒಂದು ಗುಂಪು ಮತ್ತು ಇತರ ಯಾವುದೇ ಜಂಟಿ ಅಸ್ವಸ್ಥತೆಗಳೊಂದಿಗೆ ಅಥವಾ ಇಲ್ಲದಿರುವ ಹಿರಿಯರಲ್ಲದ ಇತರ ಗುಂಪುಗಳನ್ನು ಸೇರಿಸಲಾಗಿದೆ. ಇಂಟ್ಯೂಬೇಶನ್ ಸಮಯದಲ್ಲಿ ಗ್ಲೋಟಿಸ್ನ ದೃಶ್ಯೀಕರಣವನ್ನು ದಾಖಲಿಸಲಾಗುತ್ತದೆ. ಪೂರ್ವಭಾವಿ ವಾಯುಮಾರ್ಗ ಪರೀಕ್ಷೆಗಳನ್ನು ಕಾರ್ಮ್ಯಾಕ್ ಲೆಹಾನ್ ಶ್ರೇಣೀಕರಣದೊಂದಿಗೆ ಹೋಲಿಸಲಾಗುತ್ತದೆ. ಕಷ್ಟಕರವಾದ ವಾಯುಮಾರ್ಗವನ್ನು ನಿರೀಕ್ಷಿಸುವಲ್ಲಿ ಪೂರ್ವಭಾವಿ ಪರೀಕ್ಷೆಗಳ ಬಳಕೆಯನ್ನು ವಿಶ್ಲೇಷಿಸಲಾಗುತ್ತದೆ. ಇದು ವೀಕ್ಷಣಾ ಅಧ್ಯಯನವಾಗಿರುವುದರಿಂದ ಅಧ್ಯಯನದಲ್ಲಿ ಯಾವುದೇ ಅಪಾಯವಿರುವುದಿಲ್ಲ. ಭಾಗವಹಿಸುವವರು ಯಾವುದೇ ಹಣಕಾಸಿನ ವೆಚ್ಚಗಳನ್ನು ಹೊಂದಿರುವುದಿಲ್ಲ ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಯಾವುದೇ ಹಣಕಾಸಿನ ಪ್ರಯೋಜನಗಳನ್ನು ಪಡೆಯುವುದಿಲ್ಲ.

ದಯವಿಟ್ಟು ಮಾಹಿತಿಯನ್ನು ಓದಿ ಮತ್ತು ನಿಮ್ಮ ಕುಟುಂಬ ಸದಸ್ಯರೊಂದಿಗೆ ಚರ್ಚಿಸಿ. ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ನೀವು ಯಾವುದೇ ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳಬಹುದು. ನೀವು ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಒಪ್ಪಿದರೆ, ನಾವು ಮಾಹಿತಿಯನ್ನು ಸಂಗ್ರಹಿಸುತ್ತೇವೆ. ಸಂಬಂಧಿತ ಇತಿಹಾಸವನ್ನು ತೆಗೆದುಕೊಳ್ಳಲಾಗುವುದು. ಸಂಗ್ರಹಿಸಿದ ಈ ಮಾಹಿತಿಯನ್ನು ಪ್ರಬಂಧ ಮತ್ತು ಪ್ರಕಟಣೆಗೆ ಮಾತ್ರ ಬಳಸಲಾಗುತ್ತದೆ.

ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಲಾದ ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯವಾಗಿ ಇರಿಸಲಾಗುತ್ತದೆ ಮತ್ತು ಯಾವುದೇ ಹೊರಗಿನವರಿಗೆ ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ. ನಿಮ್ಮ ಗುರುತನ್ನು ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನವನ್ನು ಒಪ್ಪಿಕೊಳ್ಳಲು ಯಾವುದೇ ಒತ್ತಾಯವಿಲ್ಲ. ನೀವು ಭಾಗವಹಿಸಲು ಬಯಸದಿದ್ದರೆ ನೀವು ಪಡೆಯುವ ಕಾಳಜಿಯು ಬದಲಾಗುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನೀವು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಸಮ್ಮತಿಸಿದರೆ ಮಾತ್ರ ನೀವು ಸಹಿ/ಹೆಬ್ಬೆರಳಿನ ಗುರುತನ್ನು ಒದಗಿಸಬೇಕಾಗುತ್ತದೆ.

ಯಾವುದೇ ಹೆಚ್ಚಿನ ಸ್ಪಷ್ಟೀಕರಣಕ್ಕಾಗಿ ನೀವು ಸಂಪರ್ಕಿಸಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ,

ಡಾ. ಸಾದ್ವಿ ಎ. ಎಸ್

(ಅರಿವಳಿಕೆ ಶಾಸ್ತ್ರದಲ್ಲಿ ಸ್ನಾತಕೋತ್ತರ ಪದವಿ)

ಅರಿವಳಿಕೆ ವಿಭಾಗ,

WRITTEN INFORMED CONSENT FORM

EVALUATION OF DIFFERENT AIRWAY TESTS IN PREDICTING DIFFICULT AIRWAY IN ELDERLY DIABETIC AND NON-DIABETIC PATIENT'S UNDERGOING SURGERY UNDER GENERAL ANAESTHESIA

DATE:

I, ______________________________aged __________, after being explained in my own vernacular language about the purpose of the study and the risks and complications of the procedure, hereby give my valid written informed consent without any force or prejudice for performing upper lip bite test, neck range of movement, palm print sign, modified mallampati grade. The nature and risks involved have been explained to me to my satisfaction. I have been explained in detail about the study being conducted. I have read the patient information sheet and I have had the opportunity to ask any question. Any question that I have asked, have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research. I hereby give consent to provide my history, undergo physical examination, undergo the procedure, undergo investigations and provide its results and documents etc., to the doctor / institute etc., For academic and scientific purpose the operation / procedure etc., may be video graphed or photographed. All the data may be published or used for any academic purpose. I will not hold the doctors / institute etc., responsible for any untoward consequences during the procedure / study.

A copy of this Informed Consent Form and Patient Information Sheet has been provided to the participant.

(Signature & Name of Pt. Attendant) (Signature/Thumb impression & Name of Patient)

(Relation with patient)

Witness 1:

Witness 2:

(Signature & Name of Research person /doctor)

<u>ಮಾಹಿತಿ ಮತ್ತು ಒಪ್ಪಿಗೆ ನಮೂನೆ</u>

ಸಾಮಾನ್ಯ ಅರವಳಿಕೆ ಅಡಿಯಲ್ಲಿ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗೆ ಒಳಗಾಗುತ್ತಿರುವ ವಯಸ್ಕಾದ ಮಧುಮೇಹ ಮತ್ತು ಮಧುಮೇಹವಲ್ಲದ ರೋಗಿಗಳಲ್ಲಿ ಕಷ್ಟಕರವಾದ ವಾಯುಮಾರ್ಗವನ್ನು ಊಹಿಸಲು ವಿಭಿನ್ನ ವಾಯುಮಾರ್ಗ ಪರೀಕ್ಷೆಗಳ ಮೌಲ್ಯಮಾಪನ.

ದಿನಾಂಕ **:**

ನಾನು,_________, ವಯಸ್ಸು ____, ಅಧ್ಯಯನದ ಉದ್ದೇಶ ಮತ್ತು ಕಾರ್ಯ ವಿಧಾನದ ಅಪಾಯಗಳು ಮತ್ತು ತೊಡಕುಗಳ ಬಗ್ಗೆ ನನ್ನ ಸ್ವಂತ ಭಾಷೆಯಲ್ಲಿ ವಿವರಿಸಿದ ನಂತರ, ಸಾಮಾನ್ಯ ಅರವಳಿಕೆ ಅಡಿಯಲ್ಲಿ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗೆ ಒಳಗಾಗುತ್ತಿರುವ ವಯಸ್ಕಾದ ಮಧುಮೇಹ ಮತ್ತು ಮಧುಮೇಹವಲ್ಲದ ರೋಗಿಗಳಲ್ಲಿ ಕಷ್ಟಕರವಾದ ವಾಯುಮಾರ್ಗವನ್ನು ಊಹಿಸಲು ವಿಭಿನ್ನ ವಾಯುಮಾರ್ಗ ಪರೀಕ್ಷೆಗಳ ಮೌಲ್ಯಮಾಪನ" ಅನ್ನು ನಿರ್ವಹಿಸಲು ಯಾವುದೇ ಬಲ ಅಥವ ಪೂರ್ವಗ್ರಹವಿಲ್ಲದೆನನ್ನ ಮಾನ್ಯ ಲಿಖಿತ ತಿಳುವಳಿಕೆಯ ಒಪ್ಪಿಗೆಯನ್ನು ಈ ಮೂಲಕ ನೀಡುತ್ತೇನೆ.

ಒಳಗೊಂಡಿರುವ ಸ್ವರೂಪ ಮತ್ತು ಅಪಾಯಗಳನ್ನು ನನ್ನ ತೃಪ್ತಿಗೆವಿವರಿಸಲಾಗಿದೆ. ನಡೆಸುತ್ತಿರುವ ಅಧ್ಯಯನದ ಬ ಗ್ಗೆ ನನಗೆ ವಿವರವಾಗಿ

ತಿಳಿಸಲಾಗಿದೇ. ನಾನು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಓದಿದ್ದೇನೆ ಮತ್ತುಯಾವುದೇ ಪ್ರಶ್ನೆ ಕೇಳುವ ಅವಕಾಶ ನನ ಗೆ ಸಿಕ್ಕಿದೆ. ನಾನು ಕೇಳಿದ ಯಾವುದೇಪ್ರಶ್ನೆಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ಉತ್ತರಿಸಲಾಗಿದೆ. ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ನಾನು ಸ್ವಯಂ ಪ್ರೇರಣೆಯಿಂದ

ಒಪ್ಪುತ್ತೇನೆ. ನನ್ನ ಇತಿಹಾಸವನ್ನು ಒದಗಿಸಲು, ದೈಹಿಕಪರೀಕ್ಷೆಗೆ, ಕಾರ್ಯವಿಧಾನಕ್ಕೆ ಒಳಗಾಗಲು, ತನಿಖೆಗೆ ಒಳಗಾಗ ಲುಮತ್ತು ಅದರ ಫಲಿತಾಂಶಗಳು ಮತ್ತು ದಾಖಲೆ ಇತ್ಯಾದಿಗಳನ್ನು ವೈದ್ಯರಿಗೆ / ಸಂಸ್ಥೆಗೆ ನೀಡಲು ನಾನು ಈ ಮೂಲಕ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ.

ಶೈಕ್ಷಣಿಕ ಮತ್ತು ವೈಜ್ಞಾನಿಕಉದ್ದೇಶಕ್ಕಾಗಿ ಕಾರ್ಯಾಚರಣೆ / ಕಾರ್ಯವಿಧಾನ ಇತ್ಯಾದಿ ವೀಡಿಯೊ ಆಗಿರಬಹುದು ಗ್ರಾಫ್ ಅಥವಾ ಛಾಯಾಚಿತ್ರ, ಎಲ್ಲಾ ಡೇಟಾವನ್ನು ಯಾವುದೇ ಶೈಕ್ಷಣಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಪ್ರಕಟಿಸಬಹುದು ಅಥವಾ ಬಳಸಬಹುದು.

ಕಾರ್ಯವಿಧಾನ/ ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಯಾವುದೇ ಅಹಿತಕರ ಪರಿಣಾಮಗಳಿಗೆ ನಾನು,ವೈದ್ಯರು / ಸಂಸ್ಥೆ ಇ ತ್ಯಾದಿಗಳನ್ನು ಜವಾಬ್ದಾರರನ್ನಾಗಿ ಮಾಡುವುದಿಲ್ಲ.

ಭಾಗವಹಿಸುವವರಿಗೆ ಈ ತಿಳುವಳಿಕೆಯುಳ್ಳ ಒಪ್ಪಿಗೆ ನಮೂನೆ ಮತ್ತು ರೋಗಿಯಮಾಹಿತಿ ಹಾಳೆಯ ನಕಲನ್ನು

ಒದಗಿಸಲಾಗಿದೆ

(ಸಹಿ ಮತ್ತು ಪಂ. ಅಟೆಂಡೆಂಟ್) (ಸಹಿ / ಹೆಬ್ಬೆರಳು ಅನಿಸಿಕೆ ಮತ್ತು ರೋಗಿಯ ಹೆಸರು)

(ರೋಗಿಯೊಂದಿಗಿನ ಸಂಬಂಧ)

ಸಾಕ್ಷಿ ೧:

ಸಾಕ್ಷಿ ೨: (ಸಹಿ ಮತ್ತು ಸಂಶೋಧನಾ ವ್ಯಕ್ತಿ / ವೈದ್ಯರ ಹೆಸರು)

MASTER CHART

l. No.	Group	Age (yrs)	Gender	BMI(KG/M2)	ASA - PSA	Other comorbodities	Medications	Upper Lip Bite Test	Neck ROM< 80 degree	Neck ROM = 90 degree	Neck ROM>100 degree	Palm Print Sign	Modified Mallampati Grade	Cormack- Lehane Grade	Mask Ventilation	Time taken For Intubation	Number Of Attempts	Other Methods	
1	2	60	F	18	III	nil	nil	Class 2	0	0	1	2	2	2	Easy	<10 secs	1	nil	
2	2	62	F	19	III	HTN	antihypertensives	Class 2	0	0	1	3	4	1	Easy	< 10 secs	1	nil	
3	2	60	F	40	II	nil	nil	Class 1	0	1	0	3	4	3	Difficult due to short neck	<1 min	2	VL	
4	2	67	F	17	III	nil	nil	Class 1	0	0	1	2	2	2	Easy	10 secs	1	nil	
5	2	63	F	20	II	nil	nil	Class 1	0	0	1	1	1	2	Easy	10 secs	1	nil	
6	2	61	M	19	III	nil	nil	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
7	2	65	M	26	II	nil	nil	Class 1	0	0	1	2	3	2	Easy	10 secs	1	nil	
8	2	65	M	25	II	nil	nil	Class 1	0	0	1	1	1	2	Easy	10 secs	1	nil	
9	2	62	F	25	III	nil	nil	Class 1	0	0	1	1	3	2	Easy	10 secs	1	nil	
10	2	64	F	26	II	nil	nil	Class 2	0	0	1	1	2	1	Easy	10 secs	1	nil	
11	2	69	F	20	III	nil	nil	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
12	2	70	M	20	II	nil	nil	Class 2	0	0	1	2	3	2	Difficult	10 secs	1	nil	
13	2	65	F	21	II	nil	nil	Class 2	0	0	1	2	3	2	Easy	10secs	1	nil	
14	2	78	F	21	III	HTN	antihypertensives	Class 1	0	0	1	2	2	2	Difficult	10 secs	1	nil	
15	2	70	F	17	III	nil	nil	Class 2	0	0	1	2	4	2	Easy	10 secs	1	nil	

16	2	62	M	20	II	nil	nil	Class 1	0	0	1	1	2	2	Easy	10 secs	1	nil	
17	2	64	M	22	II	nil	nil	Class 2	0	0	1	1	1	1	easy	10 secs	1	nil	
18	2	60	F	20	III	nil	nil	Class 1	0	0	1	2	1	1	Difficult	< 1 min	1	nil	
19	2	63	M	22	II	nil	nil	Class 1	0	0	1	2	2	2	Easy	10 secs	1	nil	
20	2	82	F	24	II	nil	nil	Class 1	0	0	1	1	2	1	Difficult	10 secs	1	nil	
21	2	66	F	22	II	nil	nil	Class 1	0	1	0	2	2	2	Easy	10 secs	1	nil	
22	2	60	M	21	II	nil	nil	Class 1	0	0	1	2	1	1	Easy	10 secs	1	nil	
23	2	66	M	20	II	nil	nil	Class 2	0	0	1	1	4	4	Easy	>1 mins	3	nil	
24	2	64	F	19	III	nil	nil	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	
25	2	66	M	22	II	nil	nil	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
26	2	63	M	21	II	nil	nil	Class 1	0	0	1	2	1	1	Easy	>1 mins	3	VL	
27	2	64	F	22	II	nil	nil	Class 1	0	0	1	1	1	2	Easy	<1 min	2	nil	
28	2	66	M	18	II	nil	nil	Class 1	0	0	1	2	1	2	Easy	<1 min	2	nil	
29	2	60	M	19	II	nil	nil	Class 1	0	0	1	1	1	1	Easy	< 1 min	1	nil	
30	2	68	M	22	II	nil	nil	Class 1	0	0	1	1	3	1	Easy	>1 mins	3	VL	
31	2	69	M	22	III	nil	nil	Class 2	0	0	1	1	2	2	Easy	10 secs	1	nil	
32	2	64	F	21	II	nil	nil	Class 1	0	0	1	1	2	2	Easy	10 secs	1	nil	
33	2	61	M	22	II	nil	nil	Class 2	0	0	1	2	2	1	Easy	10 secs	1	nil	
34	2	66	F	21	III	nil	nil	Class 3	0	0	1	2	1	3	Easy	1 min	2	nil	
35	2	67	M	22	II	HTN	Antihypertensives	Class 1	0	0	1	1	2	2	Easy	10 secs	1	nil	
36	2	79	M	22	II	nil	nil	Class 3	0	1	0	1		3	Difficult	1 min	2	nil	
37	2	82	F	21	III	nil	nil	Class 2	0	0	1	1	1	3	Difficult	1 min	2	nil	
38	2	62	M	18	II	nil	nil	Class 1	0	0	1	1	2	2	Easy	10 secs	1	nil	
39	2	61	M	18	II	nil	nil	Class 1	0	1	0	2	1	2	Easy	10 secs	1	nil	

40	2	69	F	16	III	nil	nil	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
41	2	64	M	28	II	nil	nil	Class 1	0	0	1	1	2	1	Difficult	10 secs	1	nil	
42	2	69	M	21	II	HTN	antihypertensives	Class 1	0	0	1	2	1	1	Easy	1 min	1	nil	
43	2	66	F	29	II	nil	nil	Class 1	0	1	0	1	3	3	Difficult	>1 min	3	nil	
44	2	72	F	28	III	nil	nil	Class 2	0	1	0	2	4	3	Difficult	>1 min	3	nil	
45	2	75	M	26	II	nil	nil	Class 2	0	0	1	2	2	2	Easy	10 secs	1	nil	
46	2	65	M	22	II	nil	nil	Class 1	0	0	1	1	3	3	Easy	< 1min	2	nil	
47	2	66	M	20	II	nil	nil	Class 1	0	0	1	1	3	3	Easy	< 1min	2	nil	
48	2	62	M	21	II	nil	nil	Class 1	0	0	1	1	3	1	Easy	10 secs	1	nil	
49	2	70	F	18	III	nil	nil	Class 1	0	0	1	2	3	3	Easy	< 1min	2	nil	
50	2	72	M	19	II	HTN	antihypertensives	Class 1	0	0	1	1	2	2	Easy	10 secs	1	nil	
51	2	65	M	23	II	nil	nil	Class 1	0	0	1	1	1	2	Easy	10 secs	1	nil	
52	2	76	M	22	III	nil	nil	Class 1	0	0	1	1	3	3	Difficult	< 1 min	2	nil	
53	2	66	M	21	II	nil	nil	Class 1	0	0	1	1	3	1	Easy	10 secs	1	nil	
54	2	69	M	24	II	nil	nil	Class 1	0	0	1	2	2	1	Easy	10 secs	1	nil	
55	2	63	M	21	II	nil	nil	Class 1	0	0	1	2	1	1	Easy	10 secs	1	nil	
56	2	68	F	22	II	nil	nil	Class 1	0	0	1	2	1	1	Easy	10 secs	1	nil	
57	2	62	M	18	III	nil	nil	Class 1	0	0	1	1	3	3	Easy	<1 min	2	nil	
58	2	64	F	19	II	nil	nil	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	
59	2	67	M	18	II	nil	nil	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	
60	2	69	M	19	II	nil	nil	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	
61	2	66	F	21	III	nil	nil	Class 1	0	0	1	2	1	3	Easy	< 1 min	2	nil	
62	2	62	M	18	II	nil	nil	Class 1	0	0	1	2	1	2	Easy	10 secs	1	nil	
63	2	63	F	18	II	nil	nil	Class 1	0	0	1	2	1	2	Easy	10 secs	1	nil	
64	2	64	M	19	II	nil	nil	Class 1	0	0	1	2	1		Easy	10 secs	1	nil	
65	2	65	M	18	II	nil	nil	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	

66	2	66	F	19	II	HTN	antihypertensives	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	
67	2	64	F	18	II	nil	nil	Class 1	0	0	1	2	1	1	Easy	10 secs	1	nil	
68	2	78	M	22	II	nil	nil	Class 1	0	1	0	2	2	1	Difficult	10 secs	1	nil	
69	2	82	F	23	II	nil	nil	Class 1	0	0	1	3	1	1	Difficult	10 secs	1	nil	
70	2	69	F	21	II	nil	nil	Class 1	0	0	1	3	2	1	Easy	< 1 min	2	nil	
71	2	86	M	22	III	nil	nil	Class 2	0	0	1	2	1	2	Easy	< 1 min	1	nil	
72	2	78	F	22	III	nil	nil	Class 2	0	0	1	2	1	1	Easy	10 secs	1	nil	
73	2	76	M	21	II	nil	nil	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
74	2	66	M	20	II	nil	nil	Class 1	0	0	1	1	2	2	Easy	< 1 min	2	nil	
75	2	67	F	21	II	nil	nil	Class 2	0	0	1	2	3	3	Easy	>1 min	3	nil	
76	2	69	M	22	III	nil	nil	Class 1	0	1	0	2	2	2	Easy	10 secs	1	nil	
77	2	72	F	18	II	nil	nil	Class 2	0	0	1	2	2	1	Easy	10 secs	1	nil	
78	2	75	M	19	II	nil	nil	Class 2	0	0	1	3	2	1	Easy	10 secs	1	nil	
79	2	61	F	18	II	nil	nil	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
80	2	64	M	23	II	nil	nil	Class 1	0	0	1	2	2	1	Easy	10 secs	1	nil	
81	2	66	M	24	II	nil	nil	Class 2	0	0	1	2	1	1	Easy	10 secs	1	nil	
82	2	69	F	23	II	HTN	Antihypertensives	Class 1	0	0	1	1	3	4	Easy	1 min	2	nil	
83	2	68	M	22	II	nil	nil	Class 1	0	1	0	1	1	1	Easy	<1min	1	nil	
84	2	78	F	18	II	nil	nil	Class 2	0	0	1	3	2	2	Difficult	<1min	1	nil	
85	2	84	F	18	II	nil	nil	Class 1	0	0	1	3	2	2	Difficult	10 secs	1	nil	
86	2	66	F	18	II	nil	nil	Class 3	0	0	1	2	1	1	Easy	10 secs	1	nil	
87	2	63	M	22	II	nil	nil	Class 2	0	0	1	1	1	1	Easy	10 secs	1	nil	
88	2	68	F	20	II	nil	nil	Class 3	0	0	1	2	3	3	Easy	1 min	2	nil	
89	2	65	M	22	II	nil	nil	Class 1	0	0	1	2	1	1	Easy	10 secs	1	nil	
90	2	62	M	28	II	nil	nil	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
91	2	66	F	23	II	nil	nil	Class 2	0	0	1	1	2	2	Easy	10 secs	1	nil	

92	2	69	M	26	II	nil	nil	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
93	1	61	F	37	II	HTN	OHA & Antihypertensives.	Class 2	0	0	1	3	3	2	Easy	< 10 secs	1	nil	
94	1	60	F	22	II	nil	OHA	Class 2	0	0	1	2	1	1	Easy	< 10 secs	1	nil	
95	1	75	F	19	II	nil	OHA	Class 1	0	0	1	3	2	2	Easy	<10 secs	1	nil	
96	1	71	F	20	III	nil	OHA	Class 2	0	1		2	2	1	Easy	<10 secs	1	nil	
97	1	72	F	28	II	nil	OHA	Class 2	0	0	1	2	2	1	Easy	<10	1	nil	
98	1	68	M	25	III	nil	Insulin	Class 2	0	0	1	4	2	3	Easy	<1 min	2	nil	
99	1	68	M	22	III	nil	OHA	Class 2	0	0	1	4	4	3	Easy	<10 secs	1	nil	
100	1	61	M	30	III	HTN	OHA & Antihypertensives	Class 1	0	0	1	2	3	2	Easy	10 secs	1	nil	
101	1	73	F	21	III	HTN	OHA & Antihypertensives	Class 1	0	0	1	2	3	2	Easy	10 secs	1	nil	
102	1	58	F	22	II	HTN	OHA & Antihypertensives	Class 1	0	0	1	2	2	1	easy	10 secs	1	nil	
103	1	61	F	33	III	nil	OHA	Class 2	0	0	1	2	1	2	easy	10 secs	1	nil	
104	1	85	M	20	III	nil	OHA	Class 2	0	0	1	2	2	3	easy	10 secs	2	nil	
105	1	64	F	31	III	HTN	OHA & Antihypertensives	Class 3	0	0	1	3	3	3	Easy	< 1min	2	nil	
106	1	60	F	23	I	nil	OHA	Class 2	0	0	1	3	3	3	easy	< 1 min	2	nil	
107	1	63	F	17	III	nil	OHA	Class 3	0	0	1	4	1	3	Easy	10 secs	1	nil	
108	1	62	M	18	II	nil	OHA	Class 2	0	0	1	3	1	3	Easy	10 secs	1	nil	
109	1	60	M	28	II	nil	OHA	Class 1	0	0	1	3	1	2	Easy	< 1 min	2	nil	
110	1	63	F	21	III	nil	OHA	Class 1	0	0	1	2	1	1	Easy	10 secs	1	nil	

111	1	61	M	21	III	nil	OHA	Class 1	0	0	1	2	2	1	Easy	10 secs	1	nil	
112	1	69	F	18	II	nil	OHA	Class 1	0	0	1	3	1	3	Easy	1 min	2	nil	
113	1	78	F	22	III	HTN	OHA & Antihypertensives	Class 2	0	0	1	3	1	3	Difficult	10 secs	1	nil	
114	1	68	M	18	II	nil	OHA	Class 1	0	0	1	2	3	2	Difficult	1 min	2	nil	
115	1	64	M	18	III	nil	OHA	Class 1	0	0	1	2	2	1	Easy	10 secs	1	nil	
116	1	61	F	22	II	nil	OHA	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	
117	1	64	M	21	III	nil	OHA	Class 1	0	0	1	3	1	3	Easy	>1 min	2	nil	
118	1	60	M	23	II	nil	OHA	Class 2	0	0	1	2	1	2	Easy	10 secs	1	nil	
119	1	66	F	21	II	nil	OHA	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
120	1	69	M	18	III	nil	OHA	Class 2	0	0	1	1	1	1	Easy	10 secs	1	nil	
121	1	63	M	17	II	nil	OHA	Class 2	0	0	1	1	2	2	Easy	10 secs	1	nil	
122	1	78	M	22	II	nil	OHA	Class 3	0	1		1	1	2	Difficult	10 secs	1	nil	
123	1	60	M	21	II	nil	OHA	Class 3	0	0	1	1	1	1	Easy	10 secs	1	nil	
124	1	64	F	22	II	nil	OHA	Class 3	0	0	1	3	3	4	Easy	>1 min	3	VL	
125	1	81	M	19	III	nil	OHA & Insulin	Class 3	0	0	1	3	1	2	Difficult	10 secs	1	nil	
126	1	62	F	19	III	nil	OHA	Class 3	0	0	1	2	1	2	Easy	10 secs	1	nil	
127	1	69	M	18	II	nil	OHA	Class 2	0	0	1	3	2	4	Easy	>1 min	3	VL	
128	1	76	M	19	II	nil	Insulin	Class 3	0	1		2	1	2	Difficult	10 secs	1	nil	
129	1	62	F	20	II	nil	OHA	Class 3	0	0	1	1	1	1	Easy	10 secs	1	nil	
130	1	62	M	21	III	nil	OHA	Class 3	0	0	1	2	2	3	Easy	<1min	2	nil	
131	1	66	M	18	III	nil	OHA	Class 3	0	0	1	1	2	2	Easy	10 secs	1	nil	
132	1	64	F	22	II	nil	OHA	Class 3	0	0	1	1	2	1	Easy	10 secs	1	nil	
133	1	69	M	23	II	nil	OHA & Insulin	Class 3	0	0	1	3	4	4	Easy	>1 min	3	VL	
134	1	67	M	26	II	HTN	OHA	Class 3	0	0	1	2	3	3	Difficult	>1 min	2	nil	
135	1	63	F	24	II	nil	OHA	Class 3	0	0	1	2	3	1	Easy	10 secs	1	nil	

136	1	75	F	22	II	nil	OHA & Antihypertensives	Class 3	0	1	0	2	3	2	Easy	<1min	2	nil	
137	1	69	M	19	III	nil	OHA	Class 3	0	0	1	1	2	1	Easy	10 secs	1	nil	
138	1	64	M	22	II	nil	OHA	Class 3	0	0	1	1	2	1	Easy	10 secs	1	nil	
139	1	62	M	21	III	nil	OHA	Class 3	0	0	1	1	2	1	Easy	< 1min	1	nil	
140	1	65	M	23	II	nil	OHA	Class 3	0	1		2	3	3	Difficult	< 1min	2	nil	
141	1	62	F	24	II	nil	OHA	Class 3	0	0	1	2	2	3	Easy	< 1min	2	nil	
142	1	65	M	21	II	nil	OHA	Class 2	0	0	1	1	2	1	Easy	10 secs	1	nil	
143	1	58	M	37	II	HTN	OHA & Antihypertensives.	Class 2	0	0	1	1	1	2	Easy	10 secs	1	nil	
144	1	61	M	22	II	nil	OHA	Class 2	0	0	1	1	2	1	easy	10 secs	1	nil	
145	1	85	M	19	II	nil	OHA	Class 1	0	0	1	1	1	2	easy	10 secs	1	nil	
146	1	64	M	20	III	nil	OHA	Class 2	0	1	0	1	1	3	easy	10 secs	2	nil	
147	1	60	M	28	II	nil	OHA	Class 2	0	0	1	3	3	3	Easy	< 1min	2	nil	
148	1	63	F	25	III	nil	Insulin	Class 2	0	0	1	3	1	3	easy	< 1 min	2	nil	
149	1	62	M	22	III	nil	OHA	Class 2	0	0	1	2	1	3	Easy	10 secs	1	nil	
150	1	60	F	30	III	HTN	OHA & Antihypertensives	Class 1	0	0	1	3	2	3	Easy	10 secs	1	nil	
151	1	63	M	21	III	HTN	OHA & Antihypertensives	Class 1	0	0	1	2	1	2	Easy	< 1 min	2	nil	
152	1	61	M	22	II	HTN	OHA & Antihypertensives	Class 1	0	0	1	1	1	1	Easy	10 secs	1	nil	
153	1	69	F	33	III	nil	OHA	Class 2	0	0	1	2	2	1	Easy	10 secs	1	nil	
154	1	78	M	20	III	nil	OHA	Class 2	0	0	1	1	2	3	Easy	1 min	2	nil	
155	1	68	F	31	III	HTN	OHA & Antihypertensives	Class 3	0	0	1	1	2	3	Difficult	10 secs	1	nil	
156	1	64	M	23	I	nil	OHA	Class 2	0	1	0	3	4	2	Difficult	1 min	2	nil	

157	1	61	M	17	III	nil	OHA	Class 3	0	0	1	2	3	1	Easy	10 secs	1	nil	
158	1	64	F	18	II	nil	OHA	Class 2	0	0	1	2	3	1	Easy	10 secs	1	nil	
159	1	60	F	28	II	nil	OHA	Class 1	0	0	1	2	3	3	Easy	>1 min	2	nil	
160	1	66	M	21	III	nil	OHA	Class 1	0	0	1	1	2	2	Easy	10 secs	1	nil	
161	1	69	F	21	III	nil	OHA	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	
162	1	63	F	18	II	nil	OHA	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	
163	1	78	M	22	III	HTN	OHA & Antihypertensives	Class 2	0	0	1	2	3	2	Easy	10 secs	1	nil	
164	1	60	F	18	II	nil	OHA	Class 1	0	0	1	2	2	2	Difficult	10 secs	1	nil	
165	1	64	M	18	III	nil	OHA	Class 1	0	0	1	1	2	1	Easy	10 secs	1	nil	
166	1	81	M	22	II	nil	OHA	Class 1	0	0	1	1	1	4	Easy	>1 min	3	VL	
167	1	62	F	21	III	nil	OHA	Class 1	0	1		1	2	2	Difficult	10 secs	1	nil	
168	1	69	M	23	II	nil	OHA	Class 2	0	0	1	1	1	2	Easy	10 secs	1	nil	
169	1	58	F	21	II	nil	OHA	Class 1	0	0	1	1	1	4	Easy	>1 min	3	VL	
170	1	61	M	18	III	nil	OHA	Class 2	0	0	1	3	3	2	Difficult	10 secs	1	nil	
171	1	85	F	17	II	nil	OHA	Class 2	0	0	1	3	1	1	Easy	10 secs	1	nil	
172	1	64	M	22	II	nil	OHA	Class 3	0	1		2	1	3	Easy	<1min	2	nil	
173	1	60	M	21	II	nil	OHA	Class 3	0	0	1	3	2	2	Easy	10 secs	1	nil	
174	1	63	F	22	II	nil	OHA	Class 3	0	0	1	2	1	1	Easy	10 secs	1	nil	
175	1	62	M	19	III	nil	OHA & Insulin	Class 3	0	1	0	1	1	4	Easy	>1 min	3	VL	
176	1	60	F	19	III	nil	OHA	Class 3	0	0	1	2	2	3	Difficult	>1 min	2	nil	
177	1	63	F	18	II	nil	OHA	Class 2	0	0	1	1	2	1	Easy	10 secs	1	nil	
178	1	61	F	19	II	nil	Insulin	Class 3	0	0	1	1	2	2	Easy	<1min	2	nil	
179	1	69	M	20	II	nil	OHA	Class 3	0	1		3	4	1	Easy	10 secs	1	nil	
180	1	78	F	21	III	nil	OHA	Class 3	0	0	1	2	3	1	Easy	10 secs	1	nil	
181	1	68	M	18	III	nil	OHA	Class 3	0	1	0	2	3	1	Easy	< 1min	1	nil	

182	1	64	M	22	II	nil	OHA	Class 3	0	0	1	2	3	3	Difficult	< 1min	2	nil	
183	1	61	F	23	II	nil	OHA & Insulin	Class 3	0	0	1	1	2	3	Easy	< 1min	2	nil	
184	1	64	M	26	II	HTN	OHA	Class 3	0	0	1	1	2	1	Easy	10 secs	1	nil	