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Review Article

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Perioperative Management of Difficult Airway

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ABSTRACT

Introduction: It is widely recognized that the two most important tasks for anaesthetists are the management of a difficult airway and the maintenance of oxygenation. Problems related to difficult airways are known to be the primary cause of life-threatening anaesthesia-related accidents, they are one of the main sources of legal issues in the United Kingdom Défense Societies registries and in the American Society of Anaesthesiologists (ASA) closed claims. That is why difficult airway management is one of the most demanding duties for anaesthetists, and it provides a continuous challenge in addressing and solving potentially life-threatening problems. Although the incidence of the most critical situation in airway management, "cannot intubate, cannot oxygenate," is low at 0.0019–0.04%, its occurrence can have severe consequences and up to one-third of anaesthesia-related deaths are due to failure to intubate and ventilate including tracheal or oesophageal injury, aspiration, and sever hypoxemia, which can cause irreversible brain damage and lead to death.

Clinical Features of airway obstruction, respiratory arrest, Teaching post graduates basic airway manoeuvres like head- tilt/chin-lift.

Predictors of difficult airway Key parts of the examination of patients include neck mobility, mouth opening, teeth/jaw alignment, shorter horizontal distance, retrognathia, Mallampati score, thyromental distance. Specific tests like modified Mallampati, lemon test, Wilson score SARI score have been recommended as predictors Measurements of airway can help identify issues like limited neck extension, micrognathia.

Preparation of patients with difficult airway- airway management equipment ie airway cart It also covers basic airway adjuncts like oropharyngeal airways and nasopharyngeal airways. Finally, it introduces advanced airway devices like laryngeal mask airways and describes how to size them appropriately. Fibreoptic intubating bronchoscope Basic vital parameters monitor- Management of airway, to follow - the ASA difficult airway algorithm strategy used for managing difficulties and management of complication arising out non intubations situations.

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Keywords: Airway Management, Airway Obstruction, Cricothyroidotomy, Face Mask Ventilation, Intubation, Supraglottic Airway, Ventilation

Definition
A "difficult airway" is conventionally defined as a clinical situation in which a trained anaesthesiologist with more than five years of experience has difficulty with facemask ventilation or intubation of an airway. There are 2 major categories:

Airway that is Causing Difficulty to Anaesthesiologist:
There are 2 major categories:
1.Anticipated types
2.Unanticipated types

According to the 2022 American Society of Anesthesi-ologists Practice Guideline for Management of the Difficult Airway, difficult airways can be further divided into seven types:

- During mask ventilation
- During intubation - with/without muscle relaxant
- Difficult supraglottic airway ventilation
- During maintenance of anaesthesia after successful intubation
- During laparoscopic surgery
- At the time of extubation
- After extubation – hypoxemia, desaturation, airway oedema.
- Failed reintubation e.g. thyroid surgery

What is Difficult Mask Ventilation?
"Difficult mask ventilation (DMV) is a situation in which it is challenging to provide adequate oxygenation to a patient using a mask and ventilator."

DMV Mask ventilation (MV) is the most basic, yet the most essential, skill in airway management. It is the primary technique of ventilation before tracheal intubation or insertion of any airway device. Its most unique role, however, is as a rescue technique for ventilation should tracheal intubation fail or prove difficult

Factors responsible for difficult mask ventilation

Anatomy: Mallampati class III or IV, lack of teeth, sunken cheeks, and abnormal mandibular protrusion

Equipment: Using an incorrectly sized mask, or faults with the breathing circuit or anaesthetic machine
Patient Factors: Obesity, age, history of snoring, and beard.
Provider Factors: The experience and skill of the provider
Anaesthetic Factors: High dose opioids, inadequate depth of anaesthesia, and inadequate muscle relaxant

Some of the Picture Depicting Difficulties with Mask Ventilation

1. Airway-Related

Upper Airway Obstruction

- large Tongue or overhanging epiglottis
- Redundant soft tissue in morbid obesity and sleep apnoea patient, Tonsillar hyperplasia
- Oral, maxillary, pharyngeal, or laryngeal tumour
- Airway edema e.g., repeated intubation attempts, trauma, angioedema
- Laryngeal spasm
- External compression e.g., large neck masses or neck hematoma

Lower Airway Obstruction

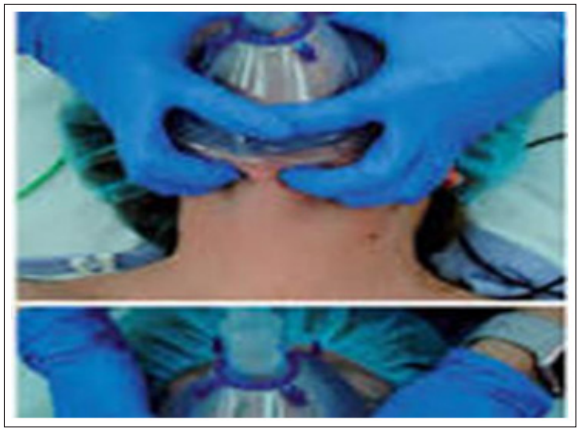
- Severe bronchospasm
- Tracheal or bronchial tumour
- Anterior mediastinal mass
- Stiff lung e.g. foreign body, Pneumothorax
- Bronchopleural fistula
- Severe chest wall deformity or kyphoscoliosis restricting chest expansion

Management of Difficult Mask Ventilation

It is crucial to identify high risk patients preoperatively, because the management depends on whether DMV is expected.

Patients with Expected DMV- Most of these patients will also have signs indicative of a potential DI. It is essential that patients who are expected to have DMV receive adequate oxygen administration, as this will give the anaesthesiologist some extra time to manage the problem. **Expected DMV** - Simple measures can be taken, such as shaving the beard, removing dentures, or losing weight

Two-Handed Grip This technique is often used in difficult situations, as it improves the seal and airway patency



Training

Training and Regular Practice Can Help Improve the Skill of Mask Ventilation

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Original Article

Mannequin-simulation methods for teaching of postgraduates skill lab training

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ARTICLE INFO ABSTRACT

This is paper publication shows method to learn management of patients with simulation methods. Simulation is tremendous tool as it allows our students to achieve their goals without our patients being put at risk

learning Abilities Can be Made: predictable, consistent, standardized, safe and reproducible

This allows Students to Learn, Rewind, Rehearse and Practice Without Negative Patient Outcome

Methods Used Frequently for Improving Mask Ventilation and Oxygenation are

Chin lift

Jaw thrust

CPAP

Head position with extension at atlantooccipital joint and flexion of neck

RAMP position

Anticipated Difficult Intubation

- Congenital issues
- Infections Ludwig's angina and Airway infections.
- Trauma
- Obesity
- TM joint ankylosis
- Burns and neck contractures

Other Factors

Beards

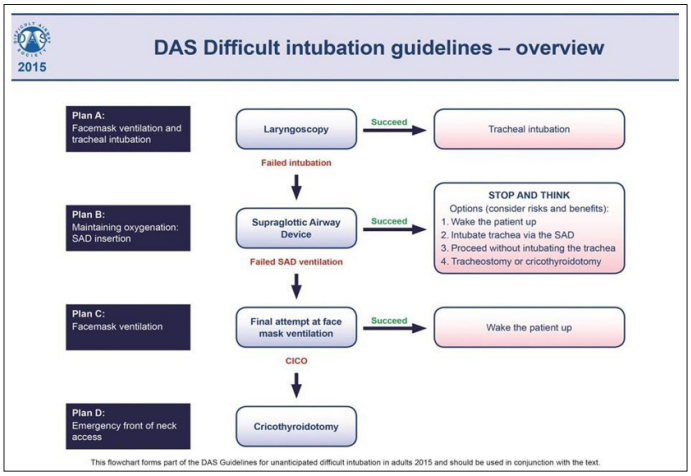
- Age older than 55 years
- Mallampati classification
- Reduced mandibular protrusion
- Reduced submandibular compliance
- Short neck
- Large neck circumference
- Limited neck extension

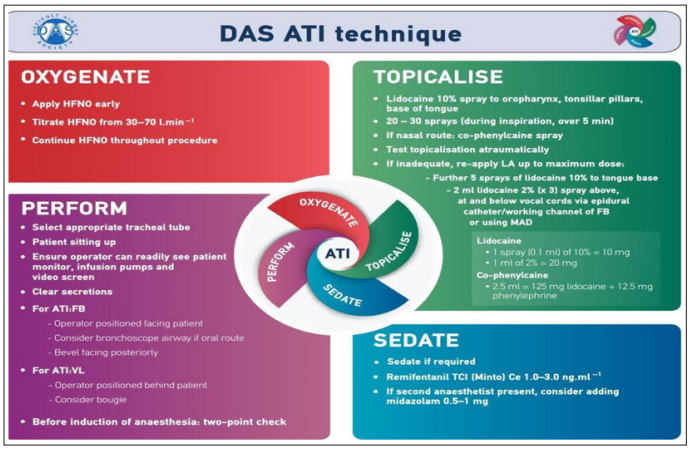
Airway Plan

Discuss the plan with the anaesthetic assistant so they can prepare the necessary equipment Guidelines for difficult airway management

Before guidelines were made available, the common response during difficult airway management cases was to count on individually acquired experience and skill. Thus, practitioners simply relied on lessons from previous errors with no preplanned protocols applied

Managing a difficult airway involves **early recognition of potential difficulties, thorough preoxygenation, utilizing alternative airway management techniques like video laryngoscopy or a laryngeal mask airway (LMA), considering awake intubation if necessary, and being prepared to escalate to surgical airway access (cricothyrotomy or tracheostomy) if ventilation cannot be maintained**; crucial aspects include calling for help promptly, optimizing oxygenation, and using appropriate devices based on the patient's anatomy and situation [1-9].





Case Reports -1

Patient was Posted for Pan-Endoscopy with Multiple Biopsies

Doing successful intubation may not relieve your nightmares about difficulties patient can have desaturation and difficulty ventilation even after intubation

16 yr old female was posted for pan endoscopy for multiple biopsies for multiple swellings in nasopharyngeal and para-tracheal region. Patient had bilateral tonsillar hypertrophy and with grade II MPC with two finger mouth opening

Preoxygenation for 5 min with 100% oxygen done to achieved expired O2 conc. of 95 percent Check ventilation done before giving muscle relaxant After confirming bag-mask ventilation, patient was induced.

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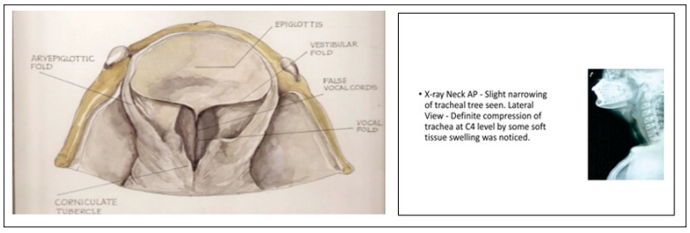


View Of Direct Laryngoscopy

Epiglottis- Edematous and large size after lifting epiglottis false cords were seen almost opposing each other in midline. True vocal cords were not seen

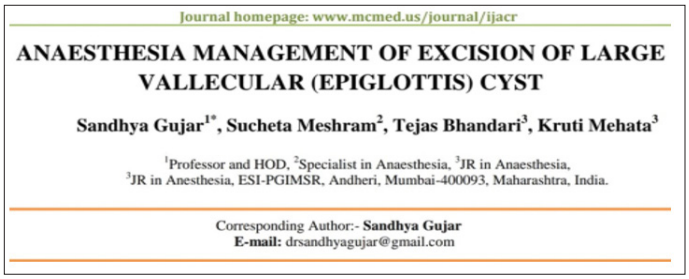
Cuffed Endotracheal tube no. 5.5 was inserted through false vocal cords. Ventilation checked Air entry was bilaterally equal. Air leak present, cuff was inflated more.

After few minutes of ventilation, there was sudden increase in resistance to ventilation which was becoming very difficult. Oxygen saturation started falling. It came down to 76 to 77 %. Patient became cyanosed.

as patient was ventilated easily before intubation Immediate decision of removing tube and mask ventilation was taken. Patient was ventilated with mask with 100% Oxygen until oxygen saturation came back to normal. Tube, which was removed, was seen to have cuff Herniation towards upper end of E.T.T.

Case Report: 2

Anaesthesia Management of Excision of large Vallecular (epiglottis) Cyst


Journal homepage: www.mcmed.us/journal/ijacr

ANAESTHESIA MANAGEMENT OF EXCISION OF LARGE VALLECULAR (EPIGLOTTIS) CYST

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Young 37 yr old male patient came for excision of large epiglottis cyst at vallecular area immediately above base of epiglottis. ASA grade I patient with no positive history in past was posted for excision of cyst under G.A. IDL was done, maintaining protocol of difficult intubation, it was decided to do awake FIBREOPTIC INTUBATION with nasal armoured tube

Preparation for Awake Fiberoptic Intubation

I. Premedication: Glycopyrrolate 0.2 mg intramuscularly With emset iv
II. Otrivin drops to decongest nostrils. Gargles with 2% Lignocaine viscous
III. 4% Lignocaine nebulisation.
IV. Bilateral superior laryngeal nerve blocks
V. 2% Lignoadrenaline packs in both nostrils

Postop Management

- After excision of cyst pt. was reversed and it was decided to keep pt intubated on t-piece with 4 liters of oxygen
- In postop. Period for 24 hrs. .to increase tolerance of tube and decrease sympathetic response pt. sedated within buprenorphine 90 µg IV 12 hrly. Pt was very much comfortable, conscious and oriented in immediate postop period

Difficult Extubation

Successful management of the difficult airway, however, does not end with placement of an endotracheal tube (ETT). Analysis of the ASA Closed Claims database has shown that the trend of improved outcomes at induction and intubation has not been seen at extubation

The importance of developing pre-planned strategies for extubation of the difficult airway to improve patient safety and outcomes mortality rate is almost 5%

It is necessary to observe and keep strict vigilance about patient with difficulties for intubation especially factors which may adversely affect ventilation and inability to ventilate in post-extubation period

Extubation Failure

This refers to the inability to tolerate the removal of an ETT due to airway obstruction: This should be differentiated from a failure to wean from ventilatory Causes for extubation failure Causes for extubation failure

A. Patients factor

1. Pre-existing airway difficulties
2. airway trauma because of multiple attempts at intubation
3. Laryngospasm, Laryngeal edema, can occur because of foreign body aspiration, wrong size of endotracheal tube
4. Tracheomalacia- condition where there is collapse of tracheal ring because constant pressure from chronic large thyroid swelling

Surgical Factors

Thyroidectomy,
Carotid Endarterectomy,
Anterior Cervical Spine procedures, and Maxillofacial Surgery

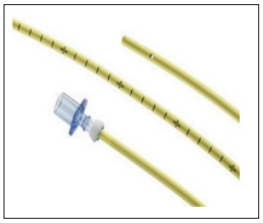
Restricted Airway Access -Post Thyroidectomy

Management of Difficult Extubation

1. Direct laryngoscopy prior to extubation.to visualize vocal cords prior to extubation always helps to know I f there is any laryngeal oedema or palsy of vocal cords which will invariably lead to post op ventilation failure
2. Cuff Leak Test:to know if there is tracheomalacia
3. Controlled Extubation Over an Airway Exchange Catheter
4. Administration of corticosteroids at least 4h prior to extubation: to decrease oedema
5. risks and benefits of an awake extubation vs extubation in the deeply anesthetized state. It is always preferable to extubate when patient is fully awake with difficult intabation

Cooks Airway Exchange Catheter

Placement of a stylet-type device or "bougie" through the ET and removing the ETT over the stylet this allows us to remove ETT or to extubate patient in guarded manner



Current Status and Progress in Difficult Airway Assessment
Traditional Methods of Difficult Airway Assessment

- **Medical History**-Patient's medical history is one of the important pieces of information when evaluating a difficult airway. Certain conditions have been shown to be strongly associated with difficult airways

Simple Bedside Assessment

- Physician assesses the patient's facial and mandibular features such as mouth opening, buck teeth, Modifed Mallampatti classification, and the upper lip bite test (ULBT) • physician also performs some simple anatomical measurements, including hyomental distance

Comprehensive Assessment of Indicators

- A Wilson score, the SARI score, and the modified LEMON score
- Preoperative endoscopic airway examination IDL/OR UNDER MICROSCOPE ,video laryngoscope planning awake fibreoptic intubation along with endoscopic examination has solved many of difficult airway
- **Imaging** - Xray, CT scan for egg linear distance from the interior border of mandible to the hyoid bone can predict size of the tongue, USG can show soft tissues of the neck
- **Computer-assisted Airway Reconstruction** and 3d-printing to develop models which can teaching and guiding students

Mathematical Methods- Creating Predictive Mathematical Airway Models

Artificial Intelligence

Main AI methods which will be used are machine learning, deep learning, and computer vision

First is to collect manual evidence and based on that to develop

1. Predictive Models, 2. Maintain Accuracy 3. Guiding Devices 4. Assiting Intubation 5. Training

Applications Based on AI for Predicting Difficult Airways:

1. The difficult airway app,
2. Airway triage supported by airway management academy and is meant for anaesthesiologist, primary care physician, critical care intensivist
3. DI Detection.

Important Considerations:

- **Teamwork:** A well-coordinated team with clear roles and responsibiliΘes is crucial for managing a difficult airway.
- **Communication:** Clear verbal communication between team members is essential during airway management.
- **Continuous Monitoring:** Closely monitor vital signs, especially oxygen saturation, during the airway management process.
- **Training and Experience:** Healthcare providers should have adequate training in airway management techniques and be comfortable with managing difficult airways.
- Disclosure
- Nil
- No conflict of interest
- This presentation is made from standard literature available and personalized experience

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