Neonates with Difficult airway

Dr Atul Londhe, Assistant Professor
Dr L S Deshmukh, Professor & Head, Department of Neonatology
Government Medical College, Aurangabad

Outline:

1) Introduction
2) Anatomy of airway
3) Etiology
4) Approach to a Neonate with Difficult airway
5) Management

Introduction:

Approximately 5-10% of newborns need some assistance at birth for breathing in the form of assisted ventilation. Of these 1-2% babies may not respond to bag and mask ventilation requiring attempts of intubation. Endotracheal intubation in newborns is a skilled procedure. The rapid provision of effective positive pressure ventilation is the single most important predictor of successful neonatal resuscitation. Ineffective respiratory support will lead to hypoxia and may increase morbidity and mortality.

Neonates represent extremely high risk group in terms of difficult airway management. The odds of desaturation is 4 fold higher than children during failed attempts of intubation. The reasons for this is multifactorial including lower FRC, higher consumption of oxygen and lower success rates of advanced airway management with Airway adjunct devices.

A difficult airway is defined as a clinical situation in which a trained practitioner experiences difficulty with face mask ventilation, difficulty with tracheal intubation or both [1]. Airway adjunct devices may help the clinician to manage the airway when tracheal intubations has not been possible. These include Video Laryngoscope (VL) and Supraglottic airway devices as Laryngeal Mask Airway (LMA).

Anatomy of the airway:

The Newborn differs from adult in many ways both in size, shape and position of the airways as well as its supporting structures. Airway of infants differs from adults in following ways.

1. Upper airway of the infant is smaller than that of adult.
2. Relatively large size of infant's head tends to flex the short neck and obstruct the airway.
3. Relatively large size of infant's tongue in relation to oropharynx increases the likelihood of airway obstruction and technical difficulties during laryngoscopy.
4. Epiglottis is shaped differently being short and stubby, and is angled over laryngeal inlet. Control with the laryngoscope blade is therefore more difficult.
5. Larynx is located higher in the neck thus making the straight blades more useful than curved blades.
6. Infant larynx is funnel shaped, narrowest portion occurring at the cricoid cartilage in children below 8 years of age.

   -Cricoid ring which is complete may not accept a tracheal tube which was passed through glottis.

   -Minimal edema of cricoid ring may reduce the airway by 70% in the neonate.
7. Vocal cords are angled, so that a "blindly" passed endotracheal tube may easily lodge in the anterior commissure rather than slide into the trachea.

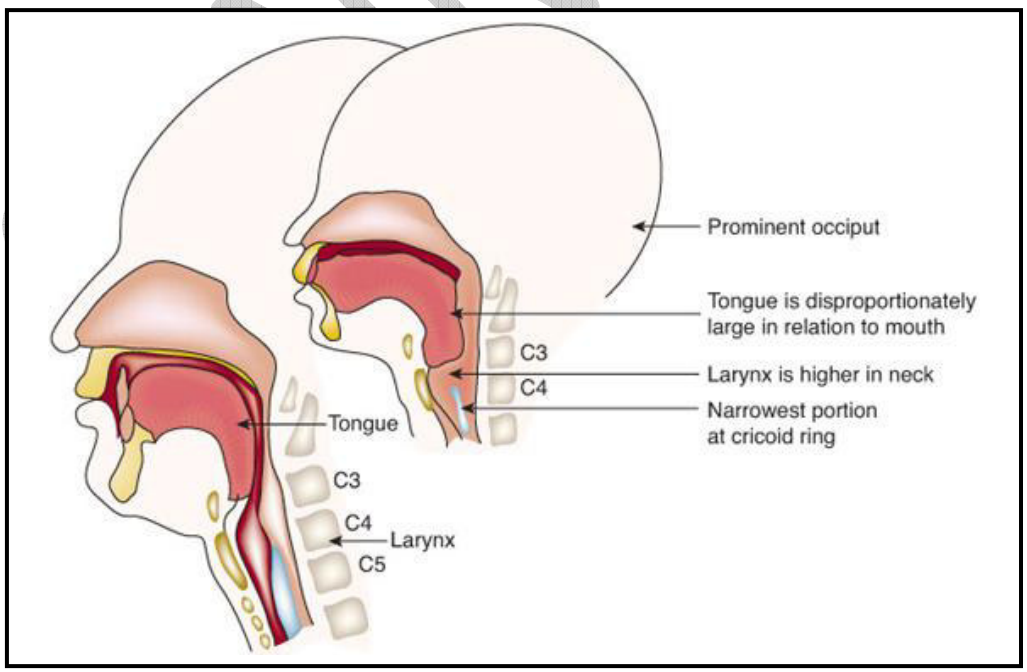

Figure 1: Difference between Infant and adult airway

Etiology:

Difficult airways may be due to:

1. External airway compression from neck masses
2. Structural compromise to the airway
3. Craniofacial structural abnormalities including cleft palate, cranial dysostosis and syndromes affecting maxillofacial structures

Table 1:- Causes of Difficult airway- Congenital and Acquired

SN	Features	Abnormalities	Syndromes
1	Misshapen head	Positioning of the head to optimally align the pharyngeal and tracheal axes may be difficult if the head is misshapen	Apert syndrome, Crouzen syndrome, Pfeiffer syndrome
2	Maxillary hypoplasia	Facial asymmetry or underdevelopment may make it difficult to achieve a good seal between the face and a mask, creating difficulties with bag mask ventilation	Apert syndrome, Crouzen syndrome, Pfeiffer syndrome
3	Abnormal Neck mobility	Limited neck mobility (as occurs with Klippel- Feil syndrome) or cervical spine instability (which can occur with Down syndrome and the mucopolysaccharidoses) may interfere with positioning of the head	Down syndrome, Klippel Feil syndrome, Mucopolysaccharidosis
4	Microstomia	Opening the mouth for laryngoscopy may be difficult in children with microstomia	Freeman- Sheldon syndrome, Hallerman-Streiff syndrome
5	Mandibular hypoplasia		Hallerman-Streiff syndrome, Pierre-Robin sequence, Treacher-Collins syndrome, Unilateral hypoplasia of the mandible (Goldenhar syndrome)

6	High arched or narrow palate	Children with small mandibles or palatal abnormalities (such as high arched or cleft palates) have a smaller oral cavity. This may make laryngoscopy and control of oral structures difficult	Achondroplasia, Apert syndrome, Crouzen syndrome, de Lange syndrome, Hallerman-Streiff syndrome, Pfeiffer syndrome, Treacher-Collins syndrome
7	Cleft palate		Branchio-oculo-facial syndrome, cleft lip sequence, Ectrodacyly-ectodermal dysplasia clefting syndrome
8	Large tongue	A large tongue may obstruct the airway during bag mask ventilation or be difficult to control during laryngoscopy	Beckwith-Wiedemann syndrome, Down syndrome, Mucopolysaccharidosis Pierre- Robin sequence
9	Neck masses	Masses in the neck (such as cystic hygromas) may interfere with positioning. Masses within the airway (such as teratomas or hemangiomas) may obstruct the airway and interfere with visualization of the larynx	Cystic hygroma, Hemangioma, Occipital Encephalocele
10	Laryngeal or subglottic abnormalities	Abnormalities of the larynx or subglottic trachea may interfere with intubation	Laryngeal cysts or webs, subglottic stenosis
11	Malacia of the airways	Laryngotracheo or bronchomalacia exist when the cartilaginous framework of the airway is inadequate to maintain the airway patency	Tracheomalacia, Laryngomalacia

Approach to a Neonate with Difficult airway:

History-

Antenatal scans	Detailed fetal anomaly scan at 18-22 weeks
Liquor	Polyhydramnios (suggest potential airway problem)
Family history	H/o any malformed baby

Difficulty in airway management can be anticipated from good antenatal scans. But majority times it is unanticipated. When a difficult airway is anticipated before birth, it is essential that an antenatal birth plan is agreed with parents for delivery at center with appropriately skilled practitioners and equipment.

Physical examination includes:

· Evaluation of size and shape of head.
· Gross facial features.
· Size and symmetry of mandible.
· Size of tongue.
· Prominence of upper incisors.
· Range of motion in jaw and head and neck.

Predictors of difficult airway:

A combination of several clinical features can be sensitive predictor of difficult laryngoscopy in adults. A number of bed-side tests have been proposed to assess difficult airway in adults. Visual examination of the posterior wall of the pharynx by Mallampatti [2] andThyromental distance [3]. But the commonly used assessment criteria have not been valid for small babies and even mouth opening, neck and jaw mobility are difficult to assess in non-cooperative child.

1. Mallampati score assesses the view of the posterior pharynx with the mouth wide open. Intubation may be difficult for patients with a poor view (Class III or IV).However, when used alone, the score has limited accuracy for predicting a difficult airway [2].
2. Thyromental distance is the distance between the tip of the chin and the thyroid notch. Typically, the width of three of the patient's fingers is considered normal for adults. Difficulty visualizing the larynx may occur when the distance is longer or shorter [3].

3. Interincisor gap is the distance between the upper and lower incisors with the mouth open as wide as possible. For adult patients, the width of three of the patient's fingers is considered an adequate distance for laryngoscopy.

Algorithmic approach:

Association of PaediatricAnaesthetists of Great Britain and Ireland (APA) guidelines [6] for unanticipated difficult airway management in pediatric patients suggested

a) Insertion of a shoulder roll for children <2 years of age
b) Laryngospasm, which is much more common in children than adults, is listed as a consideration for difficulty with mask ventilation.
c) Limiting the number of attempts at laryngoscopy is stressed

Management:

Airway management:

In the case of a predicted difficult airway, the first intervention should be to “call for help” if such help is available. The most expert physician available may be from anesthesia or otorhinolaryngology rather than emergency medicine or pediatrics, and they may provide valuable assistance in the rare case of a difficult airway.

Crash airway:

Children who are in extremis are considered a "crash airway" and shouldreceive bag mask ventilation, followed by orotracheal intubation. BMV may provide oxygenation andventilation as personnel and equipment are being mobilized for endotracheal intubation.

Rapid sequence intubation (RSI):

Rapid sequence intubation should be considered for childrenwho are not in extremis when the clinician is confident that the child can be adequatelyventilated with a bag and mask and that oral tracheal intubation will be successful.

Awake intubation:

Awake intubation, using sedation and local anesthesia, is an approach that is frequently used for adults. With this technique, the patient is sedated but not paralyzed and continues to breath spontaneously. There are no reports describing experience with this technique for children.

Alternative airway techniques:

Alternatives for airway management when RSI or awakeintubation are not feasible include a laryngeal mask airway or fiberoptic intubation.

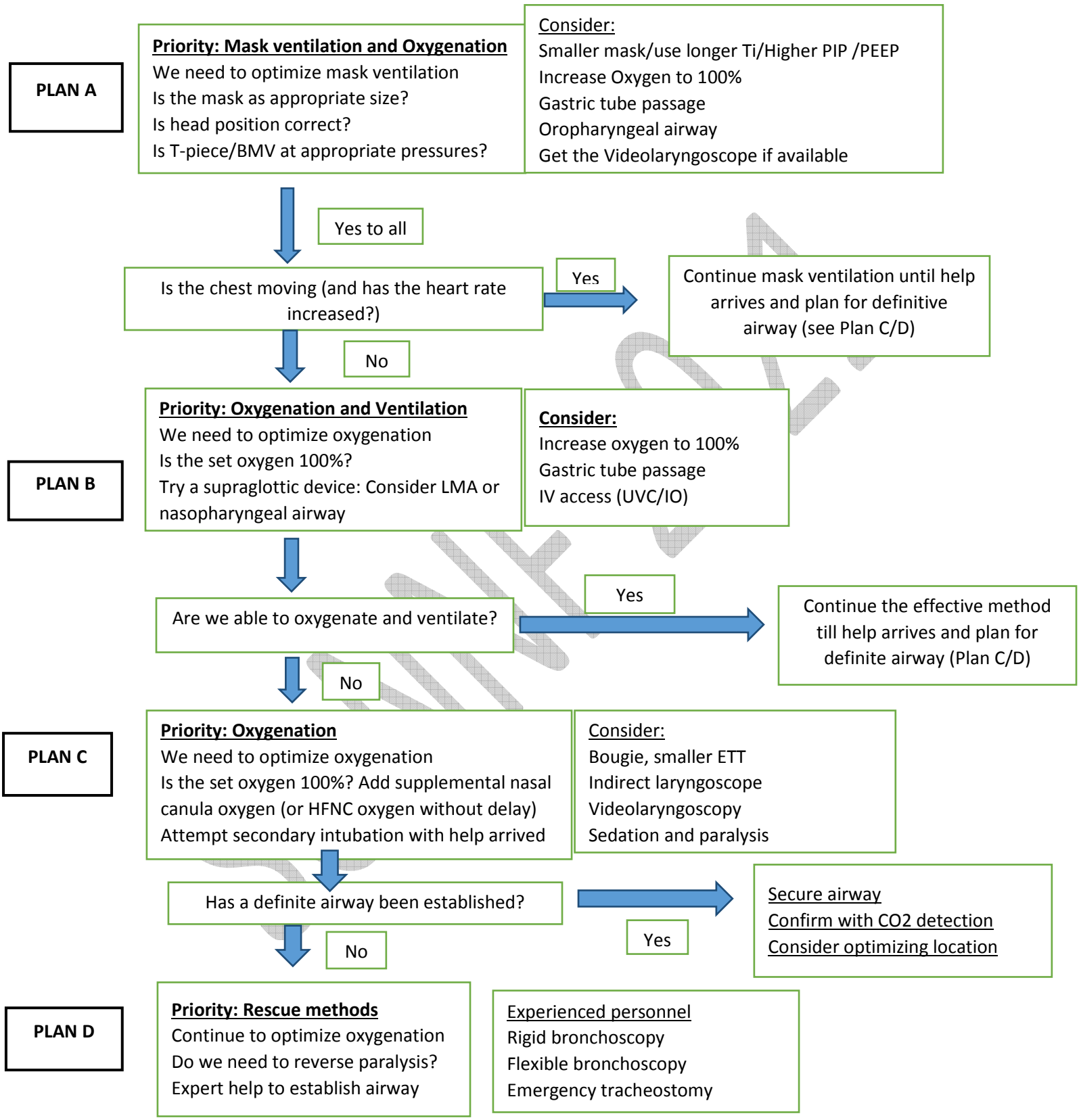

Figure 2: Algorithm for management of Difficult airway in neonates

(Managing the difficult airway in the neonate- A BAPM framework for practice, Oct 2020)[4]

Summary:

- Difficulty in airway management can be anticipated from good antenatal scans. But majority times it is unanticipated.
- In the case of a predicted difficult airway, the first intervention should be to "call for help" if such help is available.
- We need to optimize oxygenation and Ventilation.
- Bag and mask ventilation provides oxygenation and ventilation as personnel and equipment are being mobilized for endotracheal intubation.
- Alternatives for airway management include a laryngeal mask airway or fiberoptic intubation

References:

1) Park RS, Peyton JM, Kovatsis PG, Neonatal Airway Management, CLINICS IN PERINATOLOGY(2019), doi: https://doi.org/10.1016/j.clp.2019.08.008
2) Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, Liu PL. A clinical sign to predict difficult tracheal intubation: a prospective study. Can Anaesth Soc J. 1985 Jul;32(4):429-34
3) Patil VU, Stehling LC, Zauder HL (1983) Predicting the difficulty of intubation using an intubation gauge. Anesthesiol Rev10:32
4) Tinnion R et al, *Managing the difficult airway in the neonate- A BAPM framework for practice, Oct 2020.*
5) Mick NW (2019). The difficult pediatric airway. In S B Torrey (ed.), *UpToDate.* Retrieved June 1, 2021, from https://www.uptodate.com/contents/the-difficult-pediatric-airway
6) Vashist M, Miglani HPS. Approach to difficult and compromised airway in Neonatal and pediatric age group patients. Indian Journal of Anaesthesia 2008; 52 (3):273-281