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Pediatric Airway Management

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Introduction

The pediatric airway poses a challenge particularly for those who do not anesthetise small children on a regular basis. Anatomical and physiological variations of the airway at different ages have an impact on the decision of which medication to administer with regard to route, dosage, and duration of action as well as the choice of equipment. Knowledge of this helps in the routine management of airway in children.1Technological advancements and research have rendered numerous pediatric airway devices available for securing the airway in elective and emergency scenarios. However, their availability alone does not solve all problems. Having the knowledge, the ability to promptly recognise difficulty and to know when to call for help early are key factors for a favourable outcome. This advisory is formulated as aguide for a successful and safe airway management in children for the occasional pediatric anesthesiologist.

Table 1. Anatomical differences in the pediatric airway, and their anesthetic implications and solutions

Paediatric Anatomy	Anaesthetic Implications
Large head size and short neck (child < 2 years)	Neck flexion in supine position can cause airway obstruction Use a shoulder roll for neck extension and proper positioning. Aim to bring tragus and manubrium sterni in one plane
Small mouth, large tongue	Likelihood of upper airway obstruction Use oro/nasopharyngeal airway to maintain airway patency
High, anteriorly placed larynx, C2 in infants, C3/4 in children	More acute angle between oral and laryngeal axes
Leaf like, hanging epiglottis which is difficult to lift and glottic opening is difficult to visualise Large tonsil and adenoids	Choose appropriate laryngeal blade (Miller blade) to directly lift the epiglottis Likelihood of upper airway obstruction and bleeding during oral/nasal intubation Gentle laryngoscopy and ETT insertion
Short and narrow trachea	Chances of unilateral lung ventilation or accidental extubation are higher High airway resistance after inflammation making them prone to hypoxia Check for bilateral ventilation of lungs after ETT fixation
Short thick neck makes localisation of cricothyroid membrane difficult	Cricothyroidotomy difficult in children aged<8 years. Higher risk of puncture of posterior tracheal wall Pre-define and mark the landmarks if difficult airway is anticipated. Surgical tracheotomy preferred over scalpel technique in a 'can't intubate can't ventilate' (CICO) scenario in children aged <8 years

Table 2: Physiological differences in the pediatric airway and their anaesthetic implications

Paediatric Physiology	Anaesthetic Implications
Highly compliant chest wall	After induction of anaesthesia, loss of FRC causes atelectasis and rapid desaturation
Type II fibres in diaphragm	Prone to early fatigue adding to early desaturation
Rib cage is more horizontal	Restricted deep breathing
Higher respiratory and metabolic rate	Higher O_2 consumption and less apnoea time to desaturation
Higher vagal tone	More chances of bradycardia during airway instrumentation. Bradycardia leading to low cardiac output further aggravating hypoxemia Hypoxia itself causes bradycardia Ensure adequate depth of anaesthesia and oxygenation while managing the airway

INSIDE THIS ISSUE

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Preoperative airway assessment

Evaluation of the airway is an integral part of preoperative assessment for every child who undergoes sedation or anaesthesia. The following details of history should alert the anaesthetist to the possibility of a difficult airway:

1. Abnormal cry, hoarseness of voice
2. Snoring or sleeping in semi prone/prone position. Obstructive sleep apnea
3. Any known congenital or acquired disorders involving airway.
4. Upper respiratory tract infections (URTI), asthma, bronchitis, pneumonia
5. Previous trauma, burns involving the head and neck
6. Previous surgery, radiotherapy of head and neck or documentation of difficult airway management

In addition, a history of full stomach, gastroesophageal reflux, hiatus hernia, gastric outlet obstruction, pyloric stenosis, bowel obstruction, ascites or abdominal mass causing raised intra-abdominal pressure should be noted.
During airway assessment, anatomical factors predisposing to difficult airway management as well as signs of airway compromise, such as stridor and use of accessory muscles of ventilation should be looked for. The following measurements can help to identify possible anatomical abnormalities.

1. Lower lip to chin distance (LCD) < 2.2 cm
2. Tragus to corner of mouth (TMA) < 7.3 cm
3. Thyromental distance (TMD) < 4 cm
4. Neck circumference (NC) > 21.4 cm
5. Ratio of height to TMD (RHTMD) > 15.77 cm
6. BMI < 12.7 cm

All the above measures have a good negative predictive value and can be used as screening tools for preoperative assessment. A combination of LCD, TMD and BMI, have been found to be more accurate at predicting difficult laryngoscopic view.[2-4]The Mallampati score can assess the airway only in a cooperative older child. In children, aged 4-8 years, the Mallampati score can be correlated with the Cormack Lehane scoring assessed during direct laryngoscopy.[2,5]

Availability of appropriate airway equipment

A simple mnemonic to remember the list of drugs and equipment required in difficult airway cart is explained in Table 3.Figure 1 is an example of a portable airway cart. Table 4details the appropriate size of equipment recommended for various age groups.

Table 3. Requirement for airway cart for a child (SOAPME)[6]

Mnemonic	Full form	Equipment
S	Suction	Working, effective suction and appropriate size suction catheter.
O	Oxygen	Oxygen source, tubing, flow meters.
A	Airway Devices	Appropriate sizes of face masks, self-inflating bag, oropharyngeal and nasopharyngeal airways, laryngoscope blades (MacIntosh: 1, Miller: 0,1,2) video laryngoscope, supraglottic airway (SGA, 1st and 2nd generation), ETT, intubating stylet, tube exchanger, FOB.
P	Positioning Pharmacy	"Sniffing" position, shoulder roll for smaller children. IV anaesthetics, muscle relaxants. Resuscitation drugs: adrenaline, flumazenil.
M	Monitors	SpO_2, ECG, NIBP, $EtCO_2$, RR, temperature.
E	Equipment	Defibrillator, cricothyroidotomy, tracheostomy sets for emergency front of neck access (FONA).

Figure 1: Portable difficult airway cart with list of contents in each drawer

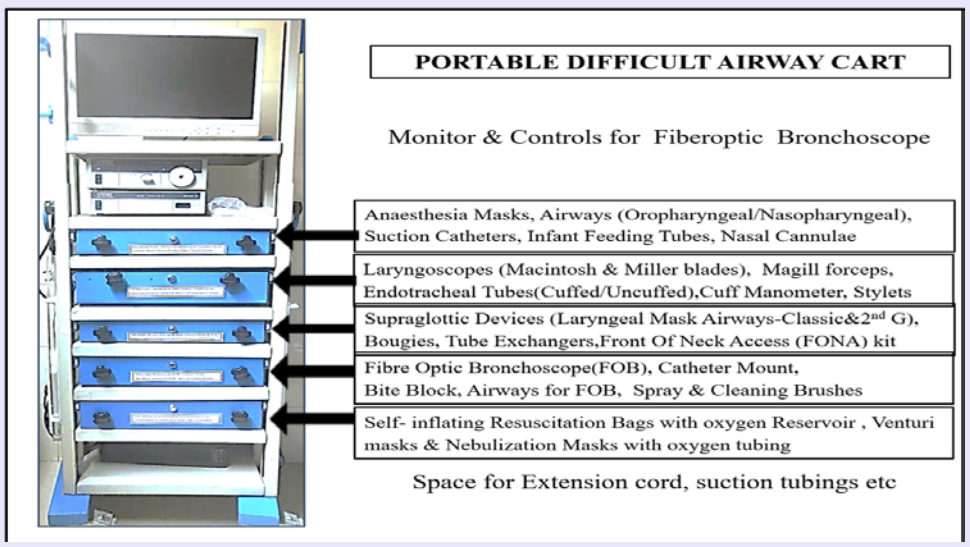


Table 4:pediatric airway equipment chart

Age Group	Neonate			Infant		Toddler	Preschool	Child	Adolescent
	Weeks of Gestation			Months		Years			
	Microprimi <28	Preterm 28-37	Term >37-40	1-6	6-12	1-3	>3-5	>5-8	>8-12
Weight (kg)	<1	1-2.5	2.5-3.5	>3.5-7	>7-10	>10-15	>15-20	>20-30	>30-50
Face masksize	00	0	0	0,1	1	2	2, 3	3	3, 4
Oropharyngeal airway size (mm)	00 (40)	00 (40)	00,0 (40,50)	0 (50)	0 (50)	1 (60)	1,2 (60,70)	2 (70)	3,4 (80-90)
Nasopharyngeal airway(ID mm)	2.5	3.0	3.0	3.0	3.0, 3.5	3.5, 4.0	4.0, 4.5	5.5, 5.5	6,7
Nasogastric tube(Fr G)	6	6, 8	8	10	10	10, 12	12, 14	14, 16	14, 16
Laryngoscope straight/curved	0	0	1	1	1	1, 2	2	2, 3	3, 4
ETT (uncuffed)(mm ID)	2.5	2.5, 3.0	3.0, 3.5	3.5, 4.0	4.0, 4.5	4.5, 5.0	5.0, 5.5	5.5, 6.0, 6.5	6.5,7.0, 7.5
ETT (cuffed)(mm ID)	-	-	3.0	3.0, 3.5	3.5, 4.0	4.0, 4.5	4.5, 5.5	5.0, 5.5	6.0, 6.5, 7.0
Tracheostomy tube(mm ID)	2.5, 3.0	2.5, 3.0	3.0	3.5	3.5, 4.0	4.5	4.5, 5.0	5.5, 6.0	6.0, 6.5, 7.0
LMA size (ETT mm ID for LMA size)	1	1	1(3.5)	1,1.5 (3.5, 4.0)	1.5 (4.0)	2.0 (4.5)	2.0 (4.5)	2.5 (5.0)	3.0,4.0 (6.0)
FOB (mm)	-		2.2	2.7	3.5	3.5	3.5	4.0	5.0

Endotracheal tube size calculations in children >1 year of age in mm ID:

Uncuffed ETT: Cole's formula = (age/4 + 4)

Cuffed ETT: Motoyama formula= (age/4 + 3.5)

Khine formula = (age/4 + 3.0)

Calculation of depth of insertion of ETT at lips or nares in cm:

	Oral	Nasal
Neonate:	weight in kg + 6	weight in kg +7
Child:	age in years/2 + 12	age in years/2 + 15

Conduct of anesthesia

Premedication: is recommended to avoid physical struggle which increases the work of breathing and oxygen consumption. It is indicated in anxious children. Nonpharmacological methods include; behaviour interventionse.g., showing videos and interactive books, music, and distraction methods (blowing bubbles, toys) or engagement with the anaesthetic process itself (choosing and handling the face mask, 'blowing up the balloon') and parental presence at induction of anesthesia.

Medications for premedication include; midazolam [oral 0.5–0.75 mg/kg, intranasal (0.3 mg/kg), rectal (0.5 mg/kg), or sublingual (0.3 mg/kg)],dexmedetomidine (intranasal 1-2 µg/kg), ketamineoral (5–8 mg/kg), intramuscular (4–6 mg/kg), or iv (1–2 mg/kg).

Preoxygenation: This maximizes the pulmonary oxygen reserve to prolong the period of safe apnea. An anxious awake child maybe unwilling to have a face mask applied. Prior training of the child and using a scented facemask may help improve acceptance. It may help to initially keep the facemask at a distance to insufflate oxygen. Hypoxaemia in infants results in bradycardia. The cardiac output being heart rate dependent, when bradycardia occurs, the resulting reduction in cardiac output further aggravates hypoxaemia, predisposing to cardiac arrest.3

Measures to minimize apnoea and desaturation in a child

1. Proper planning and adherence to the difficult airway (DA) algorithm recommendations is mandatory. Alternative plans B, C should be made in the event of failure of plan A. Extubation should also be planned in advance.
2. Preoxygenation is the best strategy in anticipated DA and unanticipated difficult airway management.
3. Preferably maintain spontaneous ventilation if DA is anticipated.
4. Provide apnoeic oxygenation via a nasal cannula while attempting intubation in anticipated DA.
5. A definitive airway should be inserted promptly after cessation of spontaneous or mask ventilation.

Optimum positioning for intubation

To facilitate a good view of the laryngeal inlet and perform endotracheal intubation, the three airway axes; laryngeal, tracheal and oral, should be maximally aligned. In children < 2 years of age, a small shoulder roll placed beneath the shoulders helps align these axes and maintain airway patency. In older children, the head is kept in "sniffing position" with the head and neck slightly extended Generally, for endotracheal intubation the child's ear lobule and tip of shoulder should be aligned in one horizontal plane

Choice of induction agent

Inhalational agents, sevoflurane or halothane are preferred as they are sweet smelling and non-irritant with less potential for laryngospasm compared with isoflurane and desflurane. Sevoflurane has the added advantage of rapid induction and rapid emergence. It is preferred in younger children especially when no intravenous access is in situ. If nitrous oxide (N2O) is being used to escalate the inhalational induction, its concentration should not exceed 50% in order to avoid hypoxia. As soon as the child loses consciousness, N2O should be discontinued followed by an oxygen-air mixture and volatile agent.

An intravenous induction is preferred in older children or those having an intravenous canula in situ preoperatively. Various induction agents like propofol, etomidate or thiopentone can be used depending on the clinical profile. However, if a DA is anticipated, these agents should be used with caution

Muscle relaxants

Adequate muscle relaxation is required to facilitate optimum viewing of the larynx and smooth endotracheal intubation.7,8,9They should be administered only after assisted facemask ventilation can be provided. Nondepolarizing muscle relaxants are preferred, except when a rapid sequence induction (RSI) is required. A modified RSI is preferred in children wherein gentle ventilation is performed in infants to maintain oxygenation without the application of cricoid pressure. The external laryngeal maneuvre helps bring the laryngeal inlet into view.

Mask ventilation

The face mask should be well fitting with minimum leak. The correct size covers the bridge of the nose and the mouth. The operator's thumb and the index finger press the mask on the face with the middle finger on the bony margin of the mandible. The index and little fingers can remain free or hooked under the angle of the mandible. The bony margin of the mandible should be pressed and not the soft tissue to avoid obstructing the airway. External laryngeal manipulation can be done with the operator's little/ring finger for better visualisation of the vocal cords or can be provided by an assistant. Optimum depth of anesthesia needs to be maintained during mask ventilation.

Airway adjuncts

A relatively large tongue sticks to the palate, leading to difficulty in mask ventilation. An OPA or NPA can open the airway during mask ventilation. The OPA is used in unconscious patients as it stimulates a gag reflex. The appropriate size of OPA is chosen by measuring from the corner of mouth to the angle of mandible. Too large a OPA can obstruct the airway and cause trauma. If it is too small, one can further push the tongue back and fail to relieve obstruction. The appropriate size of NPA is measured from the tip of nose to the tragus. While inserting an NPA, blanching of surrounding skin tissue is suggestive of too large a size. Both devices should be well lubricated prior to insertion.

Supraglottic airway devices (SGAs)

SGAs are useful for both spontaneous and mechanically ventilated children. The second-generation SGAs with a port for the gastric tube are now routinely used for short surgical procedures as an alternative to endotracheal intubation, SGAs are useful rescue airway devices for maintaining oxygenation and anesthesia in the failed intubation situation under general anesthesia. SGAs in comparison to ETT have a lower incidence of perioperative adverse respiratory events in terms of laryngospasm or bronchospasm.10However, the SGA does not provide a definitive airway therefore, they are not recommended for surgery of long duration in children with airway abnormalities and for transport of patients on ventilator. Intubating LMAs can be used as a conduit for intubation in older children.11 The maximum cuff pressure recommended for SGA to prevent oropharyngeal leak in children should not exceed 40 cm H2O.12 These devices have also been used to maintain patency of the airway during extubation in difficult airway scenarios.

Endotracheal intubation

The epiglottis is elongated in infants and a straight laryngoscope blade is generally preferred to directly lift up the epiglottis. This provides better visualisation of the laryngeal inlet and insertion of endotracheal tube under vision. Curved laryngoscope blades are used by hooking the tip of the blade in the vallecula and indirectly lifting the epiglottis. Many newer versions including video laryngoscopes have been introduced to facilitate endotracheal intubation. Choice of the specific device depends on availability and personal preferences.

Video laryngoscopes are considered the equipment of choice in anticipated difficult airway when mouth opening is adequate for its insertion. The improved glottic vision increases chances of successful intubation. As the magnified glottic view is visible to the intubator and assistant, further improvement in visualizing the laryngeal inlet can be assessed when optimum external laryngeal pressure is applied. Minimal cervical spine manipulation is required and the device can be simultaneously used along with a fibreoptic bronchoscope (FOB) to improve the chances of successful intubation.

FOB is the technique of choice of anticipated DA in expert hands. Novice users need to practice in simulated conditions and routine intubations. This is the gold standard for confirming adequate positioning of ETT in the trachea.

Uncuffed vs cuffed ETT

An increasing number of pediatric anaesthesiologists prefer cuffed ETTs over the uncuffed ones. A cuffed ETT has the advantage of high first pass success rate, less air leak and gastric insufflation, minimal escape of anesthetic gases responsible for operation theatrepollution13 and reduced incidence of post-extubation stridor.14The cuff pressure should not exceed 20 cmH20 to avoid damage to the tracheal mucosa and monitoring of cuff pressure is considered mandatory. Microcuff®tubes are especially designed cuffed tubes for children providing an effective sealing at low cuff pressures. The cylindrical shaped polyurethane cuff is placed more distally to avoid endobronchial intubation and damage to the narrower cricoid region and vulnerable mucosal tissues. The ideal depth of insertion for ETT is between the carina and vocal cords. This distance is short in neonates, so the cuff should be passed just below the vocal cords under direct laryngoscopic vision. Presence of bilateral breath sounds should be ensured and confirmed with capnography. Breath sounds should always be rechecked after any change in position of the child to detect any inadvertent migration into the mainstem bronchus or pharynx.

Rapid sequence induction (RSI)

Classical RSI requires application of cricoid pressure and rapid ETT insertion without mask ventilation, using bolus dose of IV induction agent and succinylcholine (1-2 mg/kg). This technique can pose a challenge in the pediatric population. Preoxygenation is difficult as children are not cooperative, and yet prone to rapid fall in oxygen saturation. Application of cricoid pressure is difficult as the cricoid cartilage is small. Inadequate efforts of cricoid pressure application can lead to lateral displacement of the oesophagus thereby increasing chances of pulmonary aspiration.

Succinylcholine is contraindicated in patients prone to malignant hyperthermia, hyperkalaemia and allergy to succinylcholine.10Rocuronium is an alternative muscle relaxant for rapid intubation in a dose of 0.9-1.2 mg/kg. Sugammadex is the drug of choice for prompt reversal of its neuromuscular blockade and is available in India. It has an off-label use in pediatrics as it has not been approved by the FDA15.

Controlled RSI (cRSI) is the preferred technique in children. The following technique is recommended:16,17

- The child to be kept in 20º head-up position during preoxygenation
- Provide intermittent suctioning of the Ryle's tube in situ, or insert one immediately after intubation.
- Provide adequate hypnosis using propofol or thiopentone followed by adequate muscle relaxation with either a depolarising or non-depolarising muscle relaxant.
- Gentle bag mask ventilation with insufflation pressures <12 cmH20.
- Tracheal intubation in a deep plane of anesthesia with complete muscle paralysis. Neuromuscular monitoring should be used.

Extubation and Postoperative Care

Extubation is a critical moment during pediatric anesthesia as children are prone to perioperative respiratory adverse events. Adequate suctioning should be done before planning to extubate. Subglottic suctioning should also be done if the ETT has a subglottic suction port. Small children may not be able to understand voice commands, so observing the breathing patterns and the saturation remains the only alternative. The method of extubation may be chosen according to the patient's clinical profile and the practice of the anaesthesiologist.

In a DA situation, a child should preferable be extubated when awake. 'Awake' extubation is practised when the child has achieved age-appropriate tidal volume and respiratory rate, conjugate gaze, eye opening and adequate muscle power18. As the cough reflexes return, the chances of aspiration are reduced. However, the child might be agitated and this can cause surgical site disruption, postoperative bleeding and even desaturation. Hence, extubation of a child can also be done under deep sedation. The pre-requisites for the child to be extubated in the deeply anaesthetised state are that tidal volume should be > 5 mL/kg with an age-appropriate respiratory rate. Extubation of a properly evaluated child under deep anesthesia has the advantage of reduced cough and less oxygen desaturations, but there is increased possibility of airway obstruction. Extubation can be done either in supine or lateral position. At the time of extubation, the intubation trolley should be kept ready with all the equipment required for reintubation if needed. Removal of SGA in a child is safest in the lateral position as compared to supine. The risk of airway complications was found to be least when SGA was removed at a deep plane of anesthesia in the lateral position19,20. Post operatively , oxygenation may be required, necessitating the availability of nasal prongs, face masks, high flow nasal canulae.

Post anesthesia care unit should have facility for oxygen supplementation, continuous monitoring vital parameters and pain management. The area should also be equipped to manage any untoward events.

Table 5: Key recommendations for pediatric airway management

1	Anatomical and physiological differences in the paediatric airway make it challenging. Anaesthesiologists should anticipate and be prepared for difficult airway. Airway management and simulation workshops facilitate learning in a safe environment.
2	Perioperative complications in children are mainly respiratory followed by cardiac causes. The paediatric anaesthesiologist should be well trained and equipped to handle perioperative complications which are mainly respiratory in origin.
3	Perioperative anaesthetic complications in children are more frequent with the occasional paediatric anaesthetist when compared to an experienced paediatric anaesthesiologist Trained paediatric anaesthesiologists should conduct anaesthesia for paediatric surgeries to minimise perioperative complications.
4	Preanaesthetic examination should be done thoroughly to rule out congenital anomalies and any systemic involvements. Thorough preoperative airway assessment is difficult in small children. A difficult airway cart should be readily available to reduce airway morbidity and mortality.
5	Children have low respiratory reserves and highly compliant chest wall making them prone to rapid desaturation. Appropriate measures for preoxygenation and nasal oxygen supplementation should be taken to minimize apnoea and desaturation in children. All types of airway devices should be available in the difficult airway cart including oral and nasal pharyngeal airways, supraglottic devices and endotracheal tubes.
6	Anaesthesiologist should be well versed with current difficult airway guidelines. Surgical tracheostomy remains the last resort to manage airway in CICV scenario. Paediatric airway management algorithms should be easily accessible in Paediatric ORs. Difficult airway carts should also contain invasive airway management kits.
7	Specific precautions are required while administering anaesthesia to a child with recent history of upper respiratory infection to avoid perioperative respiratory complications The child should be taken for elective surgery after assessing urgency and clinical condition. Extra vigilance is needed in a child requiring emergency surgery.
8	The goal of RSI (Rapid Sequence Intubation) is to secure an airway emergently and safely In infants and small children, modified RSI is the technique of choice i.e., administration of nasal O_2, gentle ventilation and use of a muscle relaxant with short half-life.

References:

1. John E. Fiadjoe JE, Stricker PA,Ronald S. Litman RS. Pediatric Airway Management. In: Gregory's Pediatric Anesthesia; edited by Andropoulos DB,Gregory GA. 2020; 323-355.
2. Maddali MM, Al-Zaabi HM, Al-Aamri IS, Arora NR, Panchatcharam SM. Preoperative predictors of poor laryngoscope views in pediatric population undergoing cardiac catheterization. Ann Card Anaesth. 2018; 21:376-81.
3. Raj D, Luginbuehl I. Managing the difficult airway in the syndromic child. Continuing Education in anesthesia Critical Care & Pain. 2015;15: 7–13.
4. Fiadjoe JE, Nishisaki A, Jagannath N et. al. Airway management complications in children with difficult tracheal intubation from the Pediatric Difficult Intubation (Pedi) registry: a prospective cohort analysis. Lancet Resp Med. 2016;4: 37-48.
5. Mansano AM, Módolo NS, Silva LM, Ganem EM, Braz LG, Knabe Ade C, Freitas FM. Bedside tests to predict laryngoscopic difficulty in pediatric patients. Int J PediatrOtorhinolaryngol. 2016; 83:63-8.
6. Adapted from American Academy of pediatric Committee on Drugs 2016-19.
7. Julien-Marsollier F, Michelet D, Bellon M, Horlin AL, Devys JM, Dahmani S. Muscle relaxation for tracheal intubation during paediatric anaesthesia. Eur J Anesth. 2017;34:1–12.
8. Plaud B, Baillard C, Bourgain JL, et al. Guidelines on muscle relaxants and reversal in anaesthesia. Anaesth Crit Care Pain Med. 2020;39:125-42.
9. Reddy JI, Cooke PJ, van Schalkwyk JM, Hannam JA, Fitzharris P, Mitchell SJ. Anaphylaxis Is More Common with Rocuronium and Succinylcholine than with Atracurium. Anesthesiology. 2015; 122:39–45.
10. Dadure C, Sabourdin N, Veyckemans F, Babre F, Bourdaud N, Dahmani S, Queiroz M, Devys JM, et al. Management of the child's airway under anaesthesia: The French guidelines. Anaesth Crit Care Pain Med. 2019;38:681-93.
11. Black AE, Flynn PE, Smith HL, Thomas ML, Wilkinson KA. Association of Pediatric Anaesthetists of Great B, Ireland. Development of a guideline for the management of the unanticipated difficult airway in pediatric practice. Pediatr Anaesth. 2015;25:346–62.
12. Choi KW, Lee JR, Oh JT, Kim DW, Kim MS. The randomized crossover comparison of airway sealing with the laryngeal mask airway Supreme at three different intracuff pressures in children. Pediatr Anesth. 2014; 24:1080–7.
13. De Orange FA, Andrade RG, Lemos A, Borges PS, Figueiroa JN, Kovatsis PG. Cuffed versus uncuffed endotracheal tubes for general anaesthesia in children aged eight years and under. Cochrane Database Syst Rev. 2017;11:CD011954.
14. Tareerath M, Mangmeesri P. Accuracy of Age-Based Formula to Predict the Size and Depth of Cuffed Oral Preformed Endotracheal Tubes in Children Undergoing Tonsillectomy. Ear Nose Throat J. 2021 doi: 10.1177/0145561320980511. Epub ahead of print. PMID: 33559493.
15. Tobias JD, Thomas M. Current evidence for the use of sugammadex in children. PediatrAnesth. 2016; 27: 118-25.
16. Newton R, Hack H. Place of rapid sequence induction in paediatric anaesthesia. Br J Anaesth Education 2016; 16: 120–3.
17. Bennett BL, Scherzer D, Gold D, Buckingham D, McClain A, Hill E, Andoh A, Christman J, Shonk A, Spencer. Optimizing Rapid Sequence Intubation for Medical and Trauma Patients in the Pediatric Emergency Department. Pediatr Qual Saf. 2020;5: e353.
18. Templeton WT, Goenaga-Díaz EJ, Downard MG, McLouth CJ, Smith TE, Templeton LB et al. Assessment of Common Criteria for Awake Extubation in Infants and Young Children. Anesthesiology. 2019; 131:801–808
19. Thomas-Kattappurathu G, Kasisomayajula A, Short J. Best position and depth of anaesthesia for laryngeal mask airway removal in children: a randomised controlled trial. Eur J Anaesthesiol. 2015; 32:624–30.
20. Koo CH, Lee SY, Chung SH, Ryu JH. Deep vs. Awake Extubation and LMA Removal in Terms of Airway Complications in Pediatric Patients Undergoing Anesthesia: A Systemic Review and Meta-Analysis. J. Clin. Med. 2018; 7:353.

Additional Reading

The most common complications that occur are laryngospasm and bronchospasm which can occur perioperatively with the risk of postoperative apnoea, or desaturation, the recognition and management of which are in following Table6. SGAs should be preferred over ETT in older children with the likelihood of hyper-reactive airways to minimise airway stimulation.

Table 6: Common airway related problems

Laryngospasm	
Incidence	1.7- 25% [1],Children > adults, Higher perioperative morbidity.[2]
Precipitating factors	Airway anomalies, light plane of anaesthesia, secretions or blood in the airway Recent history of URTI, airway instrumentation or surgery like tonsillectomy
Clinical presentation	Paradoxical respiratory movements Inspiratory stridor Chest retractions, totally absent chest movements in severe cases
Complications	Desaturation, bradycardia, aspiration, negative pressure pulmonary oedema cardiac arrest
Management	100 % O_2 by face mask, obtain a tight face mask seal. Give CPAP Open the airway by applying head tilt, chin lift and jaw thrust, insert OPA/NPA as required, use 'Larson manoeuvre' with pressure on laryngospasm. Deepen plane of anaesthesia by administering propofol or sevoflurane, if not relieved and patient desaturates further, IV succinylcholine 0.25- 0.5 mg/kg. If bradycardia, IV atropine 20 µg/kg Maintain ventilation with facemask/SGA/ETT, till recovery of NM Blocking agent.
Bronchospasm	
Incidence	Incidence: 0.3- 3.2 %.[16] May occur after intubation, intraoperatively or at emergence.
Clinical presentation	Ronchi on chest auscultation Changes in $EtCO_2$: upsloping of capnograph, decreased value Increased peak inspiratory pressures, decreased expired tidal volume decreasing value of SpO_2
Management	100% O_2, allow more time to exhalation: increase I:E ratio to 1:3, 1:4 Deepen the plane of anaesthesia with propofol or sevoflurane Give 8-10 puffs of salbutamol via metered dose inhaler Refractory bronchospasm:give magnesium sulphate, adrenaline, steroids, anticholinergics, neuromuscular blocking agents
Post-intubation croup	
Incidence	It usually is seen in the immediate postoperative period after extubation, due to local oedema and inflammation in laryngeal and subglottic structures due to tight fitting ETT or airway manipulation.
Precipitating factors	Age 1-4 years Multiple attempts at intubation Prolonged intubation >1 hour Excessive movements of head and neck intraoperatively Oversized / overinflated ETT (No leak observed at cuff pressure > 25 cmH_2O) Coughing during extubation with ETT in situ
Clinical presentation	Loud cough, Inspiratory stridor, Chest retractions, Respiratory distress, Cyanosis
Management	IV dexamethasone 0.6 mg/kg Nebulization with adrenaline
Child with upper respiratory tract infection (URTI)	
Elective surgery:	Should be deferred to 2-4 weeks after the episode of active URTI if fever > 38 C, wet cough, child looks sick or has lung signs. [3]
Emergency surgery:	If surgeryis life-saving, proceed keeping possibility of perioperative respiratory adverse event (PRAEs) in mind. Be well equipped with relevant drugs and equipment. *The child presents with running nose with no other sign of active URTI can be taken up for surgery under general anaesthesia without anticipated respiratory complications.
Premedication:	Nebulisation with a β-agonist like salbutamol Sedatives like midazolam should be given with caution as the child may desaturate in preoperative area Distraction techniques can be used, or parenteral presence allowed during induction to reduce the distress.
Intraoperative management	Operations of short duration anesthesia can be maintained via a facemask Maintain adequately deep plane of anaesthesia. Avoid gastric distension by inserting NG tube to minimize respiratory compromise. Pre-set ventilator settings according to age,weight of the child prior to induction. Pressure or volume control ventilatory modes used to target ventilation end points Lung protective strategies: low tidal volumes, PEEP and high I:E ratio. Ventilatory settings: Tidal volume 6 mL/kg, set age- appropriate respiratory rate. 250-500 mL reservoir bag to prevent excess delivery of tidal volume and barotrauma.

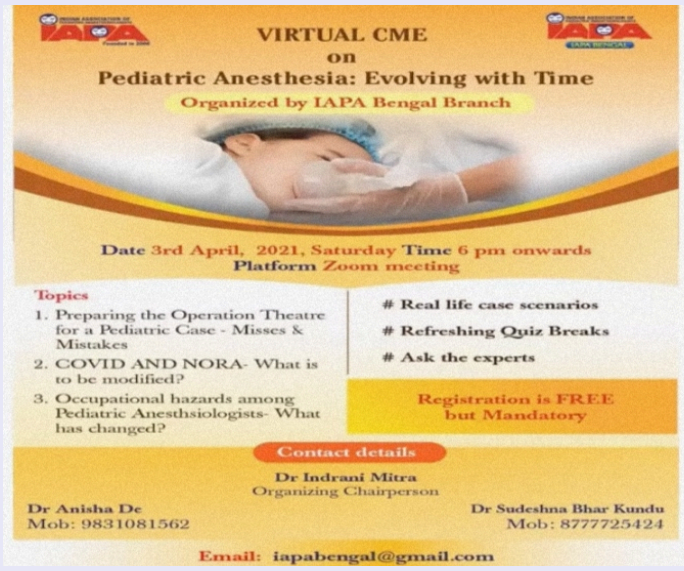
References:

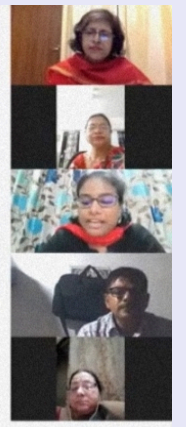
1. Cravero JP, Beach ML, Blike GT, et al. The incidence and nature of adverse events during pediatric sedation/anesthesia with propofol for procedures outside the operating room: a report from the Pediatric Sedation Research Consortium. Anesth Analg. 2009; 108:795.
2. Newton R, Hack H. Place of rapid sequence induction in pediatric anesthesia. Br J Anaesth Education 2016; 16: 120–3.
3. Pek JH, Tan HC, Shen G, Gene Ong Y-K. Apneic Oxygenation for Emergency Intubations in the Pediatric Emergency Department—A Quality Improvement Initiative. Pediatr Qual Saf. 2020;2: e255.
4. Von Ungern-Sternberg BS, Boda K, Chambers NA, et al. Risk assessment for respiratory complications in paediatric anaesthesia: a prospective cohort study. Lancet. 2010; 376:773.

ACTIVITIES

Pediatric Anesthesia - EVOLVING WITH TIME -1st Virtual CME organised by IAPA-Bengal Branch on 13th March 2021

COVID battle has undoubtedly taken a major toll on our health as well as affected us professionally and academically. However, like always, life has taught us to take up challenges. With this positive vibe, IAPA Bengal organised a focused VIRTUAL CME on ***Paediatric Anaesthesia - Evolving with Time***on13th March 2021. We received an impressive online response of around 300 enthusiastic registrants from all over the country. After a brief welcome note from the organising secretary Dr Anisha De, the discussion kick started with an interactive session on ***Preparing the Operation Theatre for a Paediatric Case- Misses & Mistakes***. It included three real life case scenarios with errors, commonly encountered while preparing the OR for a paediatric case. A lecture followed by Dr Suchismita Pal. The whole session was moderated by Dr Shailesh Kumar & chaired by Prof Gauri Mukherjee & Prof Sudakshina Mukherjee. The next lecture was on ***COVID & NORA: What needs to be modified?*** by Dr Rakhi Khemka and chaired by Prof Debasish Saha. The concluding lecture-***Occupational health hazards among Pediatric Anaesthesiologists-What has changed?*** Delivered





by Dr Rivu Basu from Dept of PSM and chaired by Prof Jyotsna Basu was an eye-opening lecture with practical suggestions to develop a healthy work life balance.The session was wrapped with a vote of thanks by our IAPA BENGAL President Dr Indrani Mitra.

Delegate interactions with the speakers was actively utilized via the chat-box. The feedback was uniformly positive with regards to the topics and content of the lectures.

13th National conference & 1stwebcon of Indian Association of pediatric Anaesthesiologists was organized by the department of anesthesia, Sri Guru Ram Das Institute of Medical Sciences in collaboration with IAPA on 27th & 28th March 2021.

- The aim of the conference was to advance the science and practice of pediatrics anesthesia which is a budding superspeciality. The mission is to improve the quality of care and safety of children undergoing anesthesia. The target population ranged from residents in anesthesia to senior consultants practicing pediatric anesthesia.
- The event was inaugurated by our honorable vice chancellor, Dr. Daljit Singh, by lighting the ceremonial lamp. Dr. AP Singh, Dean Colleges and organizing person of the Webcon released the IAPA Newsletter at the event. Dr. Elsa Varghese, National President IAP and Dr. MSRC Murthy, Secretary IAPA joined the ceremony online. Dr. Anupama Mahajan, Vice Principal, SGRDIMSAR, Amritsar also graced the occasion. Dr. Ruchi Gupta, Organizing Secretary presented the welcome address. The inauguration ceremony concluded with a motivating address by the chief Guest, Dr. Daljit Singh, Vice Chancellor, Sri Guru Ram Das University of Health Sciences, Sri Amritsar.
- The first fully virtual conference was very well received with over 1100 delegate registrations. 400-500 delegates were logged in to the Webcon at most times of the day.
- Dr. Charles Cote delivered the **Dr. Snehalata Dhayagude Oration**: on **Obstructive Sleep Apnea and Polymorphism.** She was honoured by presenting a scroll and momento by Dr. Snehalata Dhayagude, Dr. Elsa Varghese and Dr. MSRC Murthy.
- Dr. Rebecca Jacob delivered the first **Dr VG Appakutty Memorial Oration:** on **Changing Face of pediatric anesthesia.** She was honoured by presenting a scroll and momento byDr. ElsaVarghese, Dr Neerja Bhardwaj and Dr. K Balakrishnan.
- The Scientific programme spanning over two days was widely attended and a great success. Prominent international and national faculty shared their knowledge and experience with delegates.
- Panel discussion on "**Challenges in Managing Children with Burn Injury"** and **"Everyday Challenges in pediatric anesthesia: how do experts do it"** saw stimulating discussion by the pannelists.
- An interactive session on **Crisis Management during pediatric anesthesia** was casebased discussions on relevant topics in pediatic anesthesia by eminent national faculty.
- Pro&Con sessions saw fierce debate on "**Goal Directed vs Liberal Fluid Therapy"**
- Current trending topics like**: "Websites and Apps for pediatric anesthesia: Are They Useful?"** and **"Role of Ultrasound in Airway Management"** were discussed.
- "**Inotropes in pediatric Patients: Which One When?", "Emergence from anesthesia: What is Critical and What to Avoid?" and "Regional Blocks for Neonates"** were also discussed.
- Budding anaesthesiologist got an opportunity to showcase their research and talent in paper & poster presentation of the highest quality which were highly appreciated.
- The event was highly successful and received rave reviews from faculty as well as delegates.

ASPA e-PPLS Course conducted by the IAPA on 10th &11th April 2021

The second e-PPLS course conducted by the IAPA trained twenty-two middle to senior level anesthesiologists from various parts of India. The programme followed the e-PPLS template. Dr Elsa Varghese, Dr Vibhavari Naik and Dr Ekta Rai moderated the programme. Faculty included Drs R Jayanthi (Chennai), Rakhi Khemka (Kolkata), Rebecca Jacob (Bangalore), Sandhya Yaddanapudi (Chandigarh), SumalathaShetty (Mangalore), Chandrika YR (Bangalore)and Sapna Bhatla (Delhi). In addition, six PPLS trainers from the Philippines, Malaysia, Indonesia and Singapore along with six trainers from India, were silent observers. Drs Ekta Rai, Vibhavari Naik and Teddy Fabilaran the background IT requirements. Dr Agnes Ng, Singapore attended and observed the programme on both days.

Though twenty-five participants had registered only twenty-two actually participated. The virtual workshop was efficiently conducted. The interactive sessions were done in breakout rooms with five to seven participants in each room along with two moderators and observers. All these sessions witnessed very active participation and discussion. In addition to lectures,the videos provided information and focus for discussion or teaching of skills. Participants undertook a pre-test and post-test. The average pre-test score was 13.76 which improved to an average post-test score of 18.21. The participants who have been awarded the ASPA IAPA e-PPLS certification include Drs. Sayed Majid Anwer, Sujata Shivlal Rawlani, Anudeep Jafra, Swati Das, Ridhima Sharma, S Sanjay Prabhu, Divya Tewari, Rakhee Goyal, Uma Maskeri, Bhumika Kalra, Nidhi Agrawal, Geeta Kamal, ArchnaKoul, Rahil Singh, Geeta Setia, Prachi Gaba, Renu Devaprasath, Alex Francisco Nicholas, Aparna Williams and Shubhada Bhagath.

The feedback rated the workshop very high and the majority mentioned that they found it a very practical and useful course and appreciated the efforts of the faculty.

Comprehensive Review of pediatric anesthesia (CROP) series conducted by NH SRCC Children's Hospital, Mumbai & IAPA Maharashtra

Dr Nandini Dave,

NH SRCC Children's Hospital, Mumbai

The NH SRCC Children's Hospital, Mumbai organised two virtual programs, both of which were well attended. Adequate time was given for the Q&A session which was well appreciated.

On Saturday, 12th September 2020, the topic "Fluid and Blood Transfusion Therapy in pediatric Surgical Patients - What, When, How Much?" was discussed. The program covered the role and evidence for crystalloid and colloid infusions in the pediatric age group. Triggers and tips for blood transfusion were also discussed. The program was attended by around 80 anesthesia consultants and trainees.

On 17th April and 24th April 2021over two weekends, the emphasis was on radiology under the topic "Essentials of Radiology for the pediatric Anaesthesiologist". This program discussed the vital role of radiology in modern day medical practice. From the simple X-ray, to CT and MRI, experts in radiology explained how to interpret these films, and how the anaesthetist can use radiology to interpret a patient's condition."Practical Aspects of anesthesia for Radiological Procedures in Children" was also discussed.

On April 24th, "Ultrasound as an Invaluable Tool in the Anaesthetists' Armamentarium"was discussed in detail during this webinar. The basics of ultrasound of the lung, airway, brain, and gastric sonology was discussed along with its implications for the anaesthesiologist. The use of focused assessment with sonography in trauma (FAST) was elaborated on. This webinar was attended by 70 participants.

Good Reads in Pediatric Anesthesia

Dr Sanjay Prabhu
Apollo children's hospital, Chennai

1. Hunyady A, Polaner D**. Pediatric airway management education and training**. PediatrAnesth. 2020;30:362–370.
2. Walter CM. **Trends in Pediatricpain:Thinking beyond opioids**. AnesthesiolClin 2020; 38 (3) 663–678
3. Procaccini D, Lobner K, Azamfirei R, Kudchadkar SR. **Melatonin for anaesthetic indications in pediatric patients: a systematic review**. anesthesia 2021; 76: 837–849
4. Templeton TW, Piccioni F, Chatterjee D. **An Update on One-Lung Ventilation in Children**. AnesthAnalg 2021;132:1389–99
5. Disma N, Veyckemans F, Virag K, Hansen TG, Becke K, Harlet P etal**Morbidity and mortality after anaesthesia in early life: results of the European prospective multicentre observational study, neonate and children audit of anaesthesia practice in Europe (NECTARINE).** BJA 2021; 126 (6): 1157 – 1172.
6. Habre W, Disma N**A decade later, there are still major issues to be addressed in paediatric anaesthesia.**CurrOpinion Anaesthesiol2021; 34(3); 271-275

Report on the First Virtual ASPA PPLS Train the Trainer (e-TTT) Course Organized by the IAPA on June 20th 2021 from 09.00 to 13.30 hours

Dr Elsa Varghese, Dr Rebecca Jacob, Dr Vibhavari Naik
ASPA PPLS India Coordinators

Setting up the first ASPA PPLS e-TTT Course: The challenge of modifying the existing framework of the ASPA PPLS TTT module to effectively train the trainers online was initially quite daunting. However, we felt there is anurgent need to expand the pool of PPLS trainers in India. Brainstorming sessions were held by Drs Rebecca Jacob, Elsa Varghese and Vibhavari Naik and a road map was created. Seasoned PPLS trainers included in the faculty team were Drs Chandrika YR, Ekta Rai, R Jayanthi, Lakshmi Kumar and Nandini Dave. Backend IT support was provided by DrsVibhavari Naik, Ekta Rai and Chandrika YR. All the above mentioned faculty were included in a WhatsApp group to help communication. Virtual meetings were held on a weekly basis to deliberate on how to teach potential trainers - to conduct a skill station, effectively moderate small group discussions and train others to function as a team leader during a crisis on a virtual platform. Faculty were assigned tasks –powerpoint presentations and videos were created and edited. The programme was rehearsed and appropriate modifications and troubleshooting strategies were made prior to the course.

eTTT Course Attendees: Sixteen ASPA PPLS certified anesthesiologists were identified and invited to participate. Mandatory requirements included IAPA and ASPA membership in addition to paying a course fee of Rs 1500.00. Programme details were communicated by email and a participant WhatsApp group formed prior to the course. The following attended the course: Drs Aikta Gupta, Amrita Rath, Anita Shirley, Anju Gupta, Anuradha Ganigara, Aparna Williams, Elizabeth Joseph, Gayatri Sasikumar, Indu Sen, Priyanka Karnik, Rakhee Goyal, Renita Marina Pinto, Renu Devaprasath, Saroj Bande, Shubhdeep Kaur and Smruthi S.Four ASPA PPLS Trainers from Singapore, Philippines and Turkey attended as observers.

eTTT Programme: At the onset a video displaying the programme details and course instructions was played, Dr Vibha welcomed the participants, introduced the faculty and provided housekeeping instructions. Dr Elsa opened the session with an overview of the course and spoke on ‘How to get the message across’. Dr Rebecca discussed small group teaching and how to encourage participant involvement concluding with an example of how a case discussion can be conducted. A group activity followed on ‘How to conduct a small group discussion’ which involved the participants being moved into assigned breakout rooms (eight in each room along with a moderator). Each room was provided a case scenario and a team leader was selected from the group. The task for the group, was to plan a strategy on what questions to ask and how the case was to be moderated by their leader when teaching the members of the other group. The participants were then moved back into the main hall and the next 30 minutes involved the two case scenarios being discussed by the team leader of one group moderating the discussion with the other group. Faculty observers Drs Nandini and Lakshmi, provided feedback on how the case discussion was planned and conducted. Dr Lakshmi then gave some useful tipson ‘Howt o handle the difficult student’.

After a 10-minute coffee break, Dr Jayanthi deliberated on ‘Online etiquette and how to navigate the Zoom platform and breakout rooms. Dr Vibha dealt with the session on ‘Crafting and conducting of skill stations’ following which, the groups were moved into their breakout rooms. Participants were shown a series of clinical slides describing ‘How to perform neonatal nasal intubation’. A group leader was again assigned whose role was to use the four-step method to teach this skill with the help of the slides. Dr Lakshmi and Dr Chandrika observed these deliberations and provided their valuable feedback on how the skill was taught.

Dr Nandini conducted the final session ‘Teamwork in a crisis’. Two videos were played showing medical teams provide CPR to a child; where in one the resuscitation team performed more effectively than in the other. Participants were required to analyse the videos and discuss the positive and negative aspects of how the teams in the videos performed. Feedback for this session was provided by Drs Nandini and Ekta. Dr Elsa later thanked the participants for their enthusiastic participation and welcomed them to the ASPA PPLS Faculty Club. Detailed participant feedback was given on the link provided to the participants and they were awarded ASPA PPLS Trainer Certificates.

Dr Elsa moderated the faculty debriefing session after the course and welcomed Drs Agnes Ng and Erlinda of the ASPA Education Committee. They congratulated us on a very well conducted course and provided useful suggestions on how to make the ‘teaching skills’ and ‘team work in a crisis’sessions more effective. The online feedback from the participants indicated that the course was highly appreciated and useful. The online format allowed them to attend the course from the comfort of their homes which was a big advantage.Several felt the durationof the course should be longer with more time allotted for interactive sessions. Some stated that instructions and expectations of participants roles in the interactive session needed to be explained with more clarity.

The ASPA PPLS India coordinators are on the job to incorporate suitable changes. We thank our amazing faculty for their passion and dedication to the process of teaching and learning. On the whole, planning and conducting this course was an exciting experience for all of us.

Answer key IAPA Quiz :

1. D
2. A
3. B
4. A
5. C
6. A
7. B
8. A
9. D
10. D

Applied Neonatal Physiology and Anesthesia

Dr Anila Malde,

Lokmanya Tilak Municipal Medical College & Hospital, Mumbai

Neonatal physiology is markedly different compared to adults. This review briefly addresses these differences in individual organ systems and how they affect the response to anesthesia

Respiratory system:

Neonates have horizontally placed ribs, and a relatively flat diaphragm with fewer type I fibres. The airway and chest wall are highly compliant, so the negative intrathoracic pressure is poorly maintained, leading to alveolar collapse, especially under general anesthesia. Closing capacity for neonates exceeds functional residual capacity. In addition, neonates have increased oxygen consumption and carbon dioxide production. Therefore, they need a higher minute ventilation which is achieved by increasing respiratory rate. Because of all these reasons, insertion of supraglottic airway or endotracheal tube and controlled ventilation are a must even for the shortest surgery. Since the lungs have less reserve of oxygen, a well oxygenated infant with upper airway obstruction can become cyanotic in a few seconds.

During the first 2 to 3 weeks of life, both full-term and premature infants in a warm environment respond to hypoxemia with a transient increase followed by sustained decreased in ventilation. Premature infants continue to show a biphasic response to hypoxemia even 25 days after birth. In preterm infants, the initial period of transient hyperpnoea is abolished in a cool environment, indicating the importance of maintaining a neutral thermal environment. Newborn infants respond to hypercapnia by increasing ventilation but less so than do older infants. The slope of the CO_2 response curve increases appreciably with gestational age as well as with postnatal age.

Apnea is common in preterm infants and may be related to an immature respiratory control mechanism. Risk factors for postoperative apnea include, low gestational age at birth, anemia, hypothermia, sepsis, and neurological abnormalities. Therefore, careful monitoring in the postoperative period is required. Both the ophylline (10 mg/kg) and caffeine have been effective in reducing apneic spells in preterm infants.

Premature babies are deficient in surfactant predisposing them to respiratory distress syndrome and require respiratory support leading to increased chances of barotraumas, and bronchopulmonary dysplasia.

Fetal hemoglobin which is present up to 3 month of age has a higher affinity for oxygen. This is compensated by having high haemoglobin, blood volume and cardiac output. To maintain oxygen carrying capacity of the blood hemoglobin concentration should be maintained to 13 g/dl in the Newborn [is there a reference or guideline for this?].

Cardiovascular system: Neonatal myocardium has a higher percentage of noncontractile protein, making it stiff and non-compliant. It has limited ability to increase the cardiac output by increasing stroke volume. Cardiac output is more dependent on heart rate. Parasympathetic predominance leads to increased incidence of bradycardia in neonates. Arterial blood pressure increases with age. Poorly developed compensatory mechanisms (e.g., vasoconstriction, tachycardia), and an immature myocardium with low calcium stores make neonates vulnerable to volatile anesthetic induced hypotension.

Many factors like hypoxia, hypercapnia, acidosis, hypothermia, anesthesia-induced changes in peripheral or pulmonary vascular tone, prematurity and infection can lead to increase in the pulmonary artery pressure up to systemic levels. This can cause reopening of the intracardiac shunts.

Central nervous system (CNS): Cerebral blood flow (CBF) in healthy neonate is 30-40 mL/100g of brain tissue /min which is less than adult (55ml/100g of brain tissue/min).The blood brain barrier is immature in neonate, facilitating the passage of large lipid soluble compounds such as anaesthetic drugs and free bilirubin into the brain.

Nervesare thinner with less myelination in the neonates and young infants, allowing a lower concentration of local anaesthetic to be effective. CSF volume is relatively high in infants requiring higher drug volume.

The germinal matrix surrounding the ventricles in the brain is immature and delicate in preterm newborns. Therefore, changes in blood flow, pressure, and osmolality are associated with the development of intraventricular hemorrhage (IVH).

Liver: Limited glycogen stores, ketogenesis and lipolysis capability makes neonates susceptible to hypoglycaemia. Due to decreased synthetic capacity of liver, plasma levels of albumin and coagulation factors are low in full-term newborns (and are even lower in preterm infants). This leads to greater levels of unbound drug and increased coagulopathy. Vitamin K is usually given to all newborns.

At term, the functional maturity of the liver is incomplete. Both phase I and II reactions are affected.

Gastrointestinal System: Neonates have inability to coordinate swallowing with respiration, thus resulting in a high incidence of gastroesophageal reflux in newborns and more so in preterm infants.

Kidney: GFR, tubular mechanisms, concentrating, and diluting capacity are not well developed in infants. Renal blood flow and GFR reaches to adult levels by two years of age. The tubular mechanisms involved in the excretion of organic acids are poorly developed in neonates. Therefore neonates do not tolerate fluid overload, dehydration and acidosis well.

Fluid and Electrolytes: Term neonate have 75% of total body weight as water (40% ECF, 35% ICF), and usually lose 5-10% of their weight in the first week of life, which is water loss. Preterm neonates have more water (at 23 weeks' gestation, 90% of body weight as water composed of 60% ECF and 30% ICF), and they lose 10-15% of their weight in the first week of life. Small for gestational age (SGA) preterm infants may have higher proportional body of water content. Neonates have larger body surface area and immature skin and therefore higher insensible fluid loss. In addition, neonates have a higher metabolic rate . Both these lead to higher fluid requirement.

The high fractional excretion of Na^+ (FE_{Na^+}) in premature infants can lead to negative Na^+ balance, hyponatremia, neurologic disturbances, and poor growth unless a Na^+ intake of 3 to 5 mmol/kg per day is given. In the early postnatal period especially in immature infants, serum potassium concentration is higher than in older persons. There are two peaks in the occurrence of neonatal hypocalcemia . Neonates who are not breast fed should be supplemented with 1mL/kg 10% Ca Gluconate 8^{th} hourly.

Temperature regulation: The large surface area to body mass ratio, insufficient body fat for insulation, and inability to shiver, make neonates more susceptible to hypothermia. They rely primarily on non-shivering thermogenesis in which brown fat is used. Metabolism of brown fat is severely limited in premature infants and in sick neonates who are deficient in fat stores. Hypothermia can lead to delayed awakening from anesthesia, altered drug responses, cardiac irritability, bradycardia, respiratory depression, increased pulmonary vascular resistance, metabolic acidosis, and hypoglycemia. To minimize oxygen consumption, the neonate must be in a neutral thermal environment. Neutral temperature is defined as the ambient temperature that results in the least oxygen consumption. The critical temperature is that ambient temperature below which an unclothed, unanesthetized person cannot maintain a normal core body temperature. Neutral temperature is 34, 32 and 28 C and critical temperature is 28, 23 and 1 C in preterm, term neonates and adults respectively. All measures have to be taken for preventing heat loss by radiation (39%), convection (34%), evaporation (24%), and conduction (3%).

Effect of physiology on pharmacology: Larger body water content, less~~er~~ proteins and fats, immature hepatic and renal function alters drug pharmacology in neonates. Initial drug requirement may be high but duration may be prolonged and effects may be severe.

Because of a smaller lung FRC, higher minute ventilation-to-FRC ratio with relatively higher blood flow to vessel-rich organs, induction is more rapid. Neonates require lower concentrations of volatile anesthetics than infants .

Suggested Readings

1. Malde AD and Virkar N. General consideration in emergency neonatal and pediatric surgeries. In: Editors: In: Gandhi MN, Malde AD, Kudalkar AG, Karnik HS, Eds. Practical Approach To Anaesthesia For Emergency Surgery. New Delhi, Mumbai, Panama City, London: Jaypee Brothers Medical Publishers (P) Limited; 2011: PP 303-320. ISBN 978-93-5025-070-9
2. Malde AD.Anesthesia for neonatal emergencies. How I do it?”In: RACE 2020 (Ramachandra Anesthesia Continuing Education), Chennai, CME book.
3. Brett CM and Davis PJ. Anesthesia for General Surgery in the Neonate. In Davis PJ, Cladis FP, Eds. Smith’s Anesthesia for Infants and Children, Ninth Edition. Philadelphia: Elsevier Inc; 2017: PP 597-603.
4. Spaeth JP, Lam JE. The Extremely Premature Infant (Micropremie) and Common Neonatal Emergencies. In: Coté CJ, Lerman J, Anderso BJ, Eds. Coté and Lerman's A Practice of Anesthesia for Infants and Children, sixth edition. Elsevier https://t.me/Anesthesia_Books).
5. Morton NS, Fairgrieve R, Moores A & Wallace E. Anesthesia for the Full -Term and Ex-Premature Infant. In: Gregory GA and Andropoulos DB, Eds. Gregory’s Pediatric Anesthesia, fifth edition. Wiley and Blackwell, John Wiley & Sons Ltd. 2012
6. Lönnqvist PA. Management of the Neonate: Anesthetic Considerations. In: Bissonnette B Ed. Pediatric Anesthesia Basic Principles—State of the Art—Future. Shelton, Connecticut: People’s Medical Publishing House—USA; 2011.

IAPA PAEDIATRIC ANAESTHESIA FELLOWSHIP TRAINING EXPERIENCE AT SRI RAMACHANDRA INSTITUTE OF HIGHER EDUCATION & RESEARCH,CHENNAI

Anaesthetizing small miracles everyday

Dr Sarat Chander, Pediatric Anesthesiology Fellow

‘Never belittle even the teeny, little information provided to you about the little ones.’ (Anon)

In spite of the changing times and practices, this one thing never changes and is here to stay, right from my days as a post graduate student in Sri Ramachandra Medical College and Research Institute, Chennai (and definitely even before my time too), to me getting enrolled as a fellow in Pediatric Anesthesiology in my alma mater.

This exacting requisite is the very reason why me taking up this fellowship gave shivers down my spine. I definitely wanted to weather this storm off my mind as early as possible. I always felt that anything related to pediatric patients (the so-called miniature adults?) is challenging, be it auscultating a crying baby who cannot be pacified, getting history from a baby’s hard of hearing grandmother, explaining about anesthesia and NPO orders to the same grandmother (all the very best with it), keeping the pulse oximeter attached on a one year old who fancies kicking all the time; the list goes on and we haven’t even reached the operation theatre (and don’t even get me started with anesthetizing them in remote locations!), but I've finally figured my way around it.

In the operation theatre, if securing an IV line in a plump child or an endotracheal tube in a baby with Pierre Robin Sequence had tested my skill set; bringing a quiet, stable, pain free child to the recovery room, only to find a crying mother requiring consoling, has put my soft skills on a spot many a times.(the biggest question being, whom to pat first?)

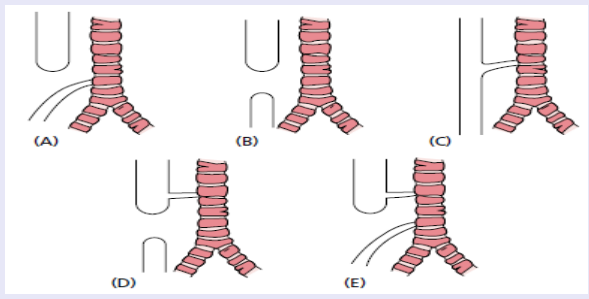
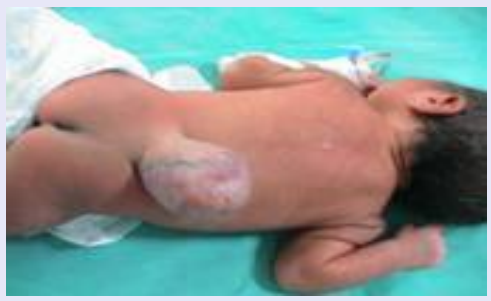
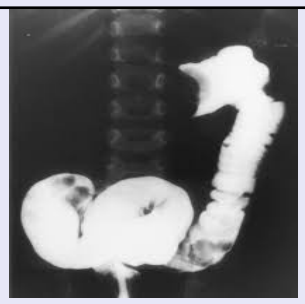
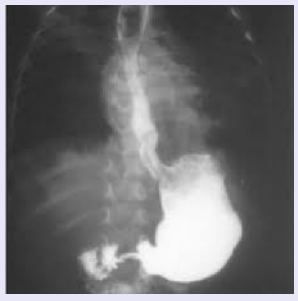
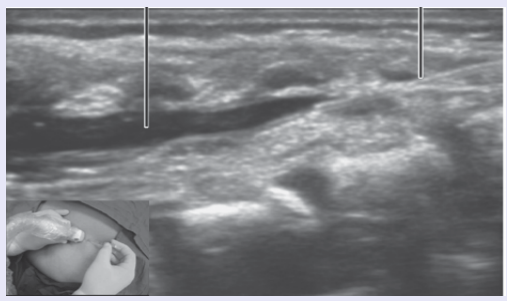
Jokes apart, on a serious note, I’m really happy to say that one thing has definitely changed in me in recent times, my apprehension to do pediatric cases. Thanks to my professors,

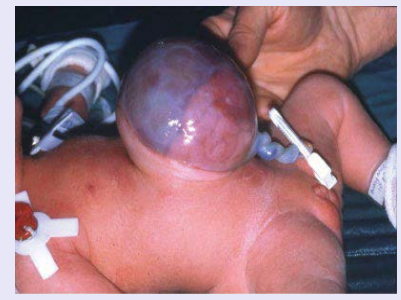
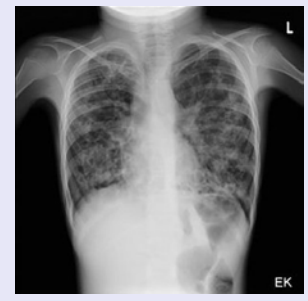
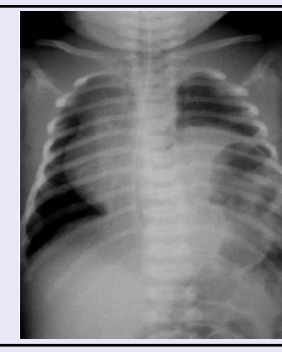
Dr. Aruna Parameswari, Dr. Akiladeshwari and the entire anesthesia department, for continuously inspiring and teaching me the essentials and helping me hone my skills. I would also like to thank my postgraduates for being supportive which aided in a cohesive learning experience and also the pediatric surgery team for easing me into this stream of learning. I’d fail in my duty if I don’t thank the IAPA for providing me this platform to improve and explore.

From being terrified to loving it 3000, this fellowship has definitely given me happy and informative times to reflect upon. I strongly believe that it’s going to be the same for the remainder of my career and I can’t wait to share my experiences with you. Au revoir!!

IAPA QUIZ

Dr Sapna Bathla, Dr Nikhilesh Chandra
VMMC and Safdarjung Hospital, New Delhi

S.no.	Question	See the images and answer the questions
1	Triad of Pierre Robin syndrome doesn't consist of A. Micrognathia B. Glossoptosis C. Upper Airway Obstruction D. Ear Abnormalities	
2	Most common variant of Tracheoesophageal fistula is A. Figure A B .Figure B C. Figure C D. Figure D E. Figure E	
3	Identify the syndrome A.Treacher Collin Syndrome B.Down Syndrome C.Apert Syndrome D.Pierre Robin Syndrome	
4	Meningomyelocele is frequently associated with which of the following A.Excessive CSF with in cranial cavity B. Abnormally small head C. Congenital absence of cranial vault D. Overriding of cranial sutures	
5	Claw sign on barium enema is suggestive of A. Gastroschisis B. Omphalocele C. Intussusception D. Necrotizing enterocolitis	
6	Classical electrolyte and metabolic imbalance in Hypertrophic pyloric stenosis in neonates A. Hypochloremic, hypokalemic metabolic alkalosis B. Hyperchloremic, hypokalemic metabolic alkalosis C. Hypochloremic, hypokalemic metabolic acidosis D. Hyperchloremic, hypokalemic metabolic acidosis	
7	Which block is being depicted in this USG picture A. Ilioinguinal block B. Caudal block C. Penile block D. Femoral block	

8	One common character shared between omphalocele and gastroschisis A. Intestines extend out of a defect in the abdomen. B. Defect next to umbilicus C. Intestines not covered by a protective sac D. Defect in the umbilicus	
9	Adjoining X-ray belongs to a patient of Cystic fibrosis. What is not usually associated with Cystic Fibrosis- A.Soft tissue airway obstruction B.May develop Bronchiectasis C.Possible RVH D.Club foot	
10	Adjoining X Ray Features are suggestive of A.Necrotising Enterocolitis B.Gastroschisis C.Hirschsprung's Disease D.Congenital Diaphragmatic Hernia	

Disclosure - No Conflicts of Interest

Acknowledgement –The pictures have been taken from Google free pool and are being used here for academic purpose only .

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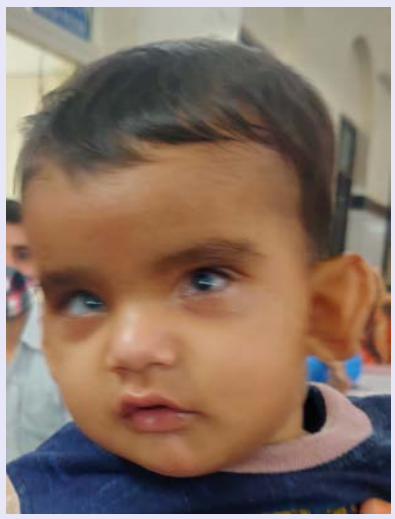
Answers Crossword IAPA

Across	Down
7. GASTROSCHISIS	1. HYDRATION
9. SURFACTANT	2. PNEUMONIA
11. HYPONATREMIA	3. DUODENAL ATRESIA
12. FETO	4. THE MISFITS
13. LEFT	5. GROSS
15. LORAZEPAM	6. MIDGUT VOLVULUS
16. ALTE	8. CAH
17. PROSTAGLANDIN E	9. STRING
	10. NEC
	11. HYPOKALEMIA
	14. DUALHIT
	18. ECG

Case Report- The use of a supraglottic device in child with Goldenhar Syndrome

Dr Ranju Singh,
LHMC, New Delhi

Goldenhar syndrome(GS) is a rare congenital disease caused by abnormal development of the first and second branchial arches, causing unilateral maxillary and mandibular hypoplasia and vertebral anomalies resulting in limitation of neck movement. It poses significant challenges in airway management.[1]We report the case of an eight-month-old 6kg, male infant, who was scheduled to undergo a cataract surgery in the left eye. The mother gave a history of gestational diabetes. On examination, the patient had various features of GS such as micrognathia, retrognathia, malformed left ear and facial asymmetry, and delaed developmental milestones. He had limited movements of the head and neck, which suggested the possibility of difficult laryngoscopy and intubation. His two-dimensional echocardiography showed a small (6mm) atrial septal defect.



Note: Appropriate consent taken

A written informed parental consent was taken. All preparations were made for an anticipated difficult airway including a video laryngoscope and fibreoptic bronchoscope. The child was fasted, transferred to the operation theatre and standard monitoring attached including pulse oximetry, non-invasive blood pressure and electrocardiogram with heart rate. The child was not premedicated in view of the anticipated difficult airway (DA).Inhalation induction was initiated with 8% sevoflurane in an air–oxygen mixture. Venous access was then established; 2µg/kg fentanyl was administered. An i-gel®#1.5 was inserted after attaining adequate jaw relaxation. anesthesia was maintained with oxygen: air (1:1) and sevoflurane 2%-3% to maintain a MAC of 1-1.3. At the end of an uneventful surgery, the child was awakened and extubated in the operating theatre.

Goldenhar syndrome (GS), also known as oculo-auriculo-vertebral dysplasia, was first described by Maurice Goldenhar in 1952. The incidence of this syndrome ranges from 1: 3500 to 1:45000 live births with a male: female preponderance of 3:2. It. The clinical manifestations include ear anomalies, hearing loss, epibulbar dermoids, upper eyelid colobomas, subconjunctival lipomas, unilateral facial hypoplasia, micrognathia, cleft palate, congenital heart disease, renal anomalies, mental retardation and vertebral abnormalities. This syndrome poses a challenge to the anaesthesiologist in terms of difficult mask ventilation and intubation due to facial asymmetry, micrognathia, cleft palate, unilateral facial hypoplasia and malocclusion. The limitation of neck movement due to vertebral abnormalities makes the intubation difficult. In a child, cardiac anomalies, mental retardation, and secondary respiratory problems further compound the problem. In view of DA, maintaining spontaneous breathing remains a vital technique in its management in children.[2]Since both mask ventilation and intubation are anticipated to be difficult, it may be advisable to manage the airway by insertion of a supraglottic device (SGD) as a primary airway device, like we did. The use of video laryngoscope and fiberoptic intubation has been described and observed as difficult with high failure rates.[3]There is still limited literature regarding the use of a SGD in such patients. [4,5]This technique led to a favourable outcome in our patient despite the anticipated DA.

Awareness regarding this rare syndrome and nuances of its anaesthetic management, particularly the management of DA with the use of a SGD can prevent the anaesthetic related morbidity in affected children.

References

1. Bogusiak K, Puch A, Arkuszewski P. Goldenhar syndrome: current perspectives. World J Pediatr2017;13:405–15.

2.Khan WA, Salim B, Khan AA, Chughtai S. Anaesthetic management in a child with Goldenhar syndrome. J Coll Physicians SurgPak 2017;27:S6–7.

3.Yan-Hua Sun, Bo Zhu,1 Bing-Yang Ji, Xiu-Hua Zhang.Airway management in a child with Goldenhar syndrome. Chin Med J. 2017; 130: 2881–2882.

4. Aydogan MS, Begec Z, Erdogan MA, Yücel A, Ersoy MO. Airway management using the ProSeal laryngeal mask airway in a child with Goldenhar syndrome. Eur Rev Med Pharmacol Sci 2012;16:559–61.

5.Sukhupragarn W, Rosenblatt WH. Airway management in a patient with Goldenhar syndrome: a case report. J Clin Anesth 2008;20:214–17.

Bewareof the Child with Repeated Respiratory Tract Infections

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Christian Medical College & Hospital, Vellore

Introduction

Subglottic stenosis is a benign condition variable etiology, with post-intubation injury being the commonest cause. Anesthesiologists may be involved in the airway management of diagnosed cases or may be challenged with a difficult airway (DA) in undiagnosed subglottic stenosis.

Case-report

A13 kg four-year-old boy with bilateral hydroureteronephrosis was planned for cystoscopy and bilateral ureteric reimplantation. He presented with recurrent urinary tract infections on admission, with the following. vital signs: HR 115/min, RR 38/min,SpO2100%Temp 99 F,BP109/77mmHg. The systemic examination was unremarkable, with no craniofacial dysmorphism and Mallampati class 2 with adequate neck extension.

After connecting standard ASA monitors, inhalational induction was performed and atracurium administered after confirming adequate bag and mask ventilation. Despite a Cormack Lehane Grade 1 direct laryngoscopy view, a 5 mmID uncuffed endotracheal tubecould not be passed beyond the glottic opening. After failure to intubate with a 4.5 uncuffed endotracheal tube, the procedure was abandoned; as the laryngoscopic view on video-laryngoscopy demonstrated subglottic mucosal bulge (Figure 1).

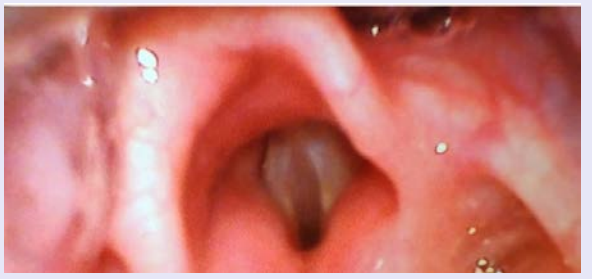

Figure1: The video-laryngoscopic view of the glottic opening with marker pointing towards the subglottic bulge.

The differential diagnoses considered were tracheal web, subglottic stenosis or mass compressing the trachea. Ventilation was supported with bag and mask(an LMA insertion was attempted but the LMA failed to provide an adequate seal) till the child was fully awake and neuromuscular blockade reversed with neostigmine and glycopyrrolate after confirmation of the train of four count. The parents were informed about the events and the surgery was deferred.

After repeated questioning, the mother provided us with the history of frequent upper respiratory tract infections (5 to 7 episodes/year) with occasional wheezing which usually settled at home but had required hospital admission with nebulisation and antibiotics on one occasion in the past. A pediatric otolaryngology consultation was sought to evaluate the airway. A lateral radiograph of neck (soft tissue) revealed narrowing of the subglottic airway (Figure 2).

The child presented for dynamic evaluation of the airway and urological surgery a week later. Inhalational induction was performed and the total intravenous anesthesia technique was used for airway assessment. Initial infusion of propofol (12mg/kg/h for 10 minutes, reduced to 10 mg/kg/h for 10 minutes, then to 8 mg/kg/h) and dexmedetomdine (1µg/kg bolus over 10 minutes followed by 0.51µg/kg/h) were utilized. The child was breathing spontaneously with oxygen delivered via nasal prongs. Using a 2.7 mm flexible fibreoptic bronchoscope (FOB),tracheal stenosis was identified about 1 cm below the level of the vocal cords (Figure 3); a size 3.0 uncuffed endotracheal tube was rail-roaded over the FOB under vision. After securing the airway, the surgical procedure continued under inhalational general anesthesia, supplemented with caudal block for analgesia. The child was observed in the post-operative care unit for three hours post-operatively and then shifted to the pediatric high-dependency unit for overnight monitoring for new onset stridor or respiratory distress. Post-operatively, the child received intravenous dexamethasone for four days to reduce glottic oedema. He was discharged on the sixth post-operative day with advice to follow up with pediatric nephrology and pediatric ENT departments. An alert regarding difficult intubation was put into the child in the electronic records system to alert the anesthesiologists and the parents were counselled to alert the anaesthesiologist regarding the difficult airway in case the child was to have further surgical procedures in any other hospital.

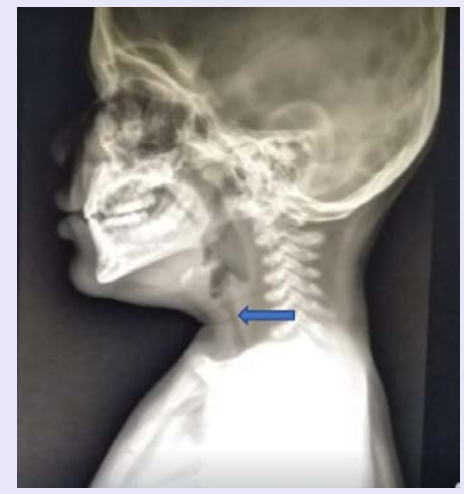

Figure 2: Lateral radiograph of the soft tissue of the neck showing narrowing of the air column below the level of the glottis

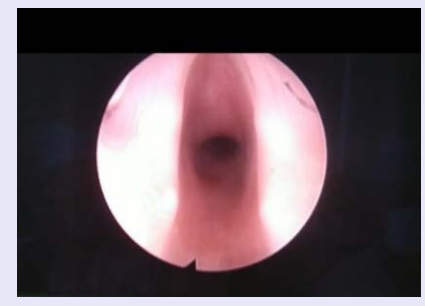

Figure 3: Direct visualisation of airway with flexible bronchoscope showing subglottic stenosis approximately 1 cm below the vocal cords

Discussion

The earliest report of two cases of DA due to subglottic stenosis, highlight its association with other congenital anomalies (1), recognize that the pre-operative diagnosis may be confounded by the presence of symptoms which may be attributed to co-existing cardiac or respiratory anomalies and the condition may only be recognised at the time of tracheal intubation. Both children in this report developed stridor post-operatively (due to repeated attempts at tracheal intubation) and one required emergency tracheostomy. (1)

Two more cases of subglottic stenosis have been reported in children, one had a recognized difficult airway (child had two previous intubations along with post-operative mechanical ventilation), while the other was an unanticipated difficult intubation, similar to this case. In both these reported cases, an LMA and i-gel® were used as rescue devices respectively to perform fibreoptic visualisation of the airway, which identified subglottic stenosis. Both these children developed stridor in the immediate post-operative period, requiring adrenaline nebulisation and observation in the ICU. (2)

Another case report highlights the use of veno-arterial extracorporeal cardiopulmonary support in a four-month-old child presenting for tracheostomy; with a CT diagnosed subglottic stenosis (airway diameter of 2.3 to 2.5 mm) posing a CVCI scenario. The airway was secured under sedation after the establishment of extracorporeal cardiopulmonary support, as backup for a CVCI situation and then the child underwent a tracheostomy uneventfully. (3)

Head and neck abnormalities may be associated with congenital subglottic stenosis but our patient did not have any facial dysmorphism or syndromic associations. The only positive history indicative of the diagnosis was a history of recurrent upper respiratory tract infections which was elicited from the parent later after repeated questioning. Since there was no previous history of tracheal intubation or airway instrumentation, our patient had an undiagnosed congenital subglottic stenosis. In our case, video laryngoscope (VLS)guided the anaesthesiologist in immediate recognition of the subglottic pathology. VLS is easy to set up in an emergency situation rather than fibreoptic bronchoscope. This helped us in involving the pediatric otolaryngologist and securing the airway under visionto facilitate surgery.

Conclusion

This report highlights, in agreement with the difficult airway guidelines; that repeated attempt at tracheal intubation in case of difficulty in passing the appropriately sized endotracheal tube for a child, should be avoided. A video-laryngoscope may aid in the diagnosis of airway anomaly in children presenting with unanticipated difficult intubation. Children with mild to moderate subglottic stenosis may be asymptomatic or may have minor symptoms; therefore, a high index of suspicion for a difficult airway is warranted in any child with a history of repeated upper respiratory tract infections or congenital anomalies. Multidisciplinary involvement and timely communication can improve the post-operative outcome in these children.

References

1. Colgan FJ, Keats AS. Subglottic stenosis: a cause of difficult intubation. Anesthesiology. 1957;18(2):265-269.
2. Dwivedi D,Dwivedi G,Gupta V, Kate S. Pediatric airway management in undiagnosed congenital subglottic stenosis patients. The Indian Anaesthetists' Forum 2020 ;21(1) : 70—73.
3. Soeda R, Taniguchi F, Sawada M, et al. Management of Anesthesia under Extracorporeal Cardiopulmonary Support in an Infant with Severe Subglottic Stenosis. Case Rep Anesthesiol. 2016; 2016: 6871565.

Pediatric Parathyroid Adenoma: A Recherché Phenomenon

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VMMC & Safdarjung hospital, New Delhi

Primary hyperparathyroidism in a male teenager presenting with multiple brown tumour lesions has been rarely reported in literature. Brown tumours can be confused with other skeletal tumours and actual treatment can be delayed. A high index of suspicionis required for accurate diagnosis.[1].As anaesthetic management it is a challenge for the anaesthesiologist, we report perioperative management of one such case scheduled for parathyroidectomy.

A fourteen-year-old male patient presented with fracture of the right forearm bones after an accidental fall, for which cast immobilization was done. Because of the pathological fractures,a skeletal survey was carried out revealing Brown tumour involving multiple bones. His biochemical investigations showed anaemia (haemoglobin9.9g%), hypercalcemia (total calcium(Ca)12mg/dL, ionized Ca-8mg/dL), increased serum parathormone (PTH) levels269pg/mL, increased alkaline phosphatase levels(ALP)322U/L and low vitaminD levels11ng/mL. Ultrasound neck and Technetium (99mTc) sestamibis can revealed a mass suggestive of right inferior parathyroid lesion likely an adenoma. Surgical resection was advised and the patient was started on capsule vitamin D3 60000 IU stat.

He was scheduled for surgery, was kept nil per oral as per fasting guidelines and started on normal salineinfusion at 100mL/h.On the day of surgery, the investigations revealed total Ca 8.2 mg/dL, ionized Ca4.6mg/dL, serum magnesium1.73mg/dL, serum PTH120pg/mL, serum sodium138mEq/L and serum potassium5.2 mEq/L. Consent was taken from his parents.

After preoxygenation for 3minutes, anesthesia was induced with injection IV fentanyl 100ug, propofol 100mg and vecuronium 5mg given and his trachea was intubated with a 7 mm ID PVC endotracheal tube (ETT) using a C-Mac Video laryngoscope with the neck in the neutral position. Laryngoscopy was done with utmost care as chances of quadriplegia were high due to an unstable cervical spine [3]. Later he was positioned with a slight head up position with a bolster kept under the shoulder to extend the neck and the head was stabilized with a head ring. All the pressure points were padded. Anaesthesia was maintained with O_2, N_2O and isoflurane. Train of four monitoring was done as coexisting skeletal muscle weakness can lead to decrease requirement of muscle relaxants whereas hypercalcemia can antagonize effect of non-depolarizing muscle relaxant and boluses of vecuronium were given accordingly.[4] Vigilant ECG monitoring of lead II and V5 was done for any abnormal cardiac rhythm and $EtCO_2$ was kept between 32 to 35mmHg. Temperature was monitored and patient was kept warm. IV morphine and paracetamol provided and IV 6 mg dexamethas one was given to prevent airway edema. Intraoperatively blood investigations revealed total Ca8.2mg/dL and ionized Ca4.5mg/dL. Surgery was uneventful and lasted for 3 hours. The blood loss was 100mL and the patient received 1.5 L of IV normal saline. With the guidance of train of four monitoring, neuromuscular blockade was reversed. As recurrent laryngeal nerve palsy can occur during surgery and vocal cord assessment required before extubation, the Bailey's Manoeuvre was performed. In a deep plane of anaesthesia, a Proseal laryngeal mask airway (PLMA)size 3 was inserted over the ETT, and its cuff inflated. The ETT cuff was then deflated and the patient ventilated through the PLMA. An airway exchange catheter (AEC) was inserted through the ETT and then ET tube was removed. Oxygen was insufflated via the AEC and a fibreoptic bronchoscope inserted through the PLMA to confirm normal vocal cord movement. Smooth removal of the PLMA was done with the patient wide awake.

Postoperatively he was monitored for hypocalcaemia, bleeding and hoarseness/aphonia.[5]Investigations revealed total Ca was 9.2mg/dL, ionized Ca 4.69mg/dL, serum PTH 64pg/mL, serum $PO_4$3.2mg/dL and serum Mg1.8mg/dL. His postoperative course was uneventful and he was discharged after one week.

The prevalence of this in children is 2-5 per 100000 occurring more common in females than males in 3:2 ratio. [6]Brown tumours, also called osteitis fibrosa cystica of hyperparathyroidism are not actual tumours but are due to excessive osteoclast activity. The incidence of brown tumour involving multiple bones is 2-5% in primary hyperparathyroidism.[7]Children who have parathyroidectomy for hyperparathyroidism require lifelong monitoring for symptoms of recurrent hypercalcemia and possible disease recurrence.[6]This type of case is rarely seen and this case can add to the few references in the anaesthetic management of children undergoing parathyroidectomy.

REFERENCES

1. Palot Manzil FF, Bhambhvani P, Vattoth S, et al. Primary hyperparathyroidism-related brown tumors mimicking other giant cell-containing skeletal tumors: role of correlative imaging in diagnosis. J Nucl Med Technol. 2013;41(1):46–8.
2. Chopra P, Mitra S. Patients with symptomatic primary hyperparathyroidism: an anaesthetic challenge. Indian J Anaesth. 2009;53(4):492–5.
3. Bajwa SJS, Sehgal V. Anesthetic management of primary hyperparathyroidism: A role rarely noticed and appreciated so far. Indian J Endocrinol Metab. 2013;17(2):235–9.
4. Hines RL, Marschall K. Stoelting'sanesthesia and co-existing disease. 6th ed. Saunders; 2012.
5. KleyenstuberT. The parathyroid glands and anaesthesia. South AfrJ Anaesth Analg.2018; 24(3).
6. Burke J, Chen H, Gosain A. Parathyroid surgery in children. Semin Pediatr Surg.2014 Apr; 23(2):66-70.
7. Xu W, Qu Y, Shi W, Ma B, Jiang H, Wang Y, et al. Multiple bone brown tumor secondary to primary hyperparathyroidism: a case report and literature review. Gland Surg. 2019;8(6):810–6.

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2. Dr. Lily Singla, PGI, Chandigarh

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1. Dr. Sayed Majid, SRCC Children's Hospital, Mumbai & Dr. Swathi V, Indra Gandhi Institute, Bangalore
2. Dr. Ramya Rajendran, Kanchi Kamakoti Childs Trust Hospital , Chennai

Effect of different ventilation strategies on lung atelectasis in children undergoing laparoscopic surgeries

Authors: Aditi Jain*, Neerja Bhardwaj, Sandhya Yaddanapudi, Indu Sen, Preethy J. Mathew.

Introduction: General anaesthesia and creation of pneumoperitoneum during laparoscopic surgeries leads to atelectasis and loss of functional residual capacity. This study planned to analyse the extent of development of atelectasis in children undergoing laparoscopic surgeries under conventional general anaesthesia (GA) compared to the effect of the application of a recruitment manoeuvre and a continuous positive airway pressure (CPAP) during induction and recovery.

Study methodology: A prospective randomised controlled trial was conducted over 1.5 years after informed written parental consent and registration at the clinical trial registry of India. Forty ASA PS 1 and 2 children up to the age of 10 years undergoing laparoscopic surgery with pneumoperitoneum lasting for more than 30 minutes under endotracheal GA were randomly allocated to one of the three study groups using computer generated random number table. Conventional group (CG): Inspiratory pressure (PIP) adjusted to achieve a tidal volume (TV) of 5-8 ml/kg, positive end expiratory pressure (PEEP) of 5 cm H2O, respiratory rate (RR) adjusted to maintain end-tidal carbon dioxide (ETCO2) between 30- 40mm Hg with no positive pressure at induction or extubation. Recruitment manouvere (RM) group: A recruitment manoeuvre of a constant pressure of 30 cmH2O for ten seconds following intubation was applied. A PEEP of 10 cmH2O was maintained intraoperatively.

CPAP group: Intraoperative maintenance with PEEP 10 cmH2O with CPAP of 10 cmH2O at induction and extubation was done. The rest of the ventilation parameters in both RM and. CPAP groups were similar to the conventional group. A standard anaesthetic regimen was followed with an arterial line placed post induction. Lung ultrasound scores (LUS), blood gas analysis and hemodynamic and ventilatory settings were recorded at pre-decided time points.

Observation and results: All three groups were comparable for the demographic variables. The LUS at closure was significantly greater than the LUS post induction and intubation for the conventional group. The LUS for the control group at closure was significantly more than the LUS of either RM or CPAP groups. There was a negative correlation between age and the LUS at induction and post intubation. The PaO2/FiO2 ratio was significantly less for CG group as compared to RM and CPAP groups during the period of pneumoperitoneum.

Conclusion: Our study indicated that application of a recruitment manoeuvre post intubation or applying CPAP during time of induction with 100% oxygen and following them up with a high PEEP leads to less atelectasis than conventional ventilation during laparoscopic surgery. These strategies also lead to better lung compliance and oxygenation during the time of pneumoperitoneum without hemodynamic compromise in the paediatric population.

ROHHADNET: Rare syndrome with Myriad Anaesthesia implications

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Dr. Nandini Dave, Consultant and Head, Dept of Anaesthesia
Department of Anaesthesiology, SRCC Children's Hospital, Mumbai.

INTRODUCTION

R • Rapid-Onset
O • Obesity
H • Hypoventilation
H • Hypothalamic
AD • Autonomous Dysregulation

- ROHHAD syndrome was first described by Ize-Ludlow and colleagues in 2007
- Although there is literature mentioning various aspects of ROHHAD syndrome, only a couple of case reports mentioned anaesthesia implications

Case Report

3yr old female child, weighing 40 kg (BMI-40) suspected ROHHADNET SYNDROME posted for tumor excision
Weight gain- 29 kg in 1 year, about 10 kg in 3 months
Adjusted body weight - 23 kg
Ideal body weight- 15kg
Presenting complaints-
Hyperphagia, Hypertension, Baseline tachycardia, Constipation, Temperature dysregulation — Autonomic Dysfunction
Co morbidity- Uncontrolled diabetes mellitus on oral hypoglycaemic drugs and insulin therapy
-OSA

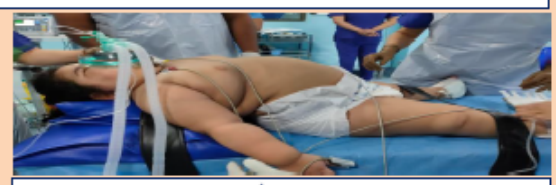
Investigation :

•Polysomnographic examination -Apnea Hypopnea Index of 12.8 and night time desaturation upto 58%
•Echocardiographic examination - mild pulmonary hypertension
•Congenital Central Hypoventilation syndrome(CCHS) - ruled out as the tested negative for POHOX2B gene
•Prader Willi syndrome, Cushing's syndrome and Beckwith Wiedemann syndrome- ruled out
•Computed tomography of abdomen pelvis -tumour in the sacral region measuring 5*3*5 cm

PREMEDICATION: Glycopyrrolate 0.06mg, Midazolam 1mg and Ketamine 20mg I/V

INDUCTION:
- Ramped position .
- Inhalational induction with Sevoflurane
- Inj. Atracurium 15mg after confirming mask ventilation
- Cormack Lehane grade II
- Intubated -4.5mm ID Microcuff endotracheal tube
- Prone position

VASCULAR ACCESS:
- 5.5 Fr -Central venous line
- Arterial line



MONITORING:
- Standard ASA monitoring
- Neuromonitoring with SSEPs and MEPs
- Bispectral index(BIS)
- Hourly blood glucose

INTRA-OPERATIVE:
-Transient SIADH like picture intraoperatively with fall in urine output which responded to Inj Furosemide
- The blood sugar level was maintained in the range of 180-200mg%
- Blood loss : 40-50ml

MAINTENANCE:
- Oxygen, air and Sevoflurane (<0.5 MAC)
- Dexmeditomidine and Propofol infusion
- Muscle relaxant - not given after initial dose
- Inj. Morphine 1.5mg given

EXTUBATION:
- The child shifted to paediatric ICU on ventilator in view of long duration surgery and severe OSA
- Extubated on next day
- Discharged 10 days later on night-time BiPAP which improved her sleep pattern

Challenges in our patient:
Morbid Obesity, Severe OSA, Difficult venous access, Difficult mask ventilation, Autonomic Dysfunction

References: 1 Eldin JAW, Tombuyoglu D, Butz L, et al. Natural history of ROHHAD syndrome: development of severe insulin resistence and fatty liver disease over time. Clinical Diabetes and Endocrinology 2019; 15: 252., 2. Goykhman A, Fitch J, Tobias JD. Perioperative care of a child with ROHHADNET Syndrome. J Med Cases 2013;4:710-4., 3. Chandrakantan A, Paulton TJ. Anesthetic considerations for rapid-onset obesity, hypoventilation, hypothalamic dysfunction and autonomic dysfunction (ROHHAD) syndrome in children. Pediatr Anesth 2013;23:28-32.7.

DISCUSSION

- Diagnosis of exclusion
- Distinguished from CCHS, Beckwith-Wiedemann and Prader Willi based on genetic evaluation[1]
- Onset of disease is around 2 to 4 years of age with dramatic weight gain, dysautonomia, and pulmonary complications[2,3]
- Life threatening with death around 10 years of age due to sudden cardiac arrest[1]
- A multidisciplinary approach involving paediatrician, endocrinologist, polysomnologist, pulmonologist, cardiologist, anaesthesiologists and surgeons is required
- Need to report such cases to formulate guidelines regarding peri-operative management[2,3]

CLINICAL FEATURES	ANAESTHESIA IMPLICATIONS
Disordered Behaviour	• Premedication is a must as patients present with emotional lability • Inj. Midazolam and Inj. Ketamine should be used judiciously
Disordered breathing	• Early nocturnal artificial ventilation(BiPAP) helps to improve daytime ventilation[3]
Difficult IV access	• USG guidance is extremely useful not only for central venous access in a patient with short neck but also for peripheral venous access
Difficult airway	• Due to the submental and buccal fat • Short neck • Severe obstructive sleep apnea.
Dysautonomia	• Rapid sequence induction may be required • Volume status needs to be optimized • Vasopressors and ionotropes can elicit variable response due to either resistance or undue sensitivity
Diabetes Mellitus, Diabetes insipidus/ SIADH	• Electrolyte disturbances due to SIADH or DI should be corrected preoperatively
Drug dosages	• Given according to total body weight, ideal body weight and adjusted body weight • Total body weight- Succinylcholine and lipophilic drugs like opiods, propofol • Ideal body weight- Hydrophilic drugs like non depolarising muscle relaxant • Adjusted body weight- Midazolam
Dysfunction	• Electrocardiography and Holter monitoring can help in detecting arrhythmias • Pulmonary function testing can be carried out in cooperative older patients • Temperature dysregulation may be present in patients with symptomatic hypothalamic dysfunction

ANAESTHETIC CHALLENGES IN THE MANAGEMENT OF LARYNGEAL PAPILLOMATOSIS IN CHILDREN: CASE SERIES

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BACKGROUND: Recurrent Respiratory Papillomatosis (RRP) is the infection of upper aerodigestive-tract by HPV. Although the lesions can affect the entire airway, larynx is the most common location.1

CASE SERIES:

CASE 1: 7-year-old male child, came with complaints of decrease in pitch of voice and progressive difficulty breathing, was posted for laryngo-tracheo-bronchoscopy and microlaryngeal-surgery(MLS). Preoperative evaluation revealed a respiratory-rate of 30, suprasternal retractions, room-air saturation of 98%.

Case 2: 4-year-old female child, with complaints of dysphonia and stridor, previously operated for laryngeal papillomatosis was posted for MLS.

Case 3: A 12-year-old male child, with history of dysphonia, previously operated for laryngeal papillomatosis, was posted for MLS.

Anaesthesia Management:

Premedication was avoided, nebulisation with lignocaine and budesonide was given. Anticipating difficult-airway, smaller-sized Endotracheal tubes, FONA-equipment and resuscitation-equipment were kept ready. Induction was done with Ketamine(1mg/Kg) and propofol(1mg/Kg), and nasopharyngeal airway was inserted. Anaesthesia was maintained with Propofol Infusion(6mg/kg/hr). Mode of ventilation was spontaneous with few assisted breaths. Adequacy of ventilation was ensured by movement of reservoir-bag, capnography trace and chest-movement.

The duration of surgery for case 1 and 3 were 40min and 30min respectively. At completion of surgery, propofol infusion was stopped and child was monitored till complete recovery of spontaneous respiration. Post-operative period in both cases were uneventful.

The duration of surgery for case 2 was 60min. At completion of surgery, trachea was intubated in view of airway edema. Postoperatively, child was ventilated overnight and extubated the next day.

Discussion:

Juvenile presentation of RRP follows a more aggressive and recurring course. Treatment consists of repeated removal of papillomas as there is no cure.1 Anaesthetic management of these procedures are a challenge as these involve sharing of an already obstructed airway. The goals of anaesthesia are to provide adequate ventilation, provide vocal-cord relaxation, avoid trauma, laryngospasm and provide good surgical access.2 Tracheostomy is best avoided as they carry the risk of virus spread. Basic ventilation-strategies used are spontaneous ventilation, IPPV, apnoeic ventilation and jet

ventilation. Spontaneous ventilation without intubation offers an unobstructed view and access of the larynx. Disadvantages of this method include risk of aspiration, inadequate ventilation, inconsistent depth causing laryngospasm.2,3

Conclusion:

Anaesthetic management of laryngeal papillomatosis needs special attention due to sharing of an already obstructed airway. Spontaneous ventilation confers the advantage of better visualisation and access to the surgeon but requires expertise.

References:

1. Seedat RY. Juvenile-Onset Recurrent Respiratory Papillomatosis Diagnosis and Management–A Developing Country Review. Pediatric health, medicine and therapeutics. 2020;11:39.
2. Bo L, Wang B, Shu SY. Anesthesia management in pediatric patients with laryngeal papillomatosis undergoing suspension laryngoscopic surgery and a review of the literature. Int J Pediatr Otorhinolaryngol. 2011;75:1442–5.
3. Li SQ, Chen JL, Fu HB, Xu J, Chen LH. Airway management in pediatric patients undergoing suspension laryngoscopic surgery for severe laryngeal obstruction caused by papillomatosis. Paediatr Anaesth. 2010;20:1084–91.

Neonatal Emergencies - Crossword

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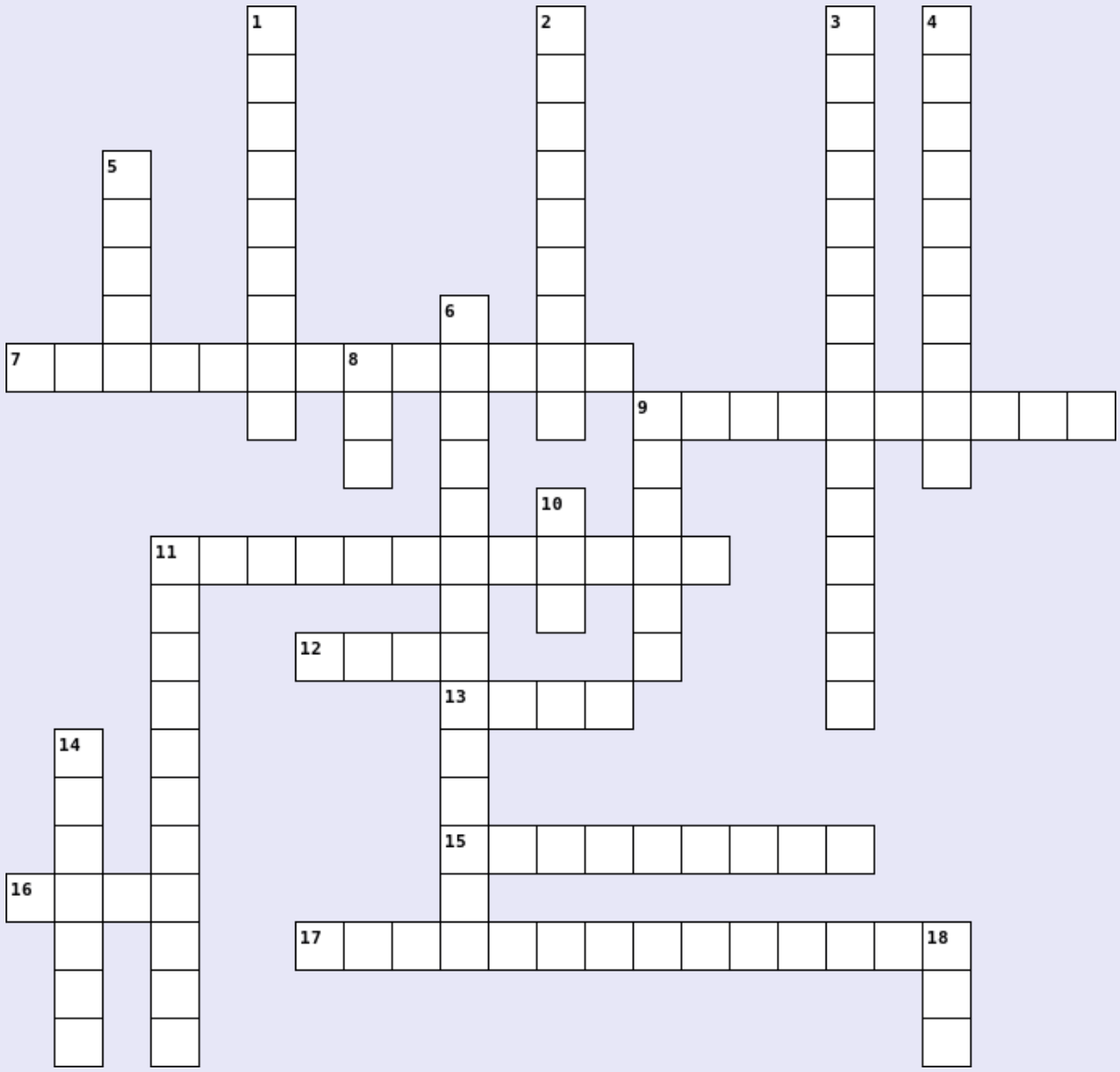

Across

7. This abdominal defect is present near the umbilicus and it's intestinal content are not covered in thin sac.

9. Insufficient production of —- results in respiratory distress syndrome.

11. This electrolyte imbalance can lead to seizures.

12. It is a method of treatment for CDH among pregnancies with predictable poor outcomes.

13. This is the common side of CDH.

15. This antiepileptic is the drug of choice for neonatal seizure.

16. It is an episode characterised by combination of apnoea, colour change, marked change in muscle tone, choking or gagging which is frightening to the observer.

17. It helps in delaying the closure of shunt in a shunt dependent cardiac defect.

Down

1. This is the first step in management of pyloric stenosis.

2. This is the usual presentation in children with H type TEF.

3. 'Double bubble sign' is diagnostic of __

4. This is a mnemonic used to recall broad differential diagnosis of a neonate with altered mental status

5. This classification is used to identify the types of TEF.

6. This diagnosis should be considered until proven otherwise when history of bilious emesis is present.

8. Occurs due to deficiency of 21-hydroxylase enzyme

9. Elongated pylorus with a narrow lumen during barium swallow forms infers pyloric stenosis. This is ————- sign .

10. Classically a disease of premature babies.

11. This electrolyte disturbance is found in Pyloric stenosis.

14. Pulmonary hypoplasia is primary disturbance occurred due to genetic and environment, it hampers development of diaphragm as a result abdominal content protrude in thoracic cavity which then further hinders lung development.This is ———— hypothesis.

18. It helps with assessment of rhythm disturbances.