INDIAN ASSOCIATION OF PAEDIATRIC ANAESTHESIOLOGISTS
IAPA
Founded in 2006

IAPA NEWSLETTER

by Indian Association of Paediatric Anaesthesiologists

February 2018

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M.D. or D.N.B in Anaesthesiology

Accredited Institutions
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- Rainbow Hospitals, Hyderabad and Bangalore
- Chacha Nehru Bal Chikitsalaya, Delhi
- Amrita Institute of Medical Sciences, Kochi

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EDITORIAL

Dr Vibhavari Naik
Hyderabad

A decade in the journey of IAPA

The IAPA (Indian Association of Paediatric Anaesthesiologists') feels proud to cross the landmark of a decade of its existence. Paediatric anaesthesia has been in practice for decades, by many senior anaesthesiologists' across major institutions and specialized pediatric care centers. But a formal body of all those with special interest in this field, was formed only in the year 2006 and IAPA was born. IAPA aims to promote safety and high standards in the field of paediatric anaesthesia through education and research.

Since then, IAPA has never looked back. Office bearers changed hands to take IAPA forward to the next level, every time. Every year, more and more members have joined and have contributed towards its goals. Academic activities have increased over the years to include city meets and CME's focused on pediatric anaesthesia apart from the yearly national conference. The yearly conference of IAPA is a feast of national and international experts in this field presenting the latest concepts and sharing their experiences in pediatric anaesthesia. Many post graduates and fellows in pediatric anaesthesia also get to present their research work, apart from enriching their knowledge by attending these conferences.

Fellowships were initiated under the aegis of IAPA to improve the training in pediatric anaesthesia. IAPA runs fellowships in five hospitals across the country as of now, and a few more would be started soon. IAPA committees help define and guide areas like fellowships, academics and publications in the form of guidelines and newsletters. IAPA guidelines released last year are an effort to stream line the care and practices in pediatric anaesthesia across the country. IAPA newsletter is released every 6 months and this is the 5th newsletter. This year, at the national conference, IAPA Honorary Fellowship awards will be bestowed upon the senior anaesthesiologists' having experience and expertise in pediatric anaesthesia. The IAPA website hosts all the relevant information including the constitution, office bearers and members lists', fellowship details, past events, guidelines and newsletters.

As we move ahead into the second decade, we need to put efforts to spread out to more people. There are lot of variations in the pediatric anaesthesia practice across the country. We need to coalesce and conduct studies together that could give us a bigger picture. Critical incidents monitoring across institutions should be studied to know our limitations and pitfalls. More guidelines covering the various aspects of pediatric anaesthesia would help improve safety and achieve higher standards of care. The newsletter can improvise in quality of content and work towards becoming an indexed journal. To improve the dissipation of information and education, IAPA can form state-wise or city-wise focal groups of paediatric anaesthesiologists'. Collaborations with experts and researchers across the globe through conferences and beyond will further broaden the scope of IAPA.

And finally, as I extend a warm welcome to all of you to IAPA 2018, I request your participation in the activities of IAPA to help IAPA achieve its goals.

Long live IAPA !!

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SPECIAL ARTICLE

The New Block on the Kid: Erector Spinae Block

Dr Gita Nath
Hyderabad

Truncal blocks with local anaesthetic (LA) injections between muscle layers are well established in paediatric anaesthesia for intraoperative and post-operative analgesia. Starting with the ilioinguinal block, we proceeded through transversus abdominus plane (TAP) and rectus sheath blocks to the quadratus lumborum block in an attempt to increase the dermatomal spread. The latest addition to this repertoire – the new kid on the block – is the Erector Spinae Block (ESB).

Forero et al (2016)[1] described the ESB in two adult patients with severe thoracic neuropathic pain. The injections were given at the level of T-5 transverse process under ultrasound guidance (USG). With the probe oriented vertically, three muscle layers could be identified, namely trapezius, rhomboid major and erector spinae. In the first patient, LA was injected deep to the rhomboid muscle, while in the second patient, LA was injected deep to the erector spinae. Both patients were relieved of their pain, but the deeper injection was more effective, and the same technique was used in two further patients having thoracic surgery.

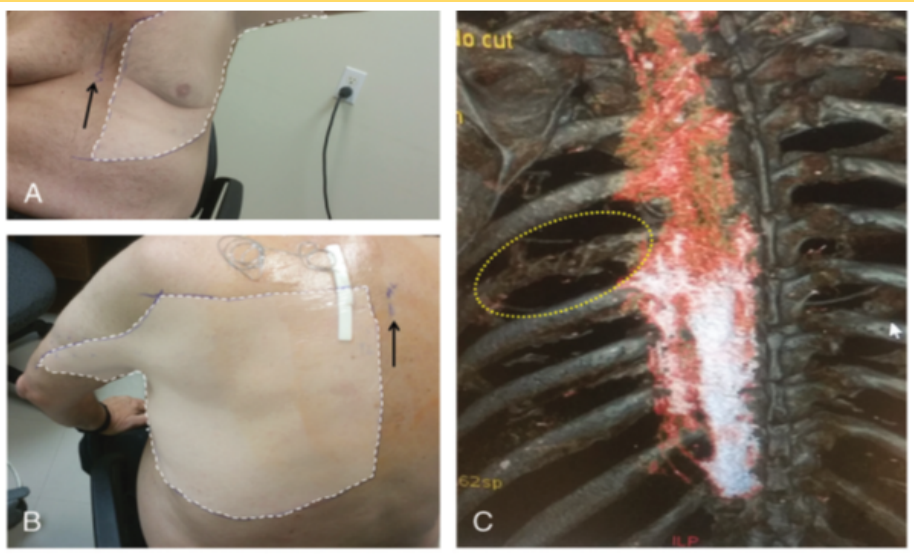

Fig 1. A & B: Cutaneous sensory loss from T2 to T9 levels
C: Spread from T1 to T11 on CT scan (Forero, 2016)

The cutaneous sensory loss in these patients extended from T2 to T9 levels and CT scan done in one patient in whom contrast was mixed in the LA solution showed spread from T1 to T11. Cadaveric study of ESB described in the same paper showed that the methylene blue solution spread from C7-T1 till T8 level. It also spread laterally beyond the transverse processes and penetrated anteriorly to the vicinity of the spinal nerve roots.

A few months later, the same group (Chin et al, 2016)[2] administered the block bilaterally at the level of T7 transverse process and produced prolonged post-operative analgesia after ventral hernia repair. At this level, the rhomboid muscle has ended, therefore only the trapezius and erector spinae muscles are seen, and LA solution is injected between the erector spinae and the transverse process. Cadaveric study in this paper showed spread of the solution from the upper thoracic to the L1-L2 level.

Subsequently, ESB has been shown to be effective in a variety of situations - breast surgery, post-thoracotomy pain, rib fractures and even hip surgery[3-5]. ESB is slowly being tried in the paediatric age group as well. It has provided effective pain relief following thoracoscopy, paediatric thoracic onco- surgery as well as nephrectomy surgeries[6-8]. In our own institution we are using this block for thoracic and upper abdominal operations, especially where there are relative contraindications to epidural.

Block technique:

In adults, the block is done in the sitting position before induction of anaesthesia. In children we perform it in the lateral position, under anaesthesia. For incisions crossing the midline, the block is performed bilaterally, with 0.5 mL/kg of 0.25% bupivacaine on each side. First, the desired vertebral level is identified (T5 for thoracic and T7 for abdominal coverage). Under aseptic conditions, a high frequency linear probe is placed 1.5 to 2 cm lateral to the selected spinous process. The probe should be positioned far enough from the midline to see the transverse process, but not so far that the pleura is visible. A 5 cm 22G Quincke needle is inserted in-plane, aiming towards the transverse process. Once bone is contacted, the needle is withdrawn slightly and a small volume (0.5 to 1 mL) of saline is injected to check the position. Linear spread of fluid deep to the erector spinae muscle confirms correct placement, and the LA solution is then injected, still watching for further linear spread.

How does ESB work?

The LA deposited deep to the erector spinae muscle spreads cranially and caudally in the paravertebral area, the extent of spread is determined by the volume of

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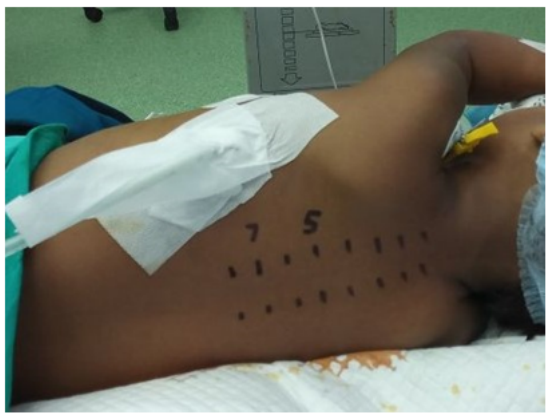

Fig 2. Lateral position. T5 & T7 levels marked

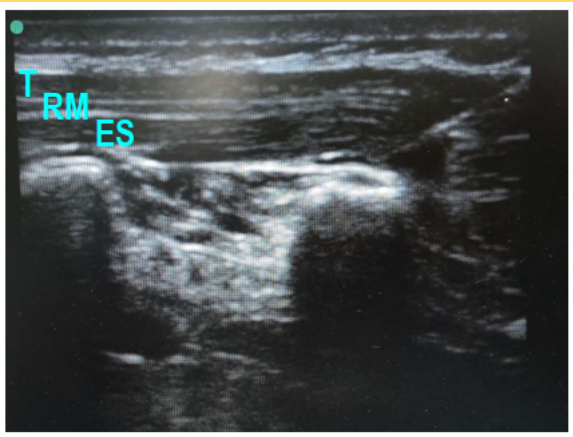

Fig 3. T - Trapezius, RM - Rhomboid major,
ES - Erector spinae
Needle targetting transverse process

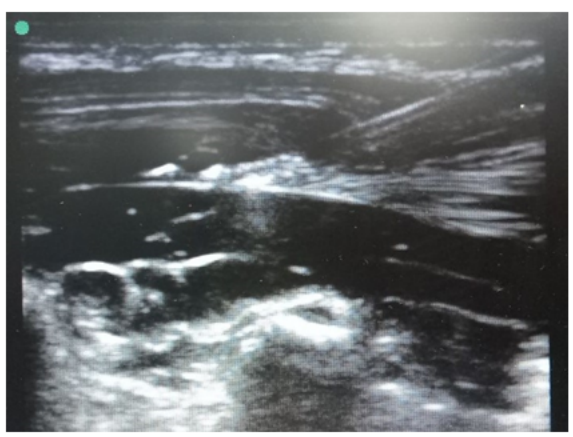

Fig 4. Linear spread of LA solution

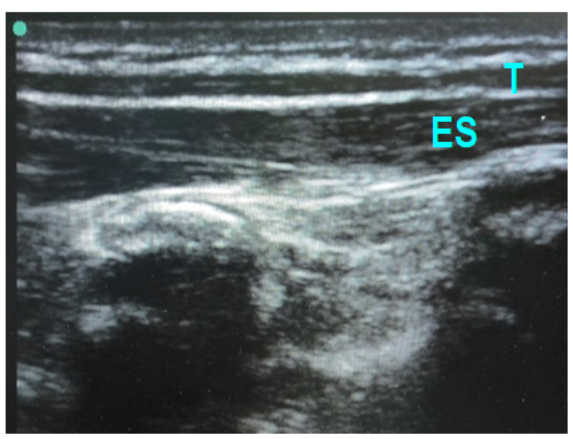

Fig 5. Only 2 muscle layers below T6

SPECIAL ARTICLE CONTD.....

solution injected. As shown by the cadaveric dye studies of Chin and Forero[1,2], the deposited solution also penetrates into the paravertebral space which is traversed by the spinal nerves after they emerge from the intervertebral foramina. Because of the linear spread, a single injection is enough to block 8 to 10 dermatomes. Injecting deep to the erector spinae is more effective because the solution is deposited closer to the site of branching of the spinal nerves into dorsal and ventral rami[9,10]. This also blocks the rami communicantes which transmit sympathetic nerve fibres carrying visceral sensation[11].

Comparison with other blocks:

The main advantage of ESB is its simplicity and avoidance of the risks of neuraxial anaesthesia, since the needle path is well away from the dura. Aiming for the transverse process also avoids the risk of pleural damage and pneumothorax, which are important concerns during paravertebral block. Comparing ESB with the various other fascial plane blocks, it is well accepted that TAP, subcostal TAP and rectus sheath blocks provide only somatic analgesia. The newer versions of quadratus lumborum blocks do provide visceral analgesia as well but these are considered advanced level blocks which are technically challenging. **In conclusion**, the newly introduced erector spinae block is a simple and safe technique which can cover a wide area with a single injection. The level of injection is determined by the area of the body to be blocked. It produces somatic and visceral analgesia, and avoids the risks associated with neuraxial and paravertebral blocks. It is early days yet, but the technique promises to be a useful addition to our capabilities.

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Crossword Answers

ACROSS

2. Oxiport
4. Lund Browder
6. Caffeine
7. PEEP
8. Aprotinin
10. Infraorbital
11. Kasai
12. Becker
16. Laryngomalacia
18. McMorrow
19. Cole
20. Craniosynostosis
21. Fontan
22. Triclofos
23. Hickman
24. Broselow

DOWN

1. Cricopharyngeus
3. Tricuspid Atresia
5. Splenectomy
9. TOF
13. Goldenhar
14. Waterston
15. Gastroschisis
17. Aschner
18. Moro
20. Clonidine

Check out the IAPA Guidelines on Fasting and Monitoring, on IAPA website http://www.iapaindia.com/guide-lines.html

PAEDIATRIC ANAESTHESIA QUIZ

Dr Sanjay Prabhu
Chennai

Indicate whether it is True or False for each stem in the following questions –

1. The differences in BLS in pediatric patients as opposed to an adult are
   a. In a witnessed cardiac arrest in a child give 2 minutes of CPR before calling for help
   b. Initiate CPR in a 9-month-old if heart rate is < 60/min.
   c. The compression to ventilation ratio when two rescuers are present is 15:2
   d. The commonest arrest rhythm in pediatrics is Asystole
   e. The thumb encircling technique for chest compressions is recommended when there is one rescuer
2. Regarding sedation practices in children
   a. Moderate sedation is when a child responds purposefully to verbal commands or light touch
   b. Dexmedetomidine is generally associated with a moderate level of sedation that, according to electroencephalogram (EEG), mimics normal sleep.
   c. Troublesome emergence in autism is best avoided by using Dexmedetomidine as the sedative agent.
   d. A child is likely to require deep sedation in many situations where an adult would require minimal or no sedation
   e. Dexmedetomidine is a medication that has the ability to provide sedation without causing respiratory depression.
3. Regarding neonatal airway and breathing
   a. both flexion and hyperextension of the neck may obstruct the airway
   b. larynx is located more anteriorly
   c. As opposed to an older child, a compliant chest wall contributes to a decreased mechanical efficiency of inspiration
   d. The neonatal diaphragm fatigues easily due to paucity of Type II fibres
   e. laryngeal braking" (auto-PEEP mediated by dynamic partial closure of the glottis) is a mechanism to counteract the small airway collapse
4. Regarding pediatric pain physiology
   a. All neural pathways required for nociception are present from birth
   b. Neonates have a higher threshold for pain
   c. There is far less discrimination between the perception of noxious and non-noxious stimuli at 2 months of age
   d. Untreated pain may have long-term negative effects on pain sensitivity,
   e. The loading dose of rectal paracetamol in a 10 kg child is 250 mg
5. IAPA guidelines of 'Minimal Mandatory Monitoring for Paediatric Anaesthesia' suggest -
   a. Vital signs should be monitored and documented every 3 minutes during anaesthesia
   b. United Nations Convention on the Rights of the Child (UNCRC) define child as a human being below the age of eighteen years
   c. To be considered a Paediatric anaesthesiologists, they should administer anaesthesia for at least 30 paediatric cases/month
   d. End tidal carbon dioxide monitoring ($EtCO_2$) and temperature monitoring are included in the mandatory monitoring required for safe conduct of anaesthesia
   e. IAPA strongly recommends that children below the age of 2 years scheduled for any surgery should be anaesthetized by paediatric anaesthesiologist.

IAPA NEWSLETTER
by Indian Association of Pediatric Anaesthesiologists

REVIEW ARTICLE

Current Status of Nitrous Oxide Use in Children

Dr Anju Gupta
New Delhi

Nitrous oxide is arguably the oldest anaesthetic agent having an important place in contemporary anaesthesia practise. Humphrey Davy had recognized its analgesic efficacy as early as 1799 but its popularity grew after 1844 when Horace Wells publically demonstrated its use for anaesthesia in 1844. From the year 1868, the commercial availability of compressed nitrous oxide cylinders led to its universal adoption as an adjunct to ether anaesthesia. Its administration along with ether led to smooth induction, reduced requirements of ether during surgery, led to minimal cardio-respiratory depression and a more rapid emergence.

The minimum alveolar concentration (MAC) of nitrous oxide and other inhalational agents are additive, as 60–70% nitrous oxide equates to MAC of approximately 0.55–0.65.[1,2] Use of nitrous oxide as an additive to anaesthesia has been found to cut down the consumption of sevoflurane, opioids and propofol in clinical trials.[2,3] The combination of nitrous oxide and volatile anaesthetic agents reduces the incidence of hypotension when compared to the administration of these agents alone, at equipotent doses.[2] Also, it provides good amnesia and prevention of awareness is a big boon with its use. In addition, it is inexpensive and reduces the consumption and associated cost of other potent inhalational agents and opioids along with the overall cost and side effects.

Its colourless and odourless nature makes its use acceptable to paediatric patients, making mask induction smoother and faster. Nitrous oxide is widely used in paediatric anaesthesia as a component of anaesthetic gas mixture, for procedural sedation, in emergency departments, and paediatric dental care. It is an antagonist to N-methyl-d-aspartate (NMDA) receptors which have role in central sensitization and development of chronic post-surgical pain (CPSP). Use of nitrous oxide has recently been shown to markedly reduce CPSP.[4] However, several undesirable effects limit its clinical utility. These include diffusion hypoxia, its ability to expand closed airspaces, increased risk of post operative nausea/vomiting (PONV), ozone depletion, hematologic and neurologic complications and more recently, adverse effects on developing brain.[5,6] Nitrous oxide has also been proposed to be associated with

Table 1: Advantages and disadvantages of nitrous oxide use for anaesthesia

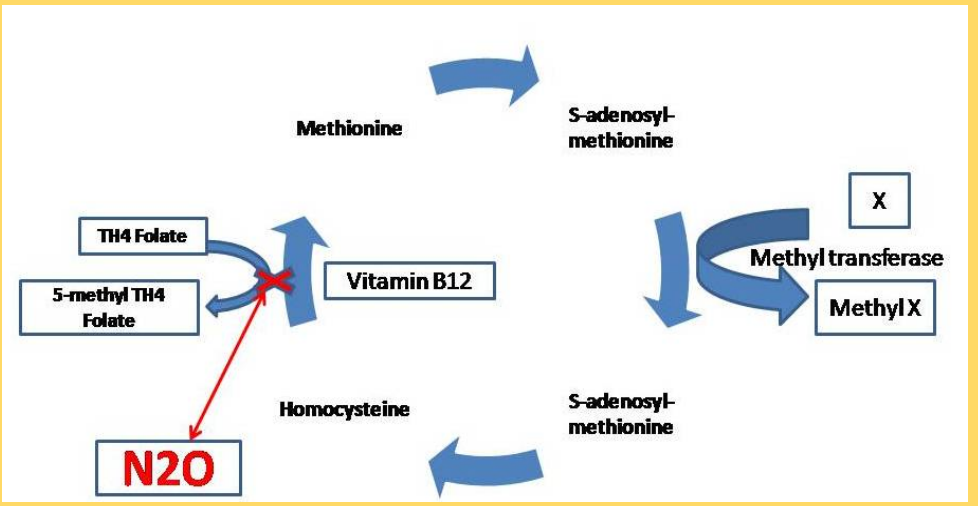
Advantages	Disadvantages
Analgesia	Low potency
Reduced awareness	Risk of diffusion hypoxia
Colourless	↑ PONV
Odourless	Ability to expand air filled cavities
Faster onset and emergence	↑ cuff pressure of ETT and LMA
Minimal metabolism	Haematological / Neurological toxicity
Cardiorespiratory stability	Immune deficiency?
CPSP	Reproductive effects
Inexpensive	Myocardial ischemia?
	Greenhouse gas
	Apoptosis in developing brains

immunosuppression due to suppression of proliferation of mononuclear cells and neutrophil chemotaxis.[6,7] There were also concerns of impaired wound healing.[5,6,7]

Metabolic effects:

Nitrous oxide gained popularity as a safe anaesthetic agent devoid of any adverse effects. However, the reports of hematologic and neurologic complications surfaced in 1956 and raised alarm over its safety. N_2O interferes with vitamin B_{12} and folate metabolism, by oxidizing the cobalt atom and irreversibly inactivating the enzyme methionine synthetase (Figure 1).

Figure 1: Effect of nitrous oxide on DNA synthesis



This impairs conversion of homocysteine to S-adenosylmethionine which is a substrate for tetrahydrofolate and thymidine during DNA synthesis. The adverse effects of nitrous oxide on DNA synthesis are related to the total duration of exposure. It was found

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REVIEW ARTICLE CONTD.....

that a brief exposure of 30 minutes in rats decreased the activity of the methionine synthase enzyme to 50% and it became undetectable after 6 hours.[8] Children with congenital deficiency or biochemical defect in the enzymes involved in the pathway to DNA synthesis are especially vulnerable to the adverse effects of nitrous oxide.

Nitrous oxide has also been found to increase homocysteine levels in children as well as adults. A report described an infant who developed acute neurologic symptoms and pancytopenia after nitrous oxide–based anaesthesia.[9] The baby was later diagnosed to be having cobalamin deficiency and the symptoms resolved with supplementation of vitamin B_{12}. Another report had mentioned the development of hypotonia and diffuse cerebral atrophy in a 6-month-old breast fed child after nitrous oxide anaesthesia.[10] The baby developed metabolic acidosis and collapsed and was found to have reduced serum cobalamin. Patients with methionine synthetase deficiency can develop pernicious anaemia (megaloblastic anaemia and subacute combined degeneration of spinal cord), growth retardation, psychomotor retardation and neurologic problems.[11] Likewise, nitrous oxide mediated inhibition of enzyme methionine synthetase in patients with Type-III Homocystinuria, caused by a defect in 5,10-methylene tetrahydrofolate reductase (MTHFR), was reported to lead to macrocytic anaemia, myelopathy and death. A catastrophic incident was reported in a child anaesthetised with nitrous oxide who developed seizures and apnoeic episodes after 25 days postoperatively and later died at 130 days of age.[12] MTHFR deficiency was found on post-mortem examination. Furthermore, single nucleotide polymorphisms (SNPs) in MTHFR are present in up to 12-57% of population and undiagnosed children exposed to nitrous oxide are at risk of complications related to B_{12} metabolism. As such, nitrous oxide should be used with caution in children at risk of to B_{12} deficiency such as post illeal resection, pernicious anaemia, malnutrition, vegetarians and those on exclusive breast feeding.

Postoperative Nausea and Vomiting:
Postoperative nausea and vomiting (PONV) are one of the most common adverse events related to anaesthesia and surgery. The risk of occurrence of PONV is 2.24 times when nitrous oxide is used in adults.[13] On the contrary, the addition of 70% nitrous oxide to sevoflurane or halothane does not increase frequency of PONV in children.[14] The severity and incidence of vomiting in children did not differ between patients who received 70% nitrous oxide and those who did not receive it.[15] On the contrary, when combined with propofol, nitrous oxide is associated with increased incidence of PONV.[15]

Occupational exposure and environmental safety:
Provider safety is also an important issue and NIOSH has set an upper limit of 25 parts per million (ppm) for safe exposure to nitrous oxide at work place as a time-weighted average (TWA) during the period of anaesthetic administration. However, in the absence of scavenging the exposure levels may reach as high as 2000 ppm and many complications such as haematological, neurological, reproductive and genotoxicity may develop in exposed staff.[16,17] This risk may be further more in pediatric anaesthesiologist because of use of nitrous and inhalation agents at high flows with open tailed bags during inhalation induction and uncuffed endotracheal tubes during anaesthesia. In addition, nitrous oxide acts as a greenhouse gas in the troposphere while it destroys ozone in the stratosphere.[18] However, all medical uses of nitrous oxide combined constitute less than 2% of nitrous oxide pollution and the effects of all inhalational anaesthetics contribute only 0.0005% of ozone destruction.

Nitrous oxide use for procedural pain in children:
Nitrous oxide is often used to alleviate mild to moderate pain related to procedures such as intercostal drain insertion, lumber puncture, bone marrow aspiration, wound sutures, venipuncture, dental extraction etc. The administration of nitrous oxide at concentrations up to 50% is an effective alternative to intravenous sedation in these minor paediatric surgical procedures by providing relief from pain and anxiety, maintaining protective reflexes and does not require extensive monitoring. Nitrous oxide is commonly used in the dental care of older children and over 90% of children undergoing dental extractions successfully complete the treatment under sedation with nitrous oxide when less than four extractions are necessary.[19] The 2009 American Academy of Paediatric Dentistry Guidelines does not mandate the use of pulse oximetry for children receiving nitrous oxide alone for dental procedures. However, quality of pain relief obtained may be unsatisfactory as revealed in presented a French survey by Annequin et al focusing on the use of Entonox to relieve 1025 procedure-related pain in children.[20] Crying was observed in 44% children and physical restraint was necessary in

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REVIEW ARTICLE CONTD.....

in 34% children younger than 3 years. Interestingly, the administration of nitrous oxide has been found to be more effective than oral midazolam for sedation when performing skin sutures in children.[21]

Neurodevelopmental effects:

In addition to the adverse metabolic effects of nitrous oxide, concern has heightened in the past decade over the role of nitrous oxide in causing widespread apoptosis and neurodegeneration in developing brain.[6,7,22] The period of synaptogenesis continues for several years after birth in human brain when cerebral neurons are rearranging to develop their synaptic connections while less utilized pathways undergo apoptosis. At this phase of rapid brain growth, exposure to nitrous oxide and many other anaesthetics may accelerate apoptosis leading to neurotoxicity and learning deficits in later life. Studies in animal models have found that NMDA antagonist e.g. nitrous oxide or ketamine in higher doses or repeated exposures led to irreversible brain damage.[22,23] Interestingly, one study done in a rat model demonstrated that though there was no increased apoptosis with use of nitrous oxide alone, its combination with isoflurane significantly increased neuronal cell death above that seen with isoflurane alone.[22] The combination of nitrous oxide and isoflurane with midazolam administered for 6 hours to young rats caused extensive apoptotic neurodegeneration, as well as memory and learning disorders.[23] Despite a sea of evidence in animal models, at present there is no human outcome data to prove the role of nitrous oxide on adverse neuro-developmental effects. Also, the duration of exposure in these preclinical studies are not seen in clinical practise of anaesthesia. Therefore, in the present context, the available evidence does not support the elimination of nitrous oxide from paediatric anaesthesia practise. (Table 2)

Do we have a better alternative?

Benzodiazepines, opioids and alpha-2 adrenoceptor agonists are all used as supplements to general anaesthesia and each might be considered likely to reduce the incidence of intra-operative awareness. However, none of these have the beneficial property of amnesia and analgesia of the degree offered by nitrous oxide with comparable cardiovascular stability. Xenon is an inert gas with profound analgesic properties and is even more cardiostable than nitrous oxide. More importantly, it has not been found to have adverse neurodevelopmental effects on growing brain and can be a suitable alternative to nitrous oxide in future in the field of paediatric anaesthesia.[23] At present, its clinical utility is severely limited by its cost.

Table 2: Summary of results of clinical trials and systematic reviews in relation to use of nitrous oxide as a component of anaesthesia.[24-28]

Trial/ systematic review	Results
ENIGMA Trial	Increased the rates of major complications (myocardial infarction, stroke, pneumonia, pulmonary embolism, wound infection, severe PONV, and death.
ENIGMA II	Risk of death at 1 year, cardiovascular complications or surgical-site infection in the nitrous oxide group not increased. Risk of PONV was reduced by one third in the patients not exposed to nitrous oxide but the absolute risk reduction was only 4%.
A large retrospective analysis of registries (Turan and colleagues)	Patients receiving nitrous oxide had 40% lower risk of pulmonary complication and death while cardiovascular complications were comparable.
Cochrane review on use of nitrous oxide	Nitrous oxide increased the incidence of pulmonary atelectasis, but had no effects on the rates of in-hospital mortality, pneumonia, myocardial infarction, stroke, venous thromboembolism, wound infection, or length of hospital stay.

Conclusion

Nitrous oxide is a very safe, cost-effective, non-pungent and versatile anaesthetic agent which provides good analgesia, decreases risk of awareness, hastens induction and recovery of anaesthesia and reduces consumption of other costlier inhalational agents. Its supplementation makes inhalation more acceptable to children while minimizing their cardio-respiratory depressant effects. At clinically used concentrations and duration, its use does not appear to be related to neurobehavioral effects on developing brain in young children. Nitrous oxide exposure for less than 6 h is considered safe as far as hematologic complications are considered. However, patients with cobalamin and folate deficiency or defects in their metabolic pathways are vulnerable to toxicity with nitrous oxide use and its use should be carefully considered in this population. Its continued use in children seems justified in the present background of evidence barring its well-recognized contraindications.

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IAPA NEWSLETTER
by Indian Association of Pediatric Anaesthesiologists

ARTICLE REVIEW

Compiled by
Dr Jayanthi Sripathi
Chennai

Pawar DK, Doctor JR, Raveendra US, Ramesh S, Shetty SR, Divatia JV, et al.
All India Difficult Airway Association 2016 guidelines for the management of unanticipated difficult tracheal intubation in Paediatrics. Indian J Anaesth 2016;60:906-14.

Majority of the children with difficult airways can be identified during preanesthetic assessment. Hence incidence of unanticipated difficult airway, both difficult mask ventilation (DMV) and difficult intubation (DI) in otherwise healthy children is relatively low compared to adults. Recommendations in management of difficult airway in children are mostly derived from extrapolation of adult data because of non availability of similar evidence in children.

The article gives an exhaustive practical review of airway management principles in children. Difficult mask ventilation is not uncommon in children and this article lists several manoeuvres to overcome this issue. Sometimes laryngospasm could be the cause of difficulty with mask ventilation, which is overcome by increasing depth of anaesthesia, giving 100% oxygen with CPAP and considering the use of a muscle relaxant. After explaining the basics of laryngoscopy and intubation in children the article recommends only two attempts at laryngoscopy with the third attempt by an experienced paediatric anaesthesiologist. All throughout the efforts at intubation, nasal oxygenation by nasal prongs or catheter from an independent oxygen source has been shown to delay the onset of desaturation and hence highly recommended.

The second generation supraglottic airway devices (SADs) are recommended as the rescue devices for failed intubation. They may be used as primary ventilation device during the surgery or as a conduit to intubation (using FOB through SAD). In the event of complete ventilation failure, the article recommends early surgical airway before desaturation occurs. Surgical tracheostomy being the gold standard, if this is not possible it is recommended to do a trans-tracheal jet ventilation in a child less than 5 years and a needle cricothyroidotomy in an older child. It is very difficult to identify the cricothyroid membrane in young children and complications of cricothyroidotomy are many. Needle cricithyroidotomy should only be done as a bridge to a tracheostomy.

The article gives an effective and practical guideline for management of unanticipated difficult intubation in a child, helpful for both, specialist paediatric anaesthesiologists' as well as those who manage children occasionally. It is an important document that you could print out and put up in your operating room. The complete algorithm is displayed on the next page.

HELPFUL WEBSITE LINKS

Dr. Vibha Naik
Hyderabad

1 . WFSA (World Federation of Society of Anaesthesiologists) has two recent ATOTW (Anaesthesia Tutorial of the week) dedicated to paediatric anaesthesia. ATOTW 368 on 'Acute upper airway obstruction in children' and ATOTW 367 on 'Paediatric anaesthesia - challenges with induction'. A sign up is necessary to access these articles and an online quiz on each topic is also available.
Click https://www.wfsahq.org/resources/anaesthesia-tutorial-of-the-week

2. Pediatric anaesthesia practice quiz for those who want to quickly test their knowledge. Other topics relevant to anaesthesia also available on the same link
Click https://www.proprofs.com/quiz-school/story.php?title=pediatric-anesthesia-practice-quiz

3. SPA (Society of Pediatric Anesthesia) has free lecture series on 35 important topics in pediatric anaesthesia. A short survey is expected to get the link for the lectures.
Click http://www.pedsanesthesia.org/education/powerpoint-lecture-series/

4. Pedi Safe App: try out Case pearls and Critical Pathway Checklist of STAT scenarios on this phone application

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by Indian Association of Pediatric Anaesthesiologists

AIDAA 2016 Guidelines for the Management of Unanticipated Difficult Tracheal Intubation in Paediatrics

CALL FOR HELP

STEP 1: Laryngoscopy and tracheal intubation

Unable to intubate during first attempt at direct/video laryngoscopy

- Continue nasal oxygen
- One more attempt at intubation (only if SpO_2 ≥ 95%)
- Final attempt only by an anaesthesiologist with paediatric experience
- Mask ventilation between attempts
- Optimise position, use external laryngeal manipulation, use bougie/stylet if required
- Consider changing device/ technique/ operator between attempts
- Maintain depth of anaesthesia

Succeed → Confirm tracheal intubation using capnography

Failed Intubation → **Resume Mask Ventilation with 100% O_2**

STEP 2: Insert SAD to maintain oxygenation

- Continue nasal oxygen
- Preferably use second generation SAD
- Maximum two attempts (only if SpO_2 ≥ 95%)
- Mask ventilation between attempts
- Consider changing size or type of SAD
- Maintain depth of anaesthesia

Succeed →

Consider one of the following options:

1. Wake up the child
2. Continue anaesthesia using SAD if considered safe
3. Intubate through the SAD using a FOB only, provided expertise is available
4. Tracheostomy

Failed Ventilation through SAD →

STEP 3: Rescue face mask ventilation

- Continue nasal oxygen
- Ensure neuromuscular blockade
- Final attempt at face mask ventilation using optimal technique and oral/nasal airways
- Consider insertion of a gastric tube

Succeed → Wake up the child

Complete Ventilation Failure → **CALL FOR ADDITIONAL HELP**

STEP 4 : Emergency surgical airway access

- Continue nasal oxygen and efforts at rescue face mask ventilation
- Perform one of the following techniques

Child < 8 years

- Surgical help available : Tracheostomy
- Surgical help unavailable :
  - < 5 years -Transtracheal needle puncture
  - 5 to 7 years needle cricothyroidotomy

Child ≥ 8 years

- Needle cricothyroidotomy (use pressure regulated jet ventilation and attempt to keep the upper airway patent)

This flow chart should be used in conjunction with the text

FOB = Fibreoptic bronchoscope
SAD = Supraglottic airway device
O_2= Oxygen
SpO_2 = Oxygen saturation

Post- procedure plan

1. Further airway management plan
2. Treat airway oedema if suspected
3. Monitor for complications
4. Counseling and documentation

Pawar DK, Doctor JR, Raveendra US, Ramesh S, Shetty SR, Divatia JV, Myatra SN, Shah A, Garg R, Kundra P, Patwa A, Ahmed SM, Das S, Ramkumar V.All India Difficult Airway Association 2016 guidelines for the management of unanticipated difficult tracheal intubation in Paediatrics.
Indian J Anaesth 2016;60:906-14. http://www.ijaweb.org/text.asp?2016/60/12/906/195483

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Answers to the Quiz Section

1. F T T T F Discussion: In a witnessed cardiac arrest in a child call for help before initiating CPR. However, if the arrest is unwitnessed, perform 2 minutes of CPR first. The thumb encircling technique is preferred when two rescuers are present and the two finger technique is recommended when 1 rescuer is present.

2. ALL TRUE

3. T F T F T Discussion: The neonate's neck is relatively short and the larynx located more cephalad (C3–C4) (of note, the larynx is more superior, not more "anterior") compared with that in the adult (C4–C6). The premature infant diaphragm may have less than 10 % type I cells; by term, the proportion increases to ~25–30 %, and through late infancy, the population of type I cells increases to the adult proportion of ~55 %

4. T F T T F Discussion: Neonates have a lower threshold for pain due to immature descending inhibitory pathways. C-fibres are mature in neonates although their cortical connections at the level of the dorsal horn are immature. The loading dose of rectal paracetamol is 40 mg/kg ie 400 mg for 10 kg child.

5. F T T T F Discussion: Vital signs to be documented at least every 5 minutes. Children < 3 years should be anaesthetized by a paediatric anaesthesiologist.

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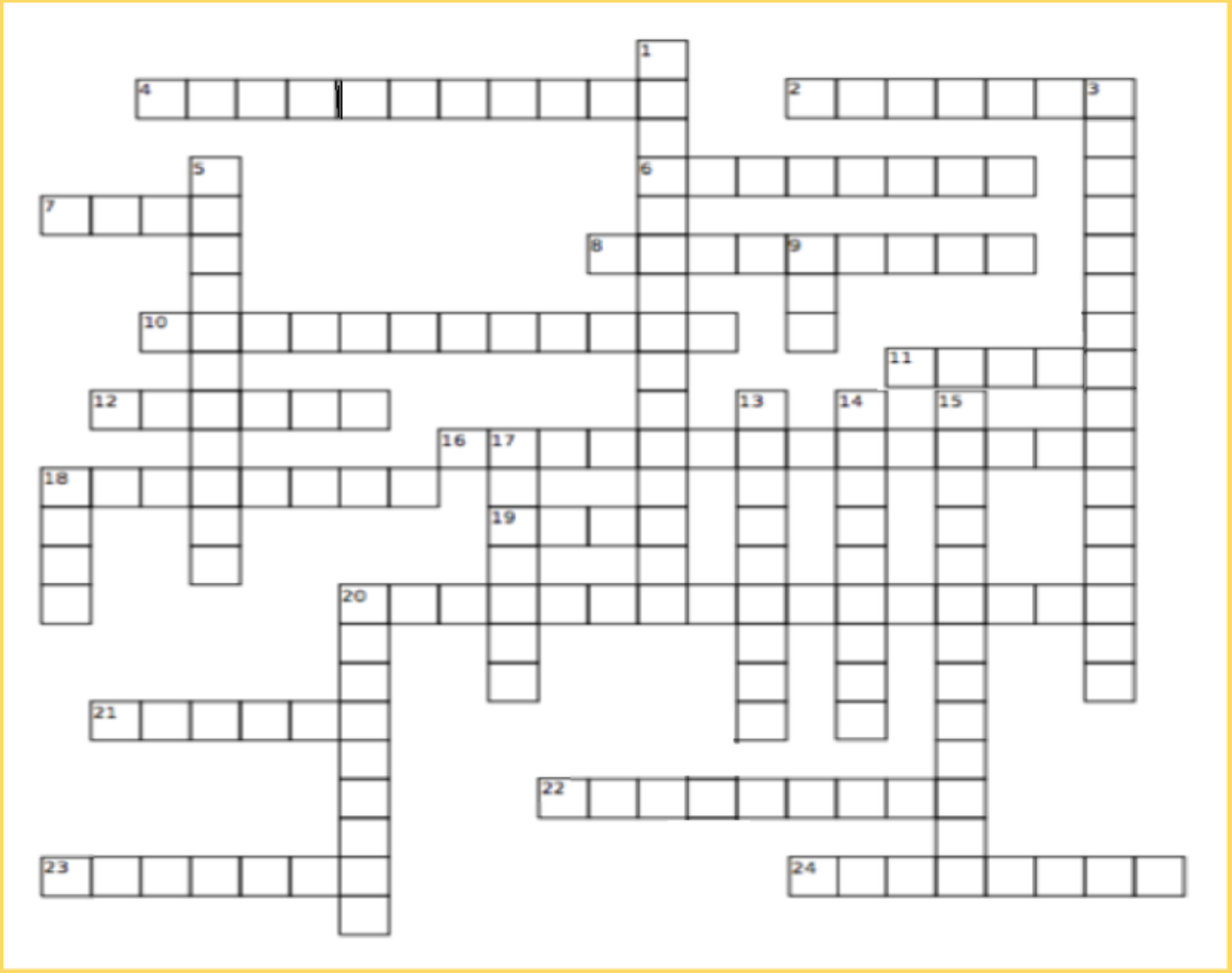
PAEDIATRIC ANAESTHESIA CROSSWORD – CHALLENGE YOURSELF !!

Prepared by
Dr Indu Ravishankar
Chennai



Across

2 Laryngoscope with channel for oxygen supplementation
4 A chart used for the assessment of total body surface area in burns children
6 A stimulant for apnea in neonates
7 Keep this parameter low in wheezing kids
8 A drug used to decrease bleeding in cardiac surgeries
10 A block that is used to relieve pain in cleft surgeries
11 The procedure for biliary atresia
12 A type of muscular dystrophy
16 A cause for neonatal stridor
18 A mirrored laryngoscope
19 An age based formula for the size of uncuffed tube
20 Premature fusion of cranial sutures
21 A shunt that increases pulmonary blood flow
22 A commonly used sedative premedication
23 A tunneled catheter
24 A color coded tape used in pediatric emergencies

Down

1 An esophageal FB most commonly lodges at the level of this muscle
3 q waves in aVL, lead 1, right atrial enlargement and left axis deviation
5 This procedure requires vaccination against pneumococcus
9 This child needs a phlebotomy
13 A syndrome of maxillary hypoplasia, cleft lip or palate
14 A risk stratification system used in TEF
15 herniation of abdominal contents with thickened bowel wall
17 Also called the oculocardiac reflex
18 A primitive reflex
20 A common adjunct in the caudal