Paediatric anaesthesia practice: Has it really changed over the times?

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Change is an essence of life and paediatric anaesthesia is no exception to this. Both, the art and science of paediatric anaesthesia have markedly changed in the new millennium. Because of the ethical issues involved in paediatric experimentation and lack of industry sponsorship for fear of smaller market size, research in paediatric anaesthesia was earlier limited. Most of the strategies were extrapolated from research involving adults. However, the scenario is changing of late, and research on paediatric devices, drugs and techniques is steadily paving the way to newer clinical practices. This is largely evident in the seven articles pertaining to paediatric anaesthesia being published in this issue of the Indian Journal of Anaesthesia (IJA).[1-7]

Drugs like dexmedetomidine and ketamine are a hot topic of research in all age groups including children.[8,9] The highly selective α2-adrenergic receptor agonist, dexmedetomidine (DEX) with its anxiolytic, sedative, hypnotic, analgesic, and sympatholytic effects with minimal respiratory depression and fairly good haemodynamic stability has taken a special place in the perioperative period in children. It is used as a premedicant of choice, sedative for airway and neurosurgical procedures, stress attenuator in cardiac surgery, and as an analgesic for painful procedures. The use of DEX for sedation in imaging studies is also well established.

In the new millennium, supraglottic airway devices have become airway devices of choice for peripheral or superficial procedures. Endotracheal intubation is restricted only for patients with high risk of aspiration, low thoracic compliance, high airway resistance, lengthy procedures or surgery in the prone position. Microcuff tubes, in spite of having a lot of advantages, have still not replaced plain tubes in India because of the higher cost and availability issues. Also, their safety is yet to be established in neonates and infants and large well-designed trials on them are needed.

Currently, we have anaesthesia work stations which not only have the capability to give tidal volume of 5 mL in the pressure-controlled ventilation (PCV) mode and 20 mL in the volume-controlled ventilation (VCV) mode, but also provide precise delivery with fresh gas compensation or decoupling. The closed circuit with circle absorber is being frequently used and is replacing Jackson Rees circuit even in infants. In fact, dual controlled modes like pressure-regulated volume control (PRVC) or pressure-controlled mode with volume guarantee (PCVVG) are replacing PCV or VCV mode except in neonates. Dual control modes may not be suitable for preterm neonates, as the lowest tidal volume that they give is 20 mL. Abdallah et al. have reported a study in this issue of the IJA wherein, the regional cerebral oxygen saturation (rScO2) was measured by near-infrared spectroscopy (NIRS) in 30 full-term neonates weighing more than 2,500 g
and undergoing either VCV or PCV through uncuffed tubes during thoracoscopic surgery. They reported more episodes of cerebral desaturation, higher fractional inspired concentration of oxygen (FIO₂), positive end-expiratory pressure (PEEP) requirement, and higher partial pressure of carbon dioxide (PaCO₂) levels with PCV mode compared with the VCV mode. The exact cause for this cannot be determined from the article. Perhaps, a larger study, with the measurement of partial pressure of oxygen (PaO₂), PaCO₂ and mean arterial pressure during an episode of cerebral desaturation may help in ascertaining the cause.

We were ruled over by the coronavirus disease (COVID-19) in the last 2 years and paediatric tertiary care centres were overburdened with surgical cases as well as intensive care unit patients. In spite of all the initial hurdles, the medical fraternity managed the pandemic in an excellent manner and each of us deserve special appreciation. On a positive note, the COVID-19 pandemic brought in newer ideas and innovations in anaesthesia. Telemedicine came up during the COVID-19 pandemic. The use of an electronic stethoscope for preoperative checkup is a novel concept and research on this application in telemedicine is a very good idea. In a study by Neeleshwar et al., being published in this issue of the IJA, the authors have explored the preoperative use of the electronic stethoscope, and found that the electronic stethoscope did not improve the detection rate of murmur when compared with the acoustic stethoscope. As per manufacturer instructions, mobile phones near the device have to be switched off. The patient must remain quiet during examination and the ambient noise has to be kept to the lowest level possible. This seems to be practically difficult in small babies. Nevertheless, slowly and steadily, most of the neonatologists, paediatricians and paediatric anaesthesiologists are learning the use of basic transthoracic echocardiography; so when in doubt, they will simply apply an echo probe and rule out gross anomalies.

The second major positive outcome of the COVID-19 pandemic was the abundance of webinars and data analysis which kept medical education and research alive. An article in this issue of the IJA is based on a survey and has highlighted some of the major difficulties in paediatric anaesthesia practice during the COVID-19 times. Anaesthetists were given prominent positions to design and develop dedicated COVID-19 operation theatres and intensive care areas. Innovative strategies such as high-efficiency particulate absorbing (HEPA) filters and negative pressure chambers came into the limelight, and we will now be able to use them for all infected cases.

The submission of research studies on these innovative strategies continues unabated and this issue of the IJA carries a novel report that describes the functional analysis of a negative pressure canopy unit developed to reduce infective aerosol and droplet spread in ad-hoc wards.

During and after the pandemic, anaesthesiologists who were hesitant to use a circle absorber with low flow techniques updated their knowledge and skills and a majority have now adapted them. Administrators could be convinced to provide video laryngoscopes, microcuffed tubes, and heat and moisture exchangers with viral filters. We realised the importance of total intravenous anaesthesia (TIVA) and target control infusion (TCI). Probably, in the future, the balance may shift toward TIVA/TCI over inhalational anaesthesia in children.

Though general anaesthesia (GA), by and large, is the preferred technique of choice in the paediatric age group, during the COVID-19 pandemic, there was a paradigm shift to regional anaesthesia even in centres that practised GA as a routine. The availability of reasonably priced ultrasound machines, and less cardiotoxic local anaesthetics have made it more practical to use regional anaesthesia as a part of multimodal analgesia in this era wherein strategies such as opioid-free anaesthesia are being explored. In addition, online webinars, video demonstrations, etc., have helped to spread awareness amongst anaesthesiologists about regional anaesthesia techniques.

Furthermore, of late, there has been an increasing emphasis on the use of peripheral nerve blocks over central neuraxial blocks in children including neonates due to the higher risk of complications. The authors (Hylton JR and Singh et al.) of two articles in this issue of the IJA have reported uncommon complications such as Harlequin syndrome and foot drop, both of which were associated with epidural anesthesia in children. Harlequin syndrome is characterised by unilateral facial flushing on the unaffected side and has been reported in paediatric patients having thoracic epidurals. The proposed mechanism is a unilateral disruption in the T2-T3 sympathetic fibers secondary to asymmetric distribution of the local anesthetic in the epidural space. There are a few interesting observations...
in the case report by Hylton JR. Firstly, the appearance of facial flushing occurred only after the initiation of infusion containing two adjuvants [clonidine and hydromorphone]. Secondly, this resolved after the temporary discontinuation of the infusion and did not reappear when the infusion was restarted at a lower dose. The need for two adjuvants, especially the hydrophilic opioid hydromorphone in an epidural infusion is not clear. The nature of pain in an osteotomy is manageable with a routine combination of a local anaesthetic and hydrophobic opioid-like fentanyl. In a recent article about error traps in paediatric regional anaesthesia, the authors highlight that commission bias a tendency to action over inaction, and a form of cognitive bias, can play a role in the clinician’s choice of appropriate analgesics. [16-17] Thirdly, though the sympathetic block resulting in Harlequin syndrome was seen only on one side, the patient had good analgesia, possibly reinforcing the concept that the sympathetic block spread was 2–3 segments higher than a sensory block. [4]

Hydromorphone, though unavailable in the Indian scenario, is claimed to have some benefits over fentanyl or morphine due to its moderate hydrophilicity [octanol buffer distribution coefficient of 525]. This translates to a spinal level action at the site of administration rather than a cranial spread [as with morphine] or systemic absorption [as with fentanyl] and a lesser incidence of delayed respiratory depression or pruritus compared to morphine. [18-19] However, the neurotoxic effects of such drugs at the microscopic level are not clear and the effects of these on children need to be ascertained before using them. On the other hand, clonidine is freely available and has evidence to support its safe use as an adjuvant in regional anaesthesia techniques. [20]

Nerve injury or damage from central neuraxial blocks is a rare but distressing complication. The Pediatric Regional Anesthesia Network (PRAN) database, which is the largest database looking at complications from paediatric regional anaesthesia, has mentioned a rate of 0.24 per 1,000 cases of central neuraxial blocks, most of which were sensory in nature. [21] Thefoot drop mentioned in a letter to the editor by Singh et al. in this issue, could have been secondary to injury from the epidural catheter or epidural needle. [6] Most neurological side effects from central neuraxial blocks are transient, but anything lasting longer than a month can be very disabling for the patient. However, central neuraxial blocks have a higher success rate, produce a more complete and denser block and it will be premature to conclude at this moment that peripheral nerve blocks are preferred over central blocks since complications can occur in both if due diligence and a safe approach are not followed.

Someone has rightly said “old is gold”. This is reflected in the observation that few old regional anaesthesia techniques like pudendal nerve block for surgeries on the external genitalia and perianal procedures, and maxillary nerve block in the pterygopalatine fossa for adenotonsillectomy are nowadays regaining popularity in the paediatric population. [22-26]

All of us are well aware about patient blood management strategies; however, very few of us really apply them in clinical practice. Pavithran et al. must be complimented for having applied all the possible avenues and avoided allogenic red blood cell transfusion in an 11-year-old girl, weighing 35 kg, with a preoperative haemoglobin of 8.8 g%, and blood loss of 1,800 mL during a scoliosis correction procedure. [5]

Though some old techniques and devices such as the Rendell Baker-Soucek face mask still continue to rule the world of paediatric anaesthesia, it has certainly evolved over time and will continue to evolve in the days to come. Two dreadful situations in any paediatric anaesthesiologist’s career are failure to secure the airway and vascular access. However, supraglottic airway devices with gastric drain port have now made rescue ventilation easy. Devices like Air Q can be used as conduit for fibreoptic guided endotracheal intubation. The second challenge of difficult vascular access can be overcome with technologies like transillumination, near infrared light, ultrasound and fluoroscopy. [27] Needless to say, members of our Indian Society of Anaesthesiologists (ISA) should take up the challenge of designing, and developing new devices in our own country and making them available at an affordable cost in every corner of the country. This will enable us to deliver safe paediatric anaesthesia which should always remain our goal.

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