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Anaesthesia-Related Child Mortality in a Niger Delta Tertiary Hospital: 5-Year Impact of Paediatric Anaesthesia Training

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ABSTRACT
Background: A rising under-five perioperative death occurring especially in sub-Saharan Africa, despite global decline in child mortality over the last decade, necessitates a review of the contribution from anaesthesia-related causes.
Objective: To analyze the 5-year impact of Paediatric Anaesthesia Fellowship on anaesthesia-related child deaths in the University of Port Harcourt Teaching Hospital (UPTH).
Method: A five-year survey of all anaesthetic interventions and outcomes in children aged 0 to 5 years, in UPTH, was undertaken. Data including general or loco-regional anaesthesia for elective/emergency surgeries, sedation-analgesia for diagnostic radiology, the indications, perioperative critical events/child deaths up to 24 hours following anaesthesia, and their causes, were obtained from the registers and records of the relevant units in the UPTH, after ethical approval.
Results: Totally, 1596 anaesthetic interventions [987 (61.842%) electives; 609 (38.158%) emergencies] and outcomes were reviewed. General anaesthesia with endotracheal tube (GA + ETT) placement was the most frequent form of anaesthesia, administered to 1,075 (67.36%), and perioperative laryngospasm [49 (3.07%)] was the ranking critical event, followed by hypoxaemia, delayed recovery and difficult tracheal intubation respectively as the second, third and fourth, with the corresponding values of 34 (2.13%), 33 (2.07%) and 25 (1.57%); anaesthesia-related mortality was 1 (0.06%), occurring postoperatively from respiratory failure, following GA + ETT placement for elective abdominoplasty in a child with Prune-belly Syndrome.
Conclusion: Within the five-year period in this survey, anaesthesia-related child mortality was 1 (0.06%), occurring postoperatively from respiratory failure.

KEY WORDS: Anaesthesia, Child mortality, Paediatric anaesthesia training.

I INTRODUCTION

Globally, a sustained decrease in preventable perinatal, neonatal and infant deaths has led to a decline in under-five mortality rate since 1990, the finding, though, being more prevalent in advanced nations compared to low- and middle-income countries (LMICs).[1] However, of note, contrary to this declining trend, the perioperative component of child mortality has increased over the last decade. In their systematic review, Gonzalez et al[2] documented a rise in anaesthesia-related mortality in paediatric patients, with greater indices recorded in LMICs (2.4 to 3.3 per 10,000 anaesthetics), relative to values obtained in the advanced nations (< 1 death per 10,000 anaesthetics).. Anaesthesia-related death is a major contributor to child mortality rate in Africa; in this regard, gross unavailability or inadequate number of trained paediatric Anaesthetists/anaesthesia service providers has been identified as a significant contributing factor, with a consequent 100-200 times more likelihood of the occurrence of anaesthesia-related death in a child in Africa, than in high-income nations.[3]

While, evidentially, perioperative deaths are more common in children, in comparison with adults, within the paediatric population the reported values show that mortality is higher in neonates and infants compared to older children.[2] The reason for this finding of a relatively higher mortality in association with younger children is not far-fetched: neonates and infants are endowed with particularly peculiar anatomical, physiological, pharmacological and psychological features which, invariably, pose diverse significant challenges in perioperative settings, creating substantiable vulnerability to the development of critical events.[2] The vulnerability of children to the development of such adverse incidents had been documented in research.[4] This, therefore,

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necessitates training and requisite competence to surmount such anaesthetic challenges, and achieve successful and safe conduct of anaesthesia in under-five children, particularly in infants and neonates.

As a foremost tertiary and training health institution in Port Harcourt, sited in the Niger Delta Region of Nigeria, the UPTH became a beneficiary of the Paediatric Anaesthesia Training Programme sponsored by the World Federation of Societies of Anaesthesiologists (WFSA), first in 2013, leading to the production of its first WFSA-certified Paediatrc Anaesthesiologist in 2014, and the establishment of Specialist Paediatric Anaesthesia Unit in 2015, hence this retrospective survey, to audit the five-year impact of Specialist Paediatric anaesthesia training on anaesthesia-related under-five deaths within the UPTH, from January, 2018, to December, 2022.

II MATERIALS AND METHODS

Approval (UPTH/ADM/90/S.11/VOL.XI/1932) from the UPTH Research Ethics Committee secured for a retrospective survey on anaesthesia-related mortality, in children aged 0 to 5 years in UPTH, a 5-year audit of all paediatric anaesthetic interventions and outcomes was undertaken retrospectively, from January, 2018, to December, 2022. Data including loco-regional/general anaesthesia for paediatric surgical procedures, sedation-analgesia for paediatric diagnostic radiology, and their indications, perioperative critical events/deaths up to 24 hours following anaesthetic intervention, and their causes, were obtained from the Paediatric Anaesthesia Unit, Recovery room, Paediatric Radiology and Haematology Unit registers and records, as well as from the records of the Children Surgical Wards of the UPTH. Data on anaesthetic interventions and outcomes, as well as on anaesthesia-related perioperative deaths in children aged 0 - 5 years, from January, 2018, to December 2022, comprised the inclusion criteria, while data on anaesthetic interventions and outcomes, as well as on perioperative deaths in children aged > 5 years, such conducted prior to January, 2018, or after December 2022, and all deaths of children aged 0 to 5 years not involving anaesthetic intervention within UPTH, were excluded. All data was handled with confidentiality.

A. DATA COLLECTION AND STATISTICAL ANALYSIS

Collected data was entered on a spread sheet and exported to Statistical Products and Service Solutions (SPSS) version 21.0 for analysis by a Statistician. The results were presented as numbers and percentages within tables, and in figures.

III RESULTS

A total of 1,596 children, aged 5 years and below, had anaesthetic invention for surgical and radiological procedures from January, 2018, to December, 2022. Of this number, demographically, 110 (6.89%) were neonates, 601 (37.66%) were infants, while 885 (55.45%) were children within the age range of 1 to 5 years. There was male preponderance [972 (60.90%) versus 624 (39.10%), giving a male/female ratio of approximately 1.56:1. By physical fitness classification, 885 (55.45%) of the children were ASA I, 565 (35.40%) were ASA II, while 123 (7.71%) and 23 (1.44%) were ASA III and IV, respectively **(Table 1)**.

Table 1. Distribution Of Age, Sex and ASA Physical Fitness Classification OT The Children

Age N (%)				**Total**
≤ 28 days	**29 days to <1year**	**1 year to 5years**		
110 (6.89)	601 (37.66)	885 (55.45)		**1,596 (100.0)**
Sex N (%)				
Male	**Female**			
972 (60.90)	624 (39.10)			**1,596 (100.0)**
ASA classification	**Elective**		**Emergenvy**	**Total**
	Male N (%)	**Female N (%)**	**Male N (%)**	**Female N (%)**	**N (%)**
Class I	295 (18.48)	234 (14.66)	244 (15.29)	112 (7.02)	**885 (55.45)**

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Class II	218 (13.66)	186 (11.65)	98 (6.14)	63 (3.95)	**565 (35.40)**
Class III	42 (2.63)	12 (0.75)	60 (3.76)	9 (0.56)	**123 (7.71)**
Class IV	0 (0.00)	0 (0.00)	15 (0.94)	8 (0.50)	**23 (1.44)**
Total	**555 (34.8)**	**432 (27.1)**	**417 (26.1)**	**192 (12.0)**	**1,596 (100.0)**

Data are expressed in number (N) and percentage (%)

The number of anaesthetic interventions in 2018, 2019, 2020, 2021 and 2022, correspondingly were 397 (24.875%), 424 (26.566%), 98 (6.140%), 320 (20.050%) and 357 (22.368%), with the least and highest values recorded in 2020 and 2019, respectively. From 2018 to 2019, and from 2021 to 2022, the trend showed a rising number of interventions; however, there was a remarkably low value in 2020, reflecting the impact of Covid-19 pandemic on child anaesthetic services in the institution. Comparatively, there were more elective than emergent child anaesthetic interventions [987 (61.842%) versus 609 (38.158%)], over the 5-year period **(Figure 1)**.

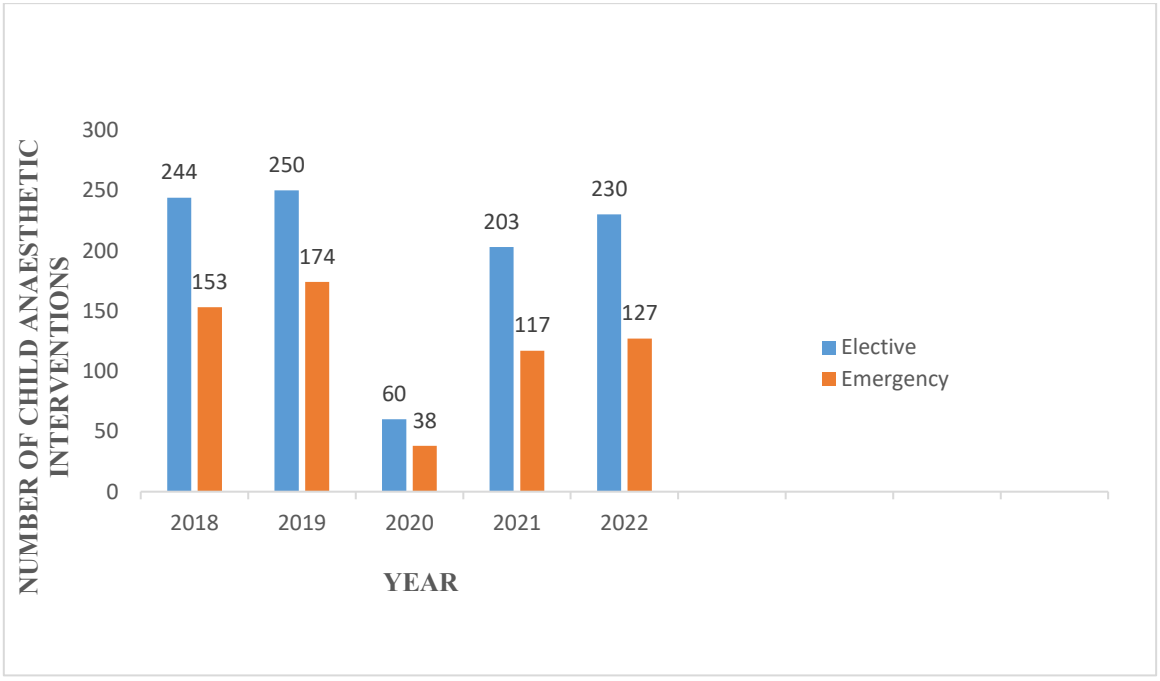

Figure 1: Distribution Of Annual Number of Child Anaesthetic Interventions Over The 5-Year Period

Of the various indications for anaesthesia, respectively, inguinal surgery (herniotomy, orchidopexy) and oto-rhino-laryngologic surgery (adenotonsillectomy, tracheostomy bronchoscopy/oesophagoscopy for foreign body removal) ranked first [288 (18.05%)] and second [275 (17.23%)], respectively; exploratory laparotomy (for gastroschisis, intussusception, burst abdomen closure) and plastic surgical procedures equally ranked third [240 (15.04%)], while surgery on urological organs [156 (9.77%)], surgical correction of different ano-rectal malformations/conditions [108 (6.77%)], and magnetic resonance imaging for diverse brain and/or spinal cord disorders [80 (5.01)%] ranked fourth, fifth and sixth, correspondingly. The seventh, eighth, ninth and tenth ranking indications, respectively, were umbilical [52 (3.26%)], ophthalmic [50 (3.13%)], brain/spinal cord [48 (3.01%)] surgeries, and excision biopsies for different benign tumours [26 (1.63%)]; cardiothoracic surgery [6 (0.38)] and Ramstedt's procedure [6 (0.38%)] were equal ranking eleventh; Sistrunk procedure and appendicectomy ranked twelfth [5 (0.31%)], while fasciotomy/incision with drainage of abscess [4 (0.25%)] and parotidectomy [3 (0.19%)] ranked thirteenth and fourteenth, respectively. Debulking of Rhabdomyosarcoma, upper limb amputation, closed reduction of mandibular fracture and abdominoplasty for Prune-Belly Syndrome each recorded [1 (0.06%)], ranking as the least indicator for anaesthetic intervention in the children **(Table 2)**.

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Table 2. Indications For the Anaesthetic Interventions Over 5 Years

Indication	N (%)	Rank
Inguinal Surgery (Herniotomy, Orchidopexy)	288 (18.05)	1
Oto-Rhino-Laryngologic surgery (Adenotonsillectomy, Tracheostomy, Bronchoscopy/Oesophagoscopy for foreign body removal).	275 (17.23)	2
Exploratory laparotomy for Gastroschisis, Intussusception, Burst abdomen closure.	240 (15.04)	3
Plastic surgery (Cheiloplasty, Palatoplasty, Glossoplasty, Tenoplasty, Escharotomy, Skin grafting, Syndactyly/Polysyndactyly release).	240 (15.04)	3
Urologic surgery (Urethroplasty, Meatoplasty/Meatotomy, Nephrectomy, Pyeloplasty, Repair of Extrophic Bladder, Circumcision, Frenulectomy, Ablation of Posterior Urethral Valve, Vesicotomy)	156 (9.77)	4
Surgery for Ano-Rectal Malformations/Conditions (Posterior Sagittal Anorectoplasty, Anal dilatation, Colostomy/Colostomy reversal for Anorectal malformation, Rectal biopsy, Reduction of Rectal prolapse, Repair of Anal sphicteric damage secondary to sexual assault, Anal fistula examination under anaesthesia.)	108 (6.77)	5
Magnetic Resonance Imaging for Brain and/or Spinal cord disorders.	80 (5.01)	6
Umbilical surgery (Omphalocele repair, umbilical herniorrhaphy)	52 (3.26)	7
Ophthalmic surgery (Cataract excision, Corneal/Scleral repair, Trabeculectomy for glaucoma, Blepharoplasty, Frontalis sling for Ptosis, Ectropion repair, Evisceration/Enucleation for Retinoblastoma, Correction of strabismus)	50 (3.13)	8
Neurosurgery Encephalocele and Meningocele/Meningomyelocele repair Ventriculo-Peritoneal shunt, Burr-hole for Intracranial haematoma	48 (3.01)	9
Excision biopsy (Excision of Huge Cystic Hygroma, Ganglion, Dermoid cyst, Haemangioma, Anal warts and Cervical lymph nodes)	26 (1.63)	10
Cardiothoracic surgery (Gastrostomy & Thoracotomy for Tracheoesosphageal Fistula repair, Pericardiostomy for Pericardial effusion, Thoracostomy for Massive pleural effusion)	6 (0.38)	11
Ramstedt's procedure	6 (0.38)	11
Sistrunk procedure	5 (0.31)	12
Appendicectomy	5 (0.31)	12
Fasciotomy/Incision and Drainage of abscess	4 (0.25)	13
Parotidectomy	3 (0.19)	14
Debulking of Rhabdomyosarcoma	1 (0.06)	15
Upper Limb Amputation	1 (0.06)	15
Closed Reduction of Mandibular Fracture	1 (0.06)	15
Abdominoplasty for Prune Belly Syndrome	1 (0.06)	15
Total	**1,596 (100.0)**	

Laryngospasm was the leading perioperative critical event experienced by the children, followed by hypoxaemia, delayed recovery and difficult tracheal intubation as the second, third and fourth, with the corresponding values of 49 (3.07%), 34 (2.13%), 33 (2.07%) and 25 (1.57%); hypotension and bradycardia were recorded respectively in 20 (1.25%) and 18 (1.13%) of the children. General anaesthesia with endotracheal tube (GA + ETT) placement was the most frequent form of anaesthesia, administered to 1,075 (67.36%); the least frequent technique used was sedation with penile block, performed on 4 (0.25%); the second, third, fourth and fifth most frequent techniques respectively were GA + ETT + caudal block, GA + laryngeal mask airway (LMA) + caudal block, sedation-analgesia + LMA and GA + LMA + subarachnoid block (SAB), with the corresponding values of 177 (11.09%), 162 (10.15%), 141 (8.83%) and 37 (2.32%). In the 5-year period, naesthesia-related mortality was 1 (0.06%), occurring within 24 hours postoperatively secondary to respiratory failure in a 2-year old male with prune-belly syndrome, following GA + ETT placement for elective abdominoplasty **(Table 3)**.

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Table 3. Perioperative Critical Events, Anaesthesia-Related Mortality and Anaesthetic Techniques Used

Parameter	Elective		Emergency		Total
	Male N (%)	Female N (%)	Male N (%)	Female N (%)	
Anaesthesia-related Critical event					
Laryngospasm	18 (1.13)	12 (0.75)	13 (0.81)	6 (0.38)	**49 (3.07)**
Hypoxaemia (SpO_2 <90%)	8 (0.50)	9 (0.56)	13 (0.82)	4 (0.25)	**34 (2.13)**
Delayed recovery	14 (0.88)	6 (0.38)	8 (0.50)	5 (0.31)	**33 (2.07)**
Difficult tracheal intubation	8 (0.50)	6 (0.38)	4 (0.25)	7 (0.44)	**25 (1.57)**
Hypotension (SBP decrease ≥30% of baseline)	5 (0.31)	4 (0.25)	3 (0.19)	8 (0.50)	**20 (1.25)**
Bradycardia (HR decrease ≥30% of baseline)	5 (0.31)	6 (0.38)	4 (0.25)	3 (0.19)	**18 (1.13)**
Total	**58 (3.63)**	**43 (2.69)**	**45 (2.82)**	**33 (2.07)**	**179 (11.20)**
Anaesthetic technique					
GA + ETT	260 (16.291)	236 (14.787)	393 (24.624)	186 (11.654)	**1,075 (67.36)**
GA + ETT + Caudal block	84 (5.263)	63 (3.947)	24 (1.504)	6 (0.376)	**177 (11.09)**
GA + LMA + Caudal Block	98 (6.140)	64 (4.010)	0 (0.00)	0 (0.00)	**162 (10.15)**
Sedation-analgesia + LMA	84 (5.263)	57 (3.571)	0 (0.00)	0 (0.00)	**141 (8.83)**
GA + LMA + SAB	25 (1.566)	12 (0.752)	0 (0.00)	0 (0.00)	**37 (2.32)**
Sedation + Penile Block	4 (0.251)	0 (0.00)	0 (0.00)	0 (0.00)	**4 (0.25)**
Total	**555 (34.774)**	**432 (27.068)**	**417 (26.128)**	**192 (12.030)**	**1,596 (100.0)**
Anaesthesia-related Mortality					
Respiratory Failure post Abdominoplasty for Prune-Belly Syndrome under GA + ETT	1 (0.06)	0 (0.00)	0 (0.00)	0 (0.00)	**1 (0.06)**
Total	**1 (0.06)**	**0 (0.00)**	**0 (0.00)**	**0 (0.00)**	**1 (0.06)**

Data are expressed in number (N) and percentage (%)
SBP = Systolic blood pressure; HR = Heart rate; GA = General anaesthesia;
ETT = Endotracheal tube; LMA = Laryngeal Mask Airway; SAB = Subarachnoid block

IV DISCUSSION

During the five-year period considered in this retrospective survey, out of 1,596 children aged ≤5 years, in the UPTH, anaesthesia-related child death occurred only in 1 (0.06%), the occurrence being secondary to postoperative respiratory failure, within 24 hours following an elective abdominoplasty for prune-belly syndrome, in a 2-year old.

In line with the second target of the third sustainable development goal (SDG 3 Target 2) by the United Nations.[5] to end preventable deaths of newborns and children under 5 years of age by 2030, achieving a safe outcome following an anaesthetic and surgical intervention is the desirable primary perioperative objective which, globally, also serves as a reliable indicator of the quality of perioperative care.[6] In this retrospective study the occurrence of anaesthesia-related child mortality was 1(0.06%) out of 1,596 anaesthetic interventions within 5 years, depicting a positive impact of WFSA-sponsored paediatric anaesthesia training, on the conduct and outcome of paediatric anaesthesia in the UPTH.

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Clearly, anaesthesia-related child mortality is not a phenomenon occurring in isolation, but the end-point of progressive pathophysiology, arising from non-detection, delay or inadequacy in the management of critical event consequent upon an anaesthetic intervention. Such grave complications are the outcome of an unfavourable interplay between the anaesthetic agents or procedures versus the innate vulnerabilities, underpinned by the peculiar anatomical, physiological, pharmacological and psychological profiles of the child at the period, and are mostly either airway or cardio-circulatory related in origin.[2] By definition, an anaesthesia-related critical event is any preventable mishap associated with anaesthesia administration, that leads to or could have led to an udesirable patient outcome.[7] That these peculiar endowments underpin the finding of anaesthesia-related mortality being relatively 2 – 3 times higher in children, particularly infants and neonates, than in adults, had been reported in scientific literature.[8, 9] According to the North American Pediatric Registry of Perioperative Cardiac Arrest (POCA), cardiac arrest is anesthesia-related if the Anesthesiologist or the anesthetic administered played a contributory role in its occurrence,[4] and anaesthetic death is generally defined as death of a patient within 24 hours following anaesthesia, from any cause directly or indirectly related to anaesthesia.[10]

While the remarkable dimunition in anaesthesia-related mortality observed in this study reflects a favourable impact of Paediatric Anaesthesia Fellowship on under-five anaesthetic outcome, its aetiological association with respiratory failure as the critical event leading to death conveys an important fact, that respiratory events are more likely to be the leading cause of such fatality, thus, necessitating meticulous attention to respiratory parameters in the intraoperative and postoperative periods, especially in vulnerable children. Hasan et al,[11] following a retrospective study of 183 children, documented that respiratory based adverse events [43 (23.5%)], particularly oxygen desaturation, laryngospasm and bronchospasm, constituted the ranking anaesthesia-related complication, further observing that the incidence of Oxygen desaturation, laryngospam and bronchospasm, varied differently across their different age categories, with the corresponding values (%) of 18.7, 9.4 and 3.1 for children aged <1 year, 14.5, 7.3 and 2.2 for children aged 1 – 3 years, and 8.3, 4.2 and 1.0 for those aged 4 – 12 years. Similarly, in their study of trends in deaths associated with paediatric dental sedation in 44 children, Lee et al[12] observed that most deaths occurred among 2-5 year-olds (n=21), in an office setting (n=21), under a general paediatric dentist as the anaesthesia provider (n=25), and with 17 linked to the administration of a sedative anaesthetic. Again, importantly, the documentation in the POCA Registry showed that, cardiovascular derangements (induced by hypovolaemia, and hyperkalaemia from transfused blood) were accountable for 41% of cardiac arrests, while 27% were respiratory in origin, with laryngospasm as the ranking cause. Combining the findings by Hasan et al,[11] Lee et al[12] and the documentation in the POCA Registry,[4] inferentially, there is invariably an association of greater occurrence of anaesthesia-related death with cardio-respiratory sequelae and younger age in children, and that aligns positively with the finding in this retrospective survey, of the occurrence of the only mortality in 5 years being secondary to respiratory failure in a 2-year old. Empirically, therefore, the cardio-respiratory based critical challenges encounterable by a Paediatric Anaestheisiologist increase with decreasing age of the child.

The identification of six different critical events in this study, with laryngospasm, hypoxaemia (Oxygen desaturation), delayed recovery and difficult tracheal intubation correspondingly ranking as the first, second, third and fourth leading complications within the 5-year period, while hypotension and bradycardia ranked fifth and sixth, conveys an important fact for consideration. Laryngospasm, is a sustained partial or complete closure of the rima glottidis due to reflex constriction of the intrinsic laryngeal muscles mediated by the vagus nerve;[13, 14] it is usually triggered by airway irritation from secretion or foreign body, while in the light plane of general anaesthesia, and is encountered more commonly during emergence. Unrelieved laryngospasm in young children leads to rapid Oxygen desaturation, hypoxic cerebral ischaemia, cardiac dysrhythmia and death; epidemiologically, it has an overall incidence of 0.87%, with the incidence increased to 1.74% in children within the first 9 years of age, and to a greater value of 2.82% in infants aged 1 – 3 months, as reported by Olsson et al;[15] according to the authors,[15] generally, the reported incidence in infants is twice that in older children and three times that in adults. Of note, in literature, an incidence of laryngospasm as high as 25% in association with adenoidectomy and tonsillectomy had been documented by Gulhas et al.[16] The reported association of a higher incidence of laryngospasm with younger children, especially infants, is attributable to an inherent relative vagotonia, arising from the endowment of an autonomic dysequilibrium characterized by a higher parasympathetic nervous system (PNS) tone relative to the sympathetic nervous system (SNS).[17] Harteveld et al[17] documented in their computer analyzed electrophysiological study that PNS activity followed a cubic trend, with an exponential increase from infancy, a plateau in mid-childhood and a decline toward adolescence, while the SNS activity showed a contrasting linear trend with a gradual decrease from

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infancy toward adolescence. Consequently, younger children are also prone to producing more glandular secretion, which is a verified source of stimulus capable of triggering laryngospasm, according to Gavel et al.[14]

The occurrence of hypoxaemia was 2.13% in this retrospective study, making it the second leading critical event in 5 years. This finding agrees with the report of Hasan et al,[11] that respiratory based events, particularly oxygen desaturation, was a ranking anaesthesia-related complication. Young children, especially neonates and infants below 6 months, have significantly reduced functional residual capacity (FRC), with a consequent vulnerability to rapid development of hypoxaemia in the event of apnoea.[18] The reduction in FRC is further worsened in the supine position due to an associated cephalad displacement of intra-abdominal contents, resulting in diaphragmatic splinting with defective descent during inspiratory breath;[19] as a result of this decrease in FRC, and coupled with the high Oxygen extraction ratio of 6-8ml/kg/minute compared to 2-4ml/kg/minute in adults, reverse Trendelenburg to improve the FRC, rather than preoxygenation, is more effective in slowing the rate of desaturation in young children. Edfast et al,[20] in their study of 385 children determining e rate of peri-intubation desaturation, documented an absence of a significant difference in the occurrence of peri-intubation desaturation between their preoxygenated and non-preoxygenated groups (12/190 versus 7/185). Commonly, desaturation occurs in the peri-intubation period following the administration of neuromuscular blocker and, more especially, if there is delay in tracheal intubation due to difficult airway. Furlong-Dillard et al,[21] studying the associations with severe peri-intubation desaturation events among children, documented as high as 15 - 41% occurrence. Similarly, Pokrajac et al[22] reported 3.9% (21 out of 543) hypoxaemia, in their case-controlled study of children who had emergency tracheal intubation over a period of 9 years, concluding that hypoxia was the strongest predictor of peri-intubation cardiac arrest (PICA) amongst the children. Without prompt detection and adequate intervention, hypoxia can rapidly cascade to mortality via the pathophysiological pathways of ischaemic cerebral encephalopathy.[23]

Difficult tracheal intubation was encountered in 25 (1.57%) children in this study, which, though relatively smaller in value, is in consonance with the empirical finding by Amaha et al[24] who, in their multicentre cross-sectional study of 290 paediatric patients, reported a difficult tracheal intubation incidence of 11%, documenting a significant association of prevalence of difficult airway with age 0 – 2 years. The airway anatomy in young children predisposes to difficult tracheal tube placement, underpinned characteristically by short neck, prominent occiput keeping the neck flexed in supine position, large tongue relative to the buccal cavity obscuring visualisation of laryngeal structures, floppy epiglottis and an antero-cephalad larynx with its smallest diameter at the level of the cricoid cartilage, rather than the rima glottidis as in adults;[25] thus, an optimal head-neck alignment for improved glottic visualization is necessitated, for the circumvention of repeated laryngoscopic attempts with its attendant complications of upper airway trauma, reactionary oedema and impaired air-flow mechanics. According to the research findings by Di Cicco et al,[26] the peculiar airway anatomy of under-five children only transits to resemble that of adults from the age of 6-8 years. Therefore, achieving a first-attempt success in tracheal intubation is warranted, especially in neonates and infants. Such competence comes through training.

Delayed awakening from general anaesthesia is a common adverse phenomenon in young infants, especially the expreterm and full term with postconceptional ages less than 60 and 44weeks, respectively, and it raises major concern in paediatric anaesthesia practice;[27] this study recorded its occurrence in 33 (2.07%) children. The complication is attributable to the presence of some developmental factors: (a) an immature respiratory centre, (b) an immature neuromuscular junction (NMJ) that entails a heightened sensitivity to non-depolarizing neuromuscular blocking agents, resulting in prolongation of muscle relaxant efficacy beyond the expected duration of pharmacological action; these, coupled with (c) ineffective hepatic drug biotransformation and (d) suboptimal renal clearance function, culminate in a propensity to prolonged apnoea or hypoventilation following general anaesthesia. Again, the poorly developed NMJ gives rise to a defective autoregulatory shivering thermogenesis in the event of hypothermia, with consequent triggering of brown fat metabolism and resultant metabolic acidosis; furthermore, due to the inherent overriding myocardial parasympathetic tone, the reflex physiological response to hypoxia in the under-five child is predominantly bradycardia.[28] For an age category with heart rate dependent cardiac output, therefore, this has a crucial implication: the occurrence of significant bradycardia invariably leads to hypotension, tissue hypoperfusion, poor Oxygen delivery triggering induction of complementary anaerobic metabolism and consequent lactic acidosis. A critical point is reached in the pathophysiological cascade if pulmonary vasoconstriction ensues, in response to hypoxia/acidosis in the neonate or infant, whose foramen ovale, being only functionally closed due to higher left atrial (systemic) pressure relative to the right, still possesses a reversibility component with a potential for developing Eisenmenger phenomenon.[29] This pathophysiological phenomenon, characteristically a right-to-left atrial

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flow, initiates the distribution of poorly oxygenated blood throughout the circulation, worsening an existing hypoxia and acidosis, thus establishing a vicious circle that can rapidly cascade to mortality.

Irrespective of the diversity in clinical indication, in all the 1,596 anaesthetic interventions recorded in this study, deep sedation or general anaesthesia with or without tracheal intubation was provided, either as an only technique or in combination with loco-regional block. Globally, compared to general anesthesia, there is documented association of less occurrence of critical events with loco-regional techniques due to the sparing of consciousness and absence of airway manipulations.[2] This empirical observation underpins the preferential choice of loco-regional blocks over general anaesthesia, except when it is considered unsafe or inapplicable. However, in children aged 5 years and below, the presence of a peculiar psychological profile makes it imperative that adequate sedation or general anaesthesia is provided prior to the performance of any loco-regional technique, for reaping immediate benefits of winning the child's cooperation with the planned anaesthetic, medical/surgical intervention and achieving safe perioperative outcome, as well as for circumventing long-term adverse effects of significant perioperative anxiety/agitation in vulnerable children. Feriante et al[30] had stated that as part of normal child development appropriate separation anxiety manifested between the ages of 6 – 12 months, peaked about 14 -18 months, remained steadily observable until 3 years and declined afterward, but if untamed evolved into long-term behavioural disorder. However, while periprocedural anxiolysis through the incorporation of deep sedation or general anaesthesia is necessitated, the associated additional pharmacological and airway-related significant challenges must be taken into consideration for a favourable outcome.

A practising Paediatric Anaesthesiologist, therefore, who on ethical and professional consideration is, in addition to being responsible for the safe provision of anaesthesia, the perioperative Neonatologist, Paediatrician, as well as the Neonatal/Paediatric Intensivist, must possess, not only the requisite skill in the performance of paediatric general anaesthetic/loco-regional techniques, but also a functional theoretical knowledge and understanding of the peculiar anatomical, physiological, pharmacological and psychological profiles in the under-five child, as well as of the expected resultant of their interaction with a given anaesthetic intervention. Also, he or she must be one who is, as well, competent in prompt detection and interventional management of anaesthesia-related critical events, well versed in critical perioperative decision taking, current paediatric cardiopulmonary resuscitation and paediatric airway management, reliably equipped for the role of a paediatric anaesthesia/resuscitation team player/leader, adherent to international best practice standard operating protocols for common/complex paediatric anaesthetic procedures and critical scenarios; additionally, such Paediatric Anaesthesiologist must be engaged in continuing medical education to ensure that the acquired theoretical knowledge, functional understanding and practical skills are updated for improved competence. These, and more, were provided through the robust well-structured, competence-oriented paediatric anaesthesia training curriculum and rigorous practical, hands-on sessions by the WFSA training programme, culminating in yielding competent Paediatric Anaesthesiologists for the globe.

The positive impact of fully bringing paediatric anaesthesia practice in the UPTH, since 2018, under the supervision of a WFSA-trained Paediatric Anaesthesiologist, is evident by the diminution of the anaesthesia-related child mortality, in this study, to 1(0.06%) out of 1,596 anaesthetics, which is less than the globally reported values, the diverse significant anaesthetic challenges posed notwithstanding. According to Abate et al,[31] the incidence of anaesthesia-related cardiac arrest and mortality in children is persisitently high in low- and middle-income countries. In their systematic review, meta-analysis and meta-regression, using 38 studies that included 3.35 million participants, the authors[31] reported a global perioperative cardiac arrest incidence of 2.54 (95%CI:2.23 to 2.84) per 1000 anaesthetics, and a global perioperative mortality of 41.18 (95%CI:35.68 to 46.68) per 1000 anaesthetics, in children, stating that the values probed an investment in continuous medical education of perioperative staff and compliance with standard operating protocols. Similarly, Gonzalez et al,[2] evaluating the incidence and causes of anaesthesia-related mortality in children, in their systematic review, documented the finding of the highest anaesthesia-related mortality rates (2.4 to 3.3 per 10,000 anaesthetics) in developing countries, between 2001 and 2011; comparatively, the value of anaesthesia-related child mortality in this survey (0.06 out of 1,596 anaesthetics) is less than the values by Gonzalez et al,[2] though it is greater than the incidence of < 1 death per 10,000 anaesthetics reported by same authors for developed countries. The WFSA has identified evidentially that a gross shortage of trained and competent Paediatric Anaesthesiologists is responsible for the reported high anaesthesia-related mortality in LMICs, especially sub-Saharan Africa, consequently rendering children in Africa 100-200 times more likely to die perioperatively, compared to their peers in high-income nations.[3] This observation has been interpreted as an alarming call from Africa, necessitating the establishment of medical educational programmes such as the Safer Anaesthesia From

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Education – Paediatrics (SAFEPaeds) programme, followed by the Paediatric Anaesthesia Training in Africa (PATA), by the WFSA.[3] Arbous et al[32] also demonstrated in their research that the poor practical application of techniques rather than a lack of knowledge could lead to critical events, highly recommending continuing medical education for practising Paediatric Anaesthesiologists.

Importantly, the observation by Lee et al,[12] during their study of trends in death associated with paediatric dental sedation, that out of 44 deaths 25 occurred with a general/paediatric dentist as the anaesthesia provider, lends further empirical support to the imperativeness of healthcare institutions, especially in the LMICs, considering it a prerequisite, that the conduct of paediatric anaesthesia is undertaken or, in the least, directly supervised by a Consultant Paediatric Anaesthesiologist, as this is a major determinant of success in achieving zero or significantly decreased anaesthesia-related under-five mortality. Upholding such consideration is particularly of critical relevance given the increasing awareness by patients of their rights, and the rising rate of litigations against healthcare professionals.

V CONCLUSION

With a WFSA-certified Consultant Paediatric Anaesthesiologist directly undertaking or supervising the conduct of paediatric anaesthesia, particularly in children aged 5 years and below, there was a favourable impact, in the UPTH, evidenced by the remarkable diminution in the occurrence of anaesthesia-related child mortality to approximately zero, within the 5-year period of this retrospective survey.

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REFERENCES

1. Under-five mortality". UNICEF December 2021. Archived from the original on 1 September 2022. Retrieved 2019-11-26.
2. Gonzalez LP, Pignaton W, Kusano PS, Modolo NS, Braz JR, Braz LG. Anesthesia-related mortality in pediatric patients: a systematic review. Clinics (Sao Paulo). 2012;67(4):381-387. Doi:10.6061/clinics/2012(04)12.
3. Paediatric Anaesthesia Training in Africa (PATA)-World Federation of Societies of Anaesthesilogists. Available at: https://wfsahq.org/OurWork/Education & Training. Accessed November 19, 2024
4. Morray JP, Geiduschek JM, Ramamoorthy C, Haberkern CM, Hackel A, Caplan RA, et al. Anaesthesia-relared cardiac arrest in children: initial findings of the Pediatric Perioperative Cardiac Arrest (POCA) Registry. Anesthesiology 2000;93(1):6 -14. doi: 10.1097/00000542-200007000-00007
5. United Nations. Transforming our world: The 2030 Agenda for Sustainable Development. 2015. General Assembly Resolution A/RES/70/1. Accessesd January16, 2026. Available from: https://sdgs.un.org/goals
6. Watters DA, Hollands MJ, Gruen RL, Maoate K, Perndt H, McDougall RJ, et al. Perioperative mortality rate (POMR): a global indicator of access to safe surfery and anaesthesia. World J Surg. 2015;39(4):856-864. doi: 10.1007/s00268-014-2638-4
7. Currie MA. A prospective survey of anaesthetic critical evnts in a teaching hospital. Anaesth Intensive care. 1989;17(4):403-411. doi: 10.1177/0310057X8901700402.

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www.ijcsrr.org

8. Bhanaker SM, Ramamoorthy C, Geiduschek JM, Posner KL, Domino KB, Haberkern CL, et al. Anaesthesia-related cardiac arrest in children: Update from the Pediatric Perioperative Cardiac Arrest Registry. Anesth Analg. 2007;105(2):344-350. doi: 10.1213/01.ane.0000268712.00756.dd
9. Sen I, Dave N, Bhardwaj N, Juwarkar C, Beegum S. Specialised training in paediatric anaesthesia training: Need of the hour. Indian J Anaesth. 2021;65(1):17-22. doi: 10.4103/ija.ija_1445_20.
10. Tudjegbe SO, Amadasun FE. What is anesthetic death? Ann Biomed Sci. 2010;9(1):25-28. doi: 10.4314/abs.v9i1.66579
11. Hasan MR, Sharmin T, Rickta D, Sharmin R, Gosh P. Complications of Anesthesia in Children: An Observational Study.EAS J Anesthesiol Crit Care.2025;7(4):60-66. doi: 10.36349/easjacc.2025.v07i04.001
12. Lee HH, Milgrom P, Starks H, Burke W. Trends in death associated with paediatric dental sedation and general anaesthesia. Paediatr Anaesth. 2013;23(8):741-746. doi: 10.1111/pan.12210
13. Hampson-Evans D, Morgan P, Farrar M. Pediatric Laryngospasm. Paediatr Anaesth. 2008;18:303-307. doi: 10.1111/j.1460-9592.2008.02446.x
14. Gavel G, Walker RWM. Laryngospasm in anaesthesia. 2014;14(2):47-51. doi: 10.1093/bjaceaccp/mkt031
15. Olsson GL, Hallen B. Laryngospasm during anaesthesia: a computer-aided incidence study in 136,929 patients. Acta Anaesthesiol. Scand. 1984;28(5):567-575. doi: 10.1111/j.1399-6576.1984.tb02121.x
16. Gulhas N, Durmus M, Demirbilek S, Togal T, Ozturk E, Ersoy MO. The use of magnesium to prevent laryngospasm after tonsillectomy and adenoidectomy: a preliminary study. Paediatr Anaesth. 2003;13(1):43-47.doi: 10.1046/j.1460-9592.2003,00927.x
17. Harteveld LM, Nederend I, Ten Harkel ADJ, Schutte NM, de Rooij SR, Vrijkotte TGM. et al. Maturation of the Cardiac Autonomic Nervous System Activity in Children and Adol escents. J Am Heart Assoc. 2021;10(4):e017405. doi: 10.1161/JAHA.120.017405.
18. Marciniak B. growth and development. In: Cote CJ, Lerman J, Todres ID, editors. A Practice of Anaesthesia for Infants and Children. 4th ed. Philadelphia, PA: Saunders Elsevier;2009. p7-21
19. Bhammar DM, Wilhite DP, Olojo T, Alagappan K, Jones K, Liu Y-L, et al. Effects of Obesity and Sex on Supine Functional Residual Capacity and ExpiratoryFlow Limitation in Children. Pediatr Pulmonol. 2025;60(4):e71061. doi: 101002/ppul.71061
20. Edfast PJ, Frykholm P. Can the Introduction of a Preoxygenation Routine Reduce the Incidence of Desaturation During Induction In Children? Ann Pediatr. 2021;4(1):1052
21. Furlong-Dillard JM, Nguyen A, Facciolo MD, Feygin YB, Napolitano N, Emeriaud G, et al. Associations with Severe Desaturation Events Among Children Receiving Noninvasive Respiratory Support At Time of Intubation. Respir Care. 2023;68(12):1646-1656. doi: 10.4187/respcare.10765
22. Pokrajac N, Sbiroli E, Hollenbach KA, Kohn MA, Contreras E, Murray M. Risk Factors for Peri-intubation Cardiac Arrest in Pediatric Emergency Department. Pediatr Emerg Care. 2022;38(1):e126-e131. doi: 10.1097/PEC.0000000000002171
23. Abiodun MT, Oziegbe G, Mbarie IA, Osarogiagbon WO, Etin-Osa CE, Oluwafemi RO, et al. Incidence, severity and outcomes of hypoxaemia in paediatric emergencies seen at a tertiary hospital in Southern Nigeria. Int J Cont Paediatr. 2025;12(8):1289-1298. doi: 10.18203/2349-3291.ijcp20252209
24. Amaha E, Haddis L, Aweke S, Fenta E. The prevalence of difficult airway and its associated factors in pediatric patients who underwent surgery under general anesthesia.: An observational study. SAGE Open Med. 2021;20(9):20503121211052436. doi: 10.1177/20503121211052436
25. Li H, Jia X, Ye H, Liang J-W, Zhao W-L, Cui P, et al. Impact of lateral positioning on upper airway morphology in sedated children under five. World J Pediatr. 2025;21:587-596. doi: 10.1007/s12519-025-00910-w
26. Di Cicco M, Kantar A, Masini B, Nuzzi G, Ragazzo V, Peroni D. Structural and functional development in childhood: children are not small adults. Pediatr Pulmonol. 2021;56:240-251
27. Gharavi-Fard M, Taghavi-Gilani M, Kazemi S, Razavi M. Apneas in Infants with Postconceptional Age below 60 Weeks Undergoing Herniorrhaphy. Iran J Pediatr. 2014;24(2):178-183
28. Watterson LM, Morris RW, Westhorpe RN, Williamson JA. Crisis management during anaesthesia: bradycardia.Qual Saf Health Care.2005;14(3):7-14. doi: 10.1136/qshc.2002.004457

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IJCSRR @ 2026
www.ijcsrr.org

29. Wojtowitcz-Marzec M.The Foramen ovale from the fetal to neonatal life span. Pediatr Pol 2021;96(1):60-67 doi: 10.5114/POLP.2021.104830
30. Feriante J, Torrrico TJ, Bernstein B.Separation Anxiety Disorder. [Updated 2023 Feb26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing: 2025 Jan. Available from: https://www.ncbi.nlm.nih.gov/books/NBK560793/
31. Abate SM, Nega S, Basu B, Tamrat K. Global mortality of children after perioperative cardiac arrest: A systematic review, meta-analysis, and meta-regressionAnn Med Surg. 2022;74:103285. doi: 10.1016/j.amsu.2022.103285
32. Arbous MS, Meursing AE, van Kleef JW, de Lange JJ, Spoormans HH, Touw P, et al. Impact of anaesthesia management characteristics on severe morbidity and mortality. Anaesthesiology. 2005;102(2):257-268. doi: 10.1097/00000542-200502000-00005.

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