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Pediatric Anesthesia: Techniques and Risk Reduction

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Abstract

1. Introduction to Pediatric Anesthesia

Pediatric anesthesia provides a complex and uniquely challenging interaction of surgical, anesthetic, medical, ethical, and most importantly, patient factors. Techniques and practices commonly used in adults are often not applicable to infants and neonates. It is our goal to provide safe and immediate perioperative care to such patients. Our aim is to be familiar with the basic pediatric vanguard, which will ensure appropriate preoperative evaluation and testing, use age and patient-size appropriate guidelines for induction of anesthesia, maintenance of anesthesia, perioperative pain control, and postoperative clinical care. Although we often take for granted that other members of the healthcare team possess the same or better knowledge of the medications and techniques we use, this manuscript is a template for beginners, who often do not use these techniques frequently and may need refreshing in those occasionally rare situations.

Methods

Data of all ASA Physical Status I and II, neonates (0–1 months) and infants (1–6 months) (>10,000) patients scheduled for operations, either as emergency or elective, at Saudi Arabia Children's Hospital from January 2013 to December 2018 were retrospectively collected and analyzed after review and approval of the Hospital's Institutional Ethics Committee. This consisted of preoperative condition, intraoperative events, and immediate postoperative recovery. There was also a pro forma for special observations while the patients were in post-anesthesia care unit for the next 72-hours, for early recognition of complications. All patients were scheduled for either superficial surgeries under regional block or in minority conditions, lower airway surgeries with general anesthesia including airway instrumentation.

Conclusion

Regional anesthesia can be a safer alternative to sedation or general anesthesia. In neonates and infants for minor and moderate procedures, it is possible to use a regional technique without sedation, deepening of anesthesia, airway interventions, and with minimal pain. Surgeries have been performed under such regional anesthesia for preterm babies over 1 kg, neonates, ex-preterm babies, and infants till 3 months of age; these have been both major surface surgeries lasting up to 2 hours and minor isolated procedures. Skin infiltration was supplemented with a single dose of a local anesthetic block for the relevant nerve.

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Satisfactory conditions were usually achieved within 20 to 30 minutes, at times with additional time for the block. Duration of surgery was based on the block's duration and the age of the preemie. All the babies were hemodynamically stable on monitoring. Duration of anesthesia was the block time plus "give time" post-surgery. Provided the choice of blocks, drugs, precautions and post-surgery care were taken, procedural regional anesthesia should be tried to sedation and short general anesthesia (C. Ponde et al.,).

Countries with efficiently running health systems experience a high level of trust, such as the Netherlands and Switzerland. Important factors for this trust are perceived excellence, freedom of choice, good communication, and of course - access to health services when needed. Factors responsible for a high quality of the health system, such as number of doctors, nurses working in the hospital sector, relations with the nursing staff or the GP, seem less important, although perception of waiting times has kept constant through the years. The greatest increase in this respect, among the factors relevant for the level of trust, is the lowest one - "cleanliness of the hospital." In conclusion, low waiting times, fairness, good communication and good cleaning might contribute to gaining trust in the health system (Luo et al.,).

1.1. Importance of Pediatric Anesthesia

During the rapid expansion of ambulatory surgery, great attention has been directed towards pediatric patients due to medical, economic, and social reasons. Several advantages of ambulatory surgery over inpatient treatment have been recognized for patients and society, including an increased number of available hospital resources and cost savings. When considering all these advantages, pediatric patients are exposed to potential risks, particularly in the perioperative period. Compared with adults, children subjected to anesthesia are at a higher risk of suffering adverse events due to the anatomical, physiological, and psychological differences of pediatric patients. Therefore, it is crucial to identify these adverse events and undertake effective measures to reduce the risks imposed on the most vulnerable patients. Topics of particular interest in the perioperative period of ambulatory pediatric patients include the influence of obesity, postoperative vomiting, and postoperative coughing on the airways and adequate treatment of these phenomena. One of the aspects jeopardizing safe pediatric anesthesia refers to the implementation of a safe technique for securing and maintaining airways patency during anesthesia. Significant attention has been directed towards investigating various airway management devices in order to gain an insight into the possibility of their multiple use in routine pediatric anesthesia. This longitudinal clinical study aimed to investigate and compare the occurrence of perioperative respiratory adverse events in obese and nonobese pediatric patients undergoing ambulatory anesthesia, as well as the incidence of these events in subjects managed with a laryngeal mask or tracheal tube. The obtained results indicate obesity as a risk factor for an increased incidence of

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perioperative respiratory adverse events and point to the importance of applying a laryngeal mask in the management of airways in pediatric patients. Anesthesia-induced perioperative respiratory adverse events during anesthesia could be the second most common complications in the perioperative period, slightly behind nausea and vomiting. The majority of the perioperative respiratory adverse events could be easily treated or not have clinical consequences but some of them could cause life-threatening complications such as laryngospasm, bronchospasm, intraoperative cardiac arrest, and bronchial aspiration. Since rapid development had been made in airway management techniques, it is hard to reach a consensus on which one is the best for pediatric anesthesia management.

2. Anesthesia Techniques in Pediatric Patients

Neonates and infants are a vulnerable population to undergo anesthesia and surgery due to their immature organ systems (C. Ponde et al., 2020). The Food and Drug Administration alerts health care providers and the public that "repeated or lengthy use of general anesthetics or sedation drugs during surgeries or procedures in children younger than 3 years of age or in pregnant women during their third trimester may affect the development of children's brains". This statement looks at the timeline of exposure over the brain development period, physiologic timing seems to be increasing with surgeries towards the end part of this period. These concerns have been raised for a decade, coming to the fore once more, and caution is advised. The use of regional anesthesia in conjunction with general anesthesia would allow for a significant reduction in the requirements for volatile anesthetic agents while maintaining surgical anesthesia. Additionally, accumulating data have supported the conclusion that the immature brain is far more sensitive to the adverse effects of general anesthesia. The resultant neurotoxicity comprises both apoptotic and necrotic mechanisms. There is also interest in alternative anesthetic techniques, the safe use of regional anesthesia in neonates and infants in the context of this recent alert. Regional anesthesia is being widely used in adults and older children as a supplement for general anesthesia to reduce the quantities of opioids and inhalational anesthetics required and thus smoothen recovery profiles. Furthermore, regional anesthesia has also been found to be neuroprotective in both animal and clinical settings. On the other hand, newborn infants demonstrate exaggerated doses of general anesthetic agents, have the highest risk of related side effects, and accumulate into the central nervous system because the blood-brain barrier is immature. The immature and injured nervous system in neonates has also been suggested to experience enhanced neurotoxicity. Studies in animals have clearly linked apoptotic neurodegeneration to almost all kinds of major anesthetic drugs including general anesthetics and sedatives. Volatile agents may trigger both apoptotic and also necrotic mechanisms. Some brain regions and neuronal types such as the cortical plate may experience more neurodegeneration. Age-dependent neurodevelopmental cues and processes might explain the potent and selective vulnerability of the young brain. Focal

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damage can give rise to extensive functional deficits. Brain injury can be generated at clinically relevant concentrations during acute exposures.

2.1. General Anesthesia

The use of general anesthesia (GA) in neonates and infants is associated with a higher incidence of adverse neurodevelopmental effects compared with older children. The vulnerable neonatal and infant population having immature organ systems has raised concerns toward the use of volatile anesthetic agents, sedatives, and analgesics in conjunction with surgery. The use of regional anesthesia (RA) in addition to GA and the associated need for significant reduction of volatile anesthetic agents is described in detail here. Neonates and infants receiving surgery are still largely exposed to GA without significant concern about reducing the dose or duration of the exposure. With the advent of smart alarms for the monitoring of sedation depth, the urgent need to reduce the exposure to GA triggered a pursuit for an alternative anesthetic technique, aiming to reduce the average or minimum end-tidal concentration (CET) of sevoflurane or desflurane below 1.0. RA is a suitable method to achieve this goal (C. Ponde et al., 2020).

Concerns related to anesthetic neurotoxicity prompted the institution to reevaluate current practice of short painful surgery under GA in neonates and infants. The present report describes over 6,000 blocks in a case series of 16,000 cases of short painful surgeries such as chest tube placements, spica casting, inguinal hernia repairs, orchiopexies, and penoscrotal reconstructions in neonates and infants all of whom received RA. With the exception of the mechanically ventilated, very premature or critically ill neonates, most neonates and infants receive GA using inhalational induction and placement of a supraglottic airway device. An extensive review of the available literature identified two retrospective case series of neonates and infants conducted under GA and RA, none of which were performed in neonates and infants undergoing common surface surgeries. During the study period, 16,000 neonates and infants received surgery; 1,000 of them underwent a chest, groin, or genital surgery conducted under GA and RA, raising concerns toward the use of volatile anesthetic agents.

2.2. Regional Anesthesia

The neonates and infants being operated for common surface surgeries <9 kg were provided regional anesthesia (RA) as central nerve blocks like caudal block, single shot epidural or spinal with peripheral nerve blocks like the rectus sheath block or trochlear block without the use of a tourniquet. Accumulated desflurane in closed circuits was administered to rapidly improve anesthesia depth. Regional blockades were combined with perioperative intravenous ketorolac and paracetamol. RA was performed before shifting the patient to the operating room. Smaller gauge i.v. cannulas and endotracheal tube were inserted after the patient was anesthetized. Anesthesia screens were applied during regional blockade, and wide tapes fixed

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these adequately. The adhesive was later sealed with layers and tied, to make the drapes water-resistant. The perineal area was painted before shifting. A disposable diaper with a large hole cut for the anus and nonadherent dressing attached with tape was applied. Additional dressings and drapes were used to protect the block sites. No diathermy was used near the nerve stimulator site ((Alalade et al., 2019)).

The data of the prospective case series of patients were analyzed. The surgeries, anesthetists, and the success of blockade were documented. The block in lower extremity and truncal surgeries was considered a failure; if the volatile anesthetic agent was added or a significant move was designated. After unblinding data, unsuccessful blockades were noted to improve the technique. 935 s peripheral and a central nerve blockade and 65 blocks of the lower extremity and torso segments were performed in the 1000 cases. The mean weight of the patients was 4.25 kg (1.2 - 9 kg). There were 590 cleft lip and palate, 35 circumcision, 30 hypospadias, 20 abscess, 120 hernias, lipomas, and tail 110 cysts among other surgeries. 25 patients had 2 surgeries. Failure 1.2% of the time required general anesthesia, which was converted to intubation 0.1%, due to failed LMA insertion. Non-airway complications attributed to blocks 0.6%. There was a postoperative increase in the CPAP due to block complications 0.1%. After blinding, there was an 0.3% increase in the failure of the lower and upper trunk blockades in the torso segments ((C. Ponde et al., 2020)).

3. Risk Factors in Pediatric Anesthesia

Introduction

Currently, due to the advances in surgical and medical-support technology, surgery has become a widely accepted treatment option for children suffering from various congenital and acquired diseases. However, the child's still under-developed physical and anatomical structure is significantly different from that of the adult's, and therefore, pediatric surgeries cannot be performed following the same standards or routines as adult surgeries. The growth and development of a child can be divided into several stages: the infant, preschool child, school child, and puberty, in which the drug regimen, anesthesia method, and operation method should all be varied. Similar to neonates, older children are also more sensitive to narcotic drugs, less tolerant to anesthesia and surgical procedures than are adults and, consequently, they exhibit a higher incidence of postoperative complications and adverse events. In addition, research has shown that anesthetics and surgical procedures tend to be more erratic with children than with adults. In children undergoing general anesthesia, the incidence of adverse events may be associated with a number of factors, such as age and the professional skill of the anesthesiologists.

Studies have shown that the older the child, the lower the incidence of adverse events, especially in children less 12 years of age. Only 2% of adverse events occur in children aged

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between 11 and 12 years, while this value goes up to 6.8% in children aged less than 1 year (Tao et al., 2021). High quality and experienced pediatric anesthesiologists can also reduce the risks of adverse events. Once adverse events have occurred, the effect of timely treatment on life preservation is very substantial. The most common complication for anesthesia in children is respiratory tract-related events, accounting for 15% to 41% of all post-anesthesia adverse events. Often, these events may be associated with the airway, lung ventilation or oxygenation status. Therefore, accurate risk assessment of general anesthesia in the perioperative period can allow for early intervention and risk aversion, thereby improving postoperative treatment and clinical outcomes. This study explores the risk factors in perioperative respiratory adverse events in children less 12 years of age undergoing general anesthesia and development of a predictive model, as well as constructing a prediction model for use in clinical practice, providing a basis for timely intervention and clinical decision-making.

3.1. Physiological Differences in Children

Since the pioneering observation about subarachnoid bupivacaine anesthesia in pediatric patients in 1947, pediatric anesthesia has been focused on the puerile copies of respective adult procedures. Meanwhile, the great conceptual questions and the deficit of objective data persist. Are the assumptions that can be drawn from adult anesthesia still valid for children's anesthesia, or must the concept of nowhere near to the same extent as that of the adult remain the benchmark? A review of the "ABC's" of airway, breathing, and circulation in pediatric anesthesia suggests that they are not. Minimal acceptable alveolar concentrations for surgical anesthesia for children derived from populations of 30-year-old adults are known to be fallacious. The airway anatomy in children is very different to that of adults from the first gasp at birth. Likewise, the circulatory system of babies postpartum is an entirely different beast to that of their later adulthood selves. Heart rate at birth is 100 to 130 and decreases by 3 beats/min per year until puberty. In contrast, postpartum the pulse rate of adults lies in the 70-100 beats/min range. Neonates have such a limited circulating volume greater than 40% loss results in hypovolemic shock, whereas for older children the percentage is reduced to greater than 20%. Children, especially irritable neonates, are more sensitive to the opioid effect and the union of both phenomena can lead to significant lethal outcome in the patients. In the same way, respiratory depressant effect of some opioids is also age dependent. Predictive effect-site concentrations of remifentanil for tracheal intubation were established. Simulations in children showed around 70% larger remifentanil effect-site concentration for tracheal intubation in children less than 5 years of age compared to adults. For supraglottic airway placement, there was an approximate 50% increase in remifentanil effect-site concentration for children. Similarly, age dilates the hypnotic effect of inhalational agents, which is revealed also by younger patients waking up after the intervention. Rapid awakening is especially observed, if critical illness is combined with critical weight value of inhalational.

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Anesthesia was introduced in 1846 and from the very beginnings children were anesthetized – Morton's patient was only a young man, but Percy the elder was only 8. In subsequent years there was a steep increase in the frequency of recruitment of children as research subjects. Lack of sufficient circulating volume was a reasonable excuse not to consider children for a long time, the first experiments being in children were those that independently held in London. Judging by the statements found in a treatise of 1849, these experiments were performed "from the pleasurable wish to repeat in practice an experiment which had been accomplished on several children by inhalation of sulfuric ether, and which in turn is communicated in the most important works on pathology and materia medica". It is supposed that no apprehension of pain was here uncovered. Soon afterwards, pioneers of the new method in other countries also confirmed the absence of reported complaints of pain in experimental children. Anesthetic knowledge was spread by exciting demonstrations as advertising showpieces. When Morton's patient awakened he "clapped his hands for joy"; soon multiple audience demonstrations of painless surgery in children followed. There was ruthless competitive spirit; any site for possible anesthetic administration was not passed over by the object of this demonstration. French brothers demonstrated the effects of ether anesthesia at a hospital. On 6 of September, 1847, a demonstration was organized with a patient of the age of only 2 months by the method of the elder brother. A short time earlier a demonstration took place in Turin as well, although lack of specific detail in the press suggests that the first 6 children operated were those the nearest to the fatality. Both brothers utilized difficult invalidism for advertising purpose. Upon bringing the patient into the hospital, a cry was heard; the operation occurs and the child did not awake; immediately upon cessation of the operation, "ain't it, Mamma!" came "with the happy accent of intelligence"; there was no sense, no perception before the sound; two others liked after him did not survive. Provided vital information about demonstrating painless operations on children. "Jocularly asked the patient if he had bees in his bonnet". This was attributed to youth.

4. Strategies for Risk Reduction in Pediatric Anesthesia

Perioperative respiratory adverse events (PRAEs) are common in pediatric patients during ambulatory anesthesia. A cross-sectional observational study of 430 healthy children, aged 1–7 years, who underwent elective short-term surgical procedures during general ambulatory anesthesia was done. The anesthesia technique was standardized, and demography, preoperative airway, respiratory, and antibiotic hypersensitivity, atopy and peroperative characteristics were recorded. PRAEs were defined as oxygen desaturation, coughing, laryngospasm, bronchospasm, wheezing, bag ventilator, or extubation. Statistical analysis included t-test, chi2, multiple logistic regression, and decision tree learning. A total of 268 PRAEs occurred in 214 of 430 (49.8%) study participants. Postoperatively, 256 PRAEs occurred in 199 patients (92.5%). The cough, bronchospasm, and laryngospasm/movement accounted for 77.5% of PRAEs. PRAEs were significantly associated with ASA-PS ≥2,

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allergy, adenoid hypertrophy, history of pneumonia, vaccination/antibiotics in the last 2 weeks, sevoflurane, MAC-hour sevoflurane, nitrous oxide, and fentanyl ($P < 0.05$). Sevoflurane, MAC-hour nitrous oxide, and scoliosis screening doses played an interaction role with body mass index percentiles. The children are a common location for multiple and concurrent respiratory adverse events. Most are coughing, and they mostly occurred postoperatively (Marjanovic et al., 2022).

4.1. Preoperative Evaluation and Preparation

Every year, obese children with comorbidities are increasingly placed under elective surgery, often outpatient. It is therefore necessary to perform an evaluation of the basic vital functions before the surgery and to postpone elective surgical procedures. Two weeks after a respiratory tract viral infection can affect a large part of the airway mucosa with inflammation, edema, increased mucus secretion and increased hyperreactivity. Elective surgical procedures, including outpatient, should be avoided until the expiration of at least two weeks after respiratory viral infection, until the complete recovery and the disappearance of existing airway hyperresponsiveness (Marjanovic et al., 2022). However, there is a lack of agreement in the available literature data about the time period that should elapse after respiratory infection until the performance of anesthesia and surgery in children, with a frequency of outpatient surgery. The situation is somewhat different with symptoms and recurrent respiratory infections that are very common in obese children. Obese children with comorbidities have a higher prevalence of moderate to severe obstructive sleep apnea (OSA), 40% of whom remain undiagnosed. The National Sleep Foundation Standard strongly recommends the assessment of these patients before surgery and warns of postoperative risk related to increased obstructive respiratory events. Multifactorial model shows that the simultaneous presence of certain factors in anesthetic procedures increases the risk of airway obstruction in patients with OSA, with complete airway obstruction as the most serious adverse event. Hence, predicting that surgical or nonsurgical procedures dependent on general anesthesia significantly increase the risk of respiratory adverse events in obese children with undiagnosed OSA. The preoperative evaluation of symptoms which the child currently has or has had so far in connection with airway obstruction is significantly important in predicting obstructive respiratory events that may occur postoperatively. Consequently, after GINA and ATS / ERS guidelines, obese children with existing symptoms and current management of OSA suspicious according to STOP-Bang questionnaire and surgery-directed AI for children should be postponed for anesthesia procedure. Obese children with newly diagnosed moderate to severe OSA according to overday polysomnography (necessary postoperative respiratory adverse events). They must not be treated poorly before an operation, and consideration should be given to adjusting anesthesia management before surgery. In obese children with possible undiagnosed OSA, close attention should be paid to the widespread use of regional anesthesia techniques and the

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possible administration of anxiolytic premedication with the lowest possible doses. A child with a priori suspicion of cardiac disease because of asynchronous obesity and ankle swelling requires appropriate clinical evaluation by a cardiologist, electrocardiogram, and preoperative echocardiography. A child with diabetes mellitus (DM) does is not a rarity and 60% of them are obese. Due to the higher risk of perioperative complications, the principle is that DM be well regulated in the preoperative period. Therefore, in diabetic obese children, it is obligatory to conduct a tight preoperative regulation of glycemia in consultation with a pediatric endocrinologist. It is well-known to fasting pediatric anesthesiologists with forbiddance of intake of clear liquids containing particles with caloric value at least 2 hours before the operation. Clear liquids, however, can also contain a high sodium level, which can lead to hyperglycemia in diabetic patients. For this reason, the guidelines suggest that children up to 6 months old (including infants) should abstain from fluids 2 h before any surgery, and those older take clear fluids 2-4 h before the surgery. In practice, there are often difficulties for the anesthesiologist for outpatient clear guidelines which time period is optimal in connection to the intake of clear alcoholic beverages before the scheduled operation. Hypertonic beverages have to do a higher rate of gastric emptying in comparison to water based beverages, the suggested more liberal attitude is allowed ingestion of alcoholic beverages up to 2 h before the surgery. Baseline peripheral saturation of pulse oxyhemoglobin should be measured in all children, particularly in those at increased risk of hypoxemia during the perioperative period. Both AAP and APSF guidelines make sense to perform preoperative measurement of oxyhemoglobin saturation by pulse oximetry, regardless of the method of anesthesia administration, and recommend crying tolerance upto 4 years of age. It is advisable to consider Devin and Llevi's suggestion for extending the measurement until 7 years of age. According to the ASA recommendation to monitor SpO2 both before and after the procedure, it is noteworthy that adequate equipment that includes small finger sensors are mandatory for implementation in the PACU. Due to its potential to reduce the risk of respiratory depression, airway interventions, and changes in depth of parallel, more frequent monitoring of young children and particularly obese children is recommended in the postoperative period. For premedication, the guidelines suggest consideration of the use of short-acting oral sedative sedative-to-induction medications as long as the time window is respected to pre-administer, in order to alleviate preoperative anxiety. Since there is an increased danger of airway obstruction and bronchial collapse from intravenous sedative premedication, benzodiazepines should be given for an extended 1-1.5 h before, with a recommended at least half of the usual dose. Midazolam is a potent bronchoconstrictor and is associated with risk of severe respiratory depression in pediatric patients, especially in those under 5 years of age (not recommended for use; it is only permitted with the presence of resuscitation equipment and knowledgeable personnel). Dexmedetomidine (DEX) is preferred over midazolam as superior medication for

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premedication of pediatric patients. Even with the maximum therapeutic dose, a number of studies show that the lowest frequency of respiratory disturbances is associated with the use of DEX. High doses of DEX are better tolerated because they do not cause respiratory depression, airway obstruction or collapse, as is the case with other narcotic and non-narcotic sedatives. Dexmedetomidine (DEX) in various concentrations is accepted in premedication of non-confused spectrum of pediatric surgical patients, including patients with upper respiratory tract infections. Pre-anesthesia sedation with single-dose pharmacological agents in the form of syrup can also be useful tool for the alleviation of preoperative anxiety. In the vast majority of children, insertion of an intravenous cannula become necessary to administer sedative medication or other drugs that are mandatory for anesthesia. The child's obesity and the limited visibility of the vein are generally more prone to infiltration and extravasation, which can cause burns and phlebitis. In the post-anesthesia care unit (PACU), only 10% of overweight children have inadequate hydraulic vein access in counting device. Sonopuncture represents a very helpful, efficient, and time-saving technique for deaf children which can be transported to the operating room with limited echographic equipment. Adequate ultrasound-guided venous puncture increases the efficiency of the first venipuncture in real time, which makes it more successful and leads to a decrease in potential phobi-traumatic incidents. This especially applies to obese children, since the visibility of peripheral veins is often limited. A significant difficulty for pediatric anesthesiologists and pediatric surgeons is the dosage of optimal drug doses for the induction and maintenance of anesthesia in obese pediatric patients. Due to physiological changes and morbid obesity and body composition, higher doses of anesthetic drugs are required to achieve the desired anesthetic effect. In clinical practice, a big challenge is calculating the optimal dose of induction agent. Obese children often have a greater muscle mass in relation to their ideal body weight (IBW), which means that the necessary doses of the anergic and relaxant will be calculated according to IBW, and the doses of other drugs in the end standard dosages. Any other calculation of dose decreases the therapeutic effect below or increases the risk of unwanted side effects, including life-threatening initiation of therapy. Due to the potential for surgical or anesthetic complications, it is recommended to perform so-called bariatric cases in hospitals that have all the necessary medical equipment and experienced personal medical staff. Chronic diseases are often associated with additional medical consultations and, if necessary, additional clinical tests.

5. Conclusion and Future Directions

Pediatric patients, ranging from term neonates to adolescents, require 0.5–2 new books of anesthesia each year. Hence, it is decided to go through the concepts and the current clinical implications. A section is dedicated to risk reduction in pediatric anesthesia. Monitoring of anesthesia will cover the problems and solutions of spectral analysis and neuromuscular monitors. A relevant experience is cardiac assessment. Local anesthesia and regional blocks will be covered, focusing on the prevention of awake surgery. The last section will approach

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the new trends in pediatric anesthesia. A huge amount of work is needed implementing any kind of telemonitoring and/or teleconsulting at home (O. Sepúlveda et al., 2021).

COVID-19 considerably impacts on anesthesia practice, including the endotracheal intubation process for children. The extension and fragility of hands and arms surpasses a great deal the size of a non-infant patient extraglottic airway. Personal protection equipment (PPE) increases the difficulty of intubation of highly infectious patients. Also, administration and retrieval of airway protective devices like viral filters, aren't straightforward (Gai et al., 2020). A direct view in airway management exceeds the monitoring capabilities of the operating theatre control room and the evaluator's expertise may be crucial; but it seems inappropriate to stand so near a maintenance door to witness it closely. Security personnel is also trained just to look at monitors.

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