

Careful Planning in a Pediatric Expected Difficult Airway in a Specialized Tertiary Hospital: What can Go Wrong? A Case Report

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Abstract

The expected difficult airway in children is a rare but challenging entity. Publications about pediatric airway management present global recommendations and strategies in order to improve safety and outcome. However, even when a careful plan is implemented according to these fundamental aspects, safety and efficacy may be compromised. The objective of this case report is to alert for the importance of a careful airway planning along with an exhaustive attention to details. A 6 month-year-old child with a complex polymalformative syndrome was scheduled for anti-reflux surgery due to recurrent respiratory infections. A careful plan for airway management was designed, based on airway examination and description of a previous approach with a video laryngoscope. It was decided to schedule two anesthesiologists, one of them experienced in the difficult airway approach. Airway management was planned in order to maintain spontaneous ventilation under inhalational anesthesia with sevoflurane and 100% inspired oxygen fraction. Approaches and sequential steps after failed intubation attempts are described as well as technical difficulties related to material and devices. Given the risk of losing the airway and ventilation it was decided to proceed with the final step of our plan and a surgical tracheostomy was performed.

This is an example of how meticulous should be our preparation when planning the airway management in pediatric anesthesia. The presence of another anesthesiologist with expertise in pediatric difficult airway approach, exhaustive description of previous airway approaches and the meticulous revision of the available material including that for invasive procedures should always be kept in mind.

Keywords: Airway management; Congenital abnormalities; Pediatric; Tracheostomy

Introduction

Focus on a safe conduct and raising the standards of perioperative care are key elements in pediatric anesthesia. The expected difficult airway in children is a rare but challenging entity [1]. Recognition and adequate registry of the difficult airway, as well as expertise, and a corresponding infrastructure are essential for a successful management of pediatric airway.

To the best of our knowledge, there's a lack of prospective or retrospective, multicenter and large cohort studies available focusing on the incidence, management, and outcome of expected difficult airway in children. Even though there are some recommendations about the pediatric expected difficult airway and airway management in children with facial abnormalities that we should have in mind [1-3]. Based on the existing literature, there's not a clear recommendation about which technique should preferably be used in which entity or at which age. However, maintenance of spontaneous breathing until definitive airway is secured as well as the use of flexible endoscopes is frequently suggested as the preferred technique in children with expected difficult airways [1-3]. Despite the recognition that video-laryngoscopes can be generally effective in the management of difficult airways in children, the definitive value of these devices is not currently clearly defined [2,3].

This case report highlights the importance of these topics for safety and points out what can be missing even when a careful planning is advanced for airway management of an expected difficult airway. Written consent for publication of the manuscript was granted by the child's parents.

Case Report

A 6 month-year-old girl, weighing 3.900 kg, was scheduled for Nissen fundoplication surgery and placement of a percutaneous endoscopic gastrostomy (PEG). She was an ex-premature of 32 weeks with a complex polymalformative syndrome associated with a subtelomeric deletion of the long arm of chromosome 17. She had gastro esophageal reflux and recurrent respiratory infections requiring continuous oxygen therapy. Decision about the ideal time for surgery was consensual between pediatric surgery and pediatric critical care specialists since this was the child's most stable period and the correction of reflux was important to improve the respiratory pathology. At 54 days after birth, there was a note in a previous electronic clinical record referring a difficult airway in the context of an intubation with a video-laryngoscope for surgical placement of a central venous catheter. The airway was described as "difficult and strange"; no more information provided. One month later an otorhinolaryngologist who registered no airway deformities and a mild edema of the arytenoids performed a flexible nasofibroscope. At the time of our observation, before surgery, the baby had a nasal cannula for oxygen therapy (4 L/minute) and peripheral oxygen saturation (SpO₂) 92% that diminished for 85% with agitation. Pulmonary

auscultation revealed bilateral rhonchi and wheezes. In airway examination we have recorded a retrognathia and micrognathia, cleft palate, short neck and significant reduction in cervical mobility. Blood tests: hemoglobin 9.5 g/dl, normal platelets count and no leukocytosis. No alterations in coagulation times and a normal renal and hepatic function. Previous x-rays revealed diminished thoracic expansibility with radiologic signs of atelectasis.

For anesthetic decision-making the case was discussed with the pediatric intensive care specialists and pediatric surgeons taking into account the presence of a difficult airway and the impact of ventilator strategies and upper abdominal surgery on the underlying respiratory disease. It was decided to schedule two anesthesiologists, one of them experienced in the difficult airway approach. Airway management was planned in order to maintain spontaneous ventilation under inhalational anesthesia with sevoflurane and 100% inspired oxygen fraction (FiO₂). In the operating room intraoperative monitors included electrocardiogram, non-invasive blood pressure, pulse oxymetry and end-tidal CO₂. Anesthesia was induced with sevoflurane while keeping spontaneous ventilation and two peripheral intravenous accesses were obtained.

Airway obstruction during facemask ventilation was overcome with an oropharyngeal tube. First attempt of laryngoscopy was performed by video-laryngoscopy (Glidescope®) with a size 1 blade and an endotracheal tube with a preformed stylet (Plan A-step 1). The laryngoscopy was difficult requiring backward pressure on cricoid and neck mobilization for visualization of the posterior commissure and vocal cords. Intubation attempt was not successful due to difficulties directing the endotracheal tube, abundant and thick secretions and rapid desaturation. After optimizing patient position and modifying the shape of the tracheal tube with the stylet it was made a second attempt with the video-laryngoscope (Plan A-step 2). It was visualized edema of laryngeal structures and there was a resistance when trying to advance the tube. A secondary tracheal intubation plan was followed changing the technique in order to achieve a better visualization and easier orientation of the tracheal tube. A third attempt with direct laryngoscopy showed a grade 4 in Cormack-Lehane classification (Plan B). Given the rapid desaturation and technical difficulties, it was decided to introduce a laryngeal mask I gel® size 1 in order to optimize oxygenation and obtain a conduit for fiberoptic intubation (Plan C-step 1). This approach was complicated by abundant secretions impossible to be suctioned by the smaller fiberscope without working channel (diameter 1.8mm). Regarding the edema of laryngeal structures and the underlying respiratory disorder, it was not feasible waking the baby without securing airway. The pediatric surgeon was aware of difficulties and the potential need for emergency tracheostomy. It was requested the collaboration of another anesthesiologist previously informed about this case, with a large experience in the difficult airway approach, and a pediatric otorhinolaryngologist given the risk of emergent tracheostomy. After arrival of the third anesthesiologist there was another intubation attempt by fibroscopy which was very difficult because of abundant secretions. It was administered glycopyrrolate (Plan C-step 2). Even though, after advancing the fiberscope, a resistance was felt and the endotracheal tube (size 3.5) did not progress through vocal cords. Given the doubt about distal edema or the presence of a malformation and considering the reduced glottic lumen and progressive elevation of inspiratory pressure with laryngeal mask spontaneous ventilation it was decided to proceed with surgical tracheostomy (Plan D). Parents were informed. Fentanyl was administered for analgesia. For tracheostomy there were only neonatal cannulas size 3 and 4.5 and

pediatric cannulas size 3.5 and 4. A neonatal cannula size 3 was inserted but with inefficient ventilation due to significant leakage. After changing for a pediatric cannula size 3.5, the leakage was reduced but was observed a SpO₂ 80% with 100% FiO₂. Thorax X-ray revealed a hypoventilated left lung without pneumothorax. The fibroscopy through the tracheostomy confirmed a distal localization of the cannula, which had to be exteriorized and fixed again with gauze pads as a provisory solution. The baby went to the Intensive Care Unit to improve the respiratory dysfunction and for optimization of ventilation and later reassessment of pharyngeal-laryngeal conditions by the otorhinolaryngologist. The surgery was reprogrammed.

In the day after this episode a neonatal cannula size 4 was provided and changed with improvement on ventilation without air leakage. The child gradually recovered from respiratory dysfunction and there was no clinical degradation related to the previous state before this episode. A few months later the surgery was performed.

Discussion

Publications about pediatric airway management present global recommendations and strategies in order to improve safety and outcome [1]. However, even when a global strategy is implemented according to these fundamental aspects, safety and efficacy only can be assured with commitment of all team members, double-checking equipment availability and training [1,4]. One of the main aspects for a safe conduct in pediatric anesthesia is to be able to define clearly the 'who', 'where', 'when' and 'how' [5]. Neonates, infants and small children must be anesthetized in specialized pediatric centers with operating theatres staffed by adequately trained pediatric anesthesiologists and pediatric nurses, and postoperative recovery facilities for neonates and children [5]. Regarding the 'who' and 'where', in the case reported here, the child was in a specialized center with trained pediatric staff. Decision of including two anesthesiologists, including a more experienced one in pediatric difficult airway, and a third available was based on the risks anticipated in airway management. The optimal timing for surgery was also discussed as mentioned in the case description. Considering the anesthetic risk and the perceived need for surgery, the process of decision-making ('how') involved a multidisciplinary group including anesthesiologists, pediatric surgeons, otorhinolaryngologists and pediatric intensive care specialists. Risks related to airway management and respiratory dysfunctions in the perioperative period were anticipated. These questions are crucial and should be answered before planning any airway approach. A careful planning of airway management was then conducted. Difficulties were anticipated based on the physical exam and a record of a "strange and difficult" airway in a previous intubation by video-laryngoscopy with the additional information of no airway deformities in a nasofibroscopy performed after that episode. Based on the existing literature, there is not a clear recommendation about which technique should preferably be used in which entity or at which age [1-3]. The use of a supraglottic device to secure the airway during surgery was not an option considering the scheduled surgery. It was decided to maintain spontaneous ventilation and proceed with video-laryngoscopy. Fiberscope intubation through a laryngeal mask was kept as a strategy in our plan. Our difficult airway trolley has a material checklist and is regularly inspected by an anesthesiologist experienced in the pediatric difficult airway. It was checked again the day before surgery, and the airway technical devices were tested for functioning. The surgical team was prepared to intervene if a complication came up. Since we have a multidisciplinary strategy, trained personnel, specific

equipment inspected and tested and a careful plan with multiple steps, what went wrong?

Regarding the first option in the airway approach, it was assumed that the child was previously intubated by video-laryngoscopy. However, when the case was reviewed, it was found in a handwritten registry that the child actually was not intubated and that the previous option was a laryngeal mask. The electronic alert for difficult airway was not registered and the record in the electronic clinical process was not providing accurate information. It has been demonstrated that the institution's implementation of a difficult airway registry optimizes the identification and care of patients with a suspected or known difficult airway, however it is recognized that some cases may not be reported and that the registry may be incomplete [6]. Hosking et al in a retrospective analysis of difficult laryngoscopy over time demonstrated that adequate and sufficient documentation within the anesthesia record was missing, probably a common problem in most anesthesia charts [7]. As we can see in this particular case, incomplete records and improper allocation of information may influence key decisions in the planning process. Otherwise, the most likely option in this case would be fiberoptic intubation through laryngeal mask to have shorter access to the vocal cords while keeping spontaneous breathing [2,3]. Even though, the lack of a suction channel in the fiberoptic may pose important obstacles to a successful intubation. In a previous study in a small cohort of children with craniofacial dysmorphic syndromes it was evidenced that the video-laryngoscope (GlideScope®) is not a fail-safe technique [8]. In three of the 18 patients, the use of video-laryngoscope did not improve the view as compared with direct laryngoscopy, and in two patients the flexible fiberoptic was used (once directly and once via a laryngeal mask airway). There is some evidence of the usefulness of video-laryngoscopy to manage difficult airways in children [9]. However, in the absence of studies showing the superiority of using video-laryngoscopy in the pediatric difficult airway, the fiberoptic bronchoscope probably should be the first option when facing the need to intubate a child with a difficult airway in pediatric anesthesia [3]. In this case report were also mentioned ventilation problems after tracheostomy due to the lack of an appropriate sized cannula. As mentioned above, our difficult airway trolley has a checklist and is verified regularly by an anesthesiologists, and it also follows the recommendations for devices and equipment that should be included [10,11]. Considering the invasive approach to airway, recommendations include commercial kits for cricothyrotomy. Despite the anticipation of the risk for an invasive approach and the availability of surgical equipment in the operating room, the cannulas provided hadn't an adequate size and this was a factor of inefficient ventilation. Since the incidence of expected pediatric difficult airway is very low, even in specialized centers, and those ending in a surgical approach are even more uncommon, this topic is not extensively exposed [1,10,11]. We also agree that care must be taken not to overfill the trolley with extra 'specialized' equipment as not to limit the accessibility of emergency equipment [10,12]. However, we think that is important to highlight this topic because, as we reported, the detailed revision of all material and equipment can make the difference in the efficacy and celerity of our actions. It should be also noted that the presence of trained personal and the previous preparation of the team members for anticipated difficulties is the key to manage stressful situations and solve unexpected problems.

Conclusion

This case is an example of how meticulous should be our preparation when planning the airway management in pediatric anesthesia.

As final messages we would like to reinforce the idea that perhaps the best initial approach in the case of an expected difficult pediatric airway may be fiberoptic intubation through laryngeal mask while keeping spontaneous breathing.

The presence of another anesthesiologist with expertise in difficult airway is essential not only due to technical skills but also for anticipation of difficulties and adequate decision making.

Although invasive approaches to airway management are uncommon, special attention must be kept regarding the available material for pediatric patients.

And finally, airway alerts and registries should always be done in the proper location, as previously defined by the institution, and must be exhaustive in order to help professionals in future approaches. Regular audits may be necessary to achieve this standard of care.

Reports of difficulties and misses along with information on the strategies of managing difficult airway may be an essential contribute for a safe conduct in pediatric anesthesia.

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