



PENETRATING HEAD INJURY IN A CHILD – A CHALLENGING AIRWAY MANAGEMENT

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Abstract:

Traumatic head injury could lead to morbidity as well as mortality. Airway management is also a topic of debate in such cases. In this case, a 17-month-old child presented in A and E department of Dow University of Health Sciences, Karachi with a toy car wheel penetrated in his occiput region. His craniectomy was planned to remove the foreign body and required securing of airway for anesthesia purpose. In terms of airway management, endotracheal intubation via rapid sequence intubation has been proved as a gold standard mean in trauma cases. Clinical literature has also reported early use of indirect methods such as fiber-optic laryngoscopy or video laryngoscopy as mean of easy placement of endotracheal tube with lesser complications.

A number of difficulties were faced during this case, site of injury being the major one. The impacted toy wheel on occiput region made it difficult to lie child on flat surface and limited extensive manipulation. Other than that, lack of advanced equipment and unavailability of pediatrics anesthetist were also contributing factors. With simple positioning maneuvers, we were able to secure child's airway without any further complications

Introduction:

Traumatic head injury is reported to be a common cause of death in trauma patients. ¹In pediatric age group, these injuries can lead to lifelong disabilities as well as deaths ² and can occur both; accidentally, while playing or as a result of child abuse. ³ About 0.4% of all head injuries are penetrating head injuries (PHI). ⁴ PHIs are defined as head injuries that involve the laceration of Dura

mater.⁵ Due to rare nature of PHIs, there are no standard guidelines for their management.⁶ Management of such cases becomes more difficult if the object remains impacted in skull as it creates technical difficulties in investigations and management of victims.⁷

Airway protection is utmost priority in all trauma patients and the gold standard method of securing the airway is endotracheal intubation.⁸ Airway management in pediatric population is difficult in comparison to adults. It is due to certain anatomical differences like large adenoid tissues, large tongue in proportion to oral cavity, large occiput in relation to the body and short thyromental distance.⁹ Along with these factors, the injury also contributes to difficulties in airway management.⁸

We present a case of a 17-month-old male child who sustained a penetrating injury to the head by a toy car while playing.

Case:

A 17-month-old male child weighing 12 kg with no significant medical history presented in A and E department of Dow University of Health Sciences, Karachi. He had a toy car wheel accidentally penetrated in his occiput region. (**Figure 1**)



Figure 1. Foreign body at the occipital region

On examination, his GCS was 15/15 and was hemodynamically stable maintaining saturation of 99% on room air. Chest examination revealed bilateral equal air entry with no added sound and S1 and S2 were also audible.

On airway examination Malampatti score was 1 while rest of the other parameters including length of upper incisors, relation of maxillary and mandibular incisors while jaw being closed, inter-incisor distance, shape of palate, thyro-mental distance, mobility of cervical joint and length of neck were normal. The foreign body however, was impacted at the occipital region which was documented to be 2cm deep on CT-scan findings, which made it difficult to position his head directly on a flat surface. Patient was nil per oral for last 6 hours for solids and 2 hours for liquid.

Investigations showed a hemoglobin of 11 g/dl, total leukocyte count of $12.7 \times 10^9/L$, platelet count of 451, 000 per microliter. CXR was unremarkable. CT scan was performed and it revealed linear hyper dense object present at the occipital region, involving bone and extending into parenchyma involving posterior one third of anterior sagittal sinus showing evidence of edema around the lesion. (**Figure 2**) An emergency craniectomy and foreign body removal was planned, and patient was taken in emergency O.R.



Figure 2. CT scan

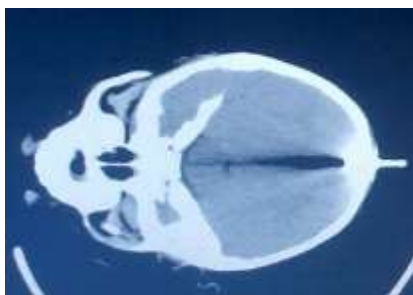


Figure 3. Foreign body with part of skull bone

As the child was a bit combative, he was first deepened using inhalation agent Sevoflurane and then a 22 G IV cannula was secured and he was positioned in a donut shaped pillow in such a way that the site with the foreign body was placed in the hollow of the pillow, so that it could not touch a flat surface directly. Also rolled sheets were placed below the shoulder and the back. All the equipment and aids including a stylet, bougie, ETTs of different sizes, a working suction, and different types and sizes of laryngoscopy blades for anticipated difficulty in intubation were placed nearby. Once position was satisfactory, rapid sequence induction was performed using Inj. Propofol 20 mg, Inj. Midazolam 1 mg and Inj. Suxamethonium 20 mg. Laryngoscopy was attempted using Miller laryngoscope of size 1 without compromising the child's position and avoiding excessive movement of the head. Upon visualization of vocal cords an uncuffed ETT of size 3.5 mm was passed and fixed at 10 cm on lips. After intubation, patient was positioned lateral. Inj. Nalbuphine 1 mg and Inj. Paracetamol 180 mg was given for pain relief and anesthesia was maintained with Isoflurane and Inj. Atracurium for muscle relaxation. Inj. Dexamethasone 2 mg was given to prevent post-operative nausea and vomiting. The foreign body along with part of skull bone was removed. (**Figure 3**) After completion of procedure, patient was safely extubated after adequate reversal of neuromuscular blockade using Inj. Neo-pyrrolate 0.8 mg.

Discussion:

Securing the airway after any form of severe injury is critical to ensure adequate oxygenation and tissue perfusion.¹⁰ In emergency, securing the airway in the form of endotracheal intubation proves to be useful and often necessary as such patients are at risk of compromised ventilation.¹¹ Trauma patients constitute around 20-30% intubations taking place within the emergency department.¹ Emergency situations create a stressful environment making intubations difficult even in adults. In the pediatric and neonatal population this becomes even more challenging. This is further complicated by the lack of clinical experience of healthcare professionals with pediatric intubations as compared to adults paired with the unique complexities of injury.¹¹ Furthermore, while providing anesthesia to children in areas with limited resources, anesthetists are faced with challenges associated with limited equipment, less healthcare providers and stringent facilities for postoperative care.¹⁵ There are existing guidelines for the management of difficult airway (DAW) in adults; however, there are no similar guidelines available for the pediatric age group.¹² In our case, we were unable to find any guidelines or literature highlighting the airway management of a child with a penetrating head injury.

The term 'difficult airway' is defined as any difficulty faced in the process of securing the airway which may include problems faced during airway access, bag mask ventilation, laryngoscopy and intubation.¹³ One of the factors predisposing to difficult intubation is inability or difficulty to position due to injury. Such cases require manual inline stabilization and airway could be approached with bougie, video laryngoscope or external laryngeal manipulation.

A multicenter study including >1000 children with difficult airways showed that 3 or more than 3 attempts of direct laryngoscopy increase risk of complications and failure of intubation. The most common complication identified was transient hypoxemia.¹⁵ Hence, early use of indirect methods

such as fiber optic bronchoscopy or video laryngoscopy can prevent such complications.¹⁶ Additionally, it is important to place the ETT correctly as incorrect placement in pediatric population is associated with a much higher risk of complications.¹⁷ Another study showed that rapid sequence induction is method of choice of induction in pediatrics emergencies with high success rate and reduced complications.¹⁸

In the US, children over the age of 2 years come under the domain of general anesthesiologists; however, children under 2 years are mostly facilitated by Pediatric anesthesiologists, a subspecialty certified by the American Board of Anesthesiology.¹⁹ This is because trauma and surgical procedures in children pose numerous challenges to the front-line workers and anesthesiologists. Neurosurgical procedures report the highest rate of morbidity in all pediatric subspecialties of surgical origin making them even more critical to cater to.²⁰⁻²¹

Conclusion:

Airway management of patients with head trauma poses a unique challenge to anesthetists especially in the pediatric age group. This is particularly difficult to manage with limitation of resources. However, securing the airway in such patients is of utmost importance and must be done as soon as the patient is received to ensure good patient outcomes. Proper positioning and team coordination are key for smooth intubation. Emergency drugs, difficult intubation trolley and the senior most anesthetist available should be present at all times

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