

Airway Obstruction following Snake Bite – A case report.

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SUMMARY

A 25-year old farmer was referred from a private clinic to the University of Ilorin Teaching Hospital (UIITH) with a 6-day history of snake bite in his farm. He was conscious on admission and had bleeding tendencies. His PCV on admission was 10%. A diagnosis of vasculotoxic snake bite was made. The patient was admitted, treated with anti-snake venom (ASV) and was transfused with 8 units of fresh whole blood. He subsequently developed a massive oedema of the tongue resulting in upper airway obstruction requiring urgent intervention. The anaesthesia team was invited for possible endotracheal intubation. The airway management is presented.

KEY WORDS: Snake bite, upper airway obstruction, difficult airway, anaesthetic management, tracheostomy.

INTRODUCTION

The fundamental responsibility of the anaesthetist is to maintain adequate gas exchange. In order to do this, the airway must be managed in such a way that it is almost continuously patent. Failure to maintain a patent airway for more than a few minutes results in brain damage or death. Complicated airway problems are common in anaesthetic practice and the common causes are well known¹. Among several known causes, airway difficulties may be related to congenital, neoplastic, infective disease or any abnormality of the structures in the vicinity of the path to be followed by an endotracheal tube. Increased antero-posterior thickness of the tongue has been used as a criterion of difficult intubation². Such abnormalities that exist along the path to be followed by the tube as seen in this patient may present as acute upper airway obstruction requiring urgent intervention for the relief of the obstruction. This patient presented with both difficult airway and acute upper airway obstruction. The management options in this scenario are discussed.

CASE PRESENTATION

S. G., a 25-year old farmer was referred from a private clinic to the Accident and Emergency ward of the University of Ilorin Teaching Hospital as a case of snake bite on the left index finger of 6 days' duration. He was initially managed by a nurse at home for 2 days, but after he "collapsed" he was rushed to the referral hospital. At the referral hospital, he developed progressive swelling of the affected upper limb, haematemesis, total haematuria

and passage of melaena stool. He also bled spontaneously from injection sites. Three units of fresh whole blood, ASV were administered, but was referred with a PCV of 12% on account of lack of satisfactory improvement.

On admission, he was acutely ill, conscious, alert and very pale. The pulse was 120/min, and was of good volume while the blood pressure was 130/50 mm Hg. There was a dressing over the left index finger, swelling of the whole left upper limb which was neither tender nor warm. Clotting time revealed that his blood did not clot after 1 hour. A diagnosis of vasculo-toxic snake bite of the viperine group was made.

The PCV on admission was 10%. Anti-tetanus serum 1,500 units were administered intravenously, while he was commenced on ampicillin and cloxacillin 1g q 5h. i. v. Three units of fresh whole blood were transfused on admission and 1 litre of 5% dextrose in 0.9% saline was administered eight hourly. The urethra was catheterized for urine output monitoring.

Investigations: -

1. PCV = 12% after initial transfusion with three units, of fresh whole blood.
2. WBC = 11. 10⁹/L (normal = 4-11 x 10⁹/L) N 80%, L 16%, Eo 4%.
3. Serum electrolytes: Na⁺ 148mmol/L, Cl⁻ 106mmol/L
4. Urea 13. 7mmol/L

By the third day of admission, the patient developed progressive swelling of the tongue and was unable to talk well. Seven more units of blood were transfused. He developed acute upper airway obstruction on the seventh day of admission. The anaesthesia team was then consulted about endotracheal intubation.

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AIRWAY OBSTRUCTION FOLLOWING SNAKE BITE

ANAESTHETIC MANAGEMENT

At pre-anaesthetic visit, the patient was found to be drowsy, restless and in severe respiratory distress. There was a massive swelling of the tongue with inability to close the mouth (see illustration). He was acyanotic, obviously due to severe anaemia and had both inspiratory and expiratory stridor. Respiratory rate was 36/minute. Auscultation of the chest revealed diminished air entry bilaterally with transmitted sounds globally. The airway was Mallampati Class IV and ASA grading was 4E. Difficult airway management was anticipated. Contingency plans for difficult airway management including the presence of an otorhinolaryngologist in the operating room were made. Various sizes of endotracheal tubes and laryngoscope blades adequate for the patient were made available.



In the operating room, baseline vital signs as recorded by the "Nellcor Puritan Bonnet NPB 4000" patient monitor showed a pulse rate of 140/min, BP 100/60mm Hg and arterial oxygen saturation (SaO_2) of 85–89%. Following pre-oxygenation and under deep halothane anaesthesia using a face mask (difficult to apply), gentle laryngoscopy was carried out. The laryngoscopic view was grade IV despite optimum external laryngeal manipulation. The base of the swollen tongue almost obliterated the pharyngeal space. The pharyngeal structures were oedematous. Nasotracheal intubation was not attempted. Because of inability to secure the airway through conventional laryngoscope, an emergency tracheostomy

was considered the best option to relieve upper airway obstruction.

For maintenance of the patency of the airway, a size 7.0mm ID polyvinyl chloride tube was passed into the oropharynx and connected to the anaesthetic machine via a Brain Circuit. The patient was placed supine with a slight Trendelenburgh and the head was extended. Synchronous excursion of the reservoir bag with the patient's respiration was used to monitor the patency of the airway.

Anaesthesia was maintained with 50% nitrous oxide in oxygen and halothane 1.5–2% with the patient breathing spontaneously. Following tracheostomy, anaesthesia was maintained via an endotracheal tube passed through the tracheostomy tube. A metal tracheostomy tube size 28FG. was used.

Intraoperatively, the systolic BP ranged between 100 and 140mm Hg while the diastolic BP ranged between 50 and 70mm Hg. The pulse rate ranged between 140 and 150/min while the SaO_2 was between 85–100%. Two hundred millilitres of normal saline were infused. Blood loss was minimal.

Surgery time was 40 minutes, anaesthesia time, 1^o hours. He was admitted into the Intensive Care Unit for management of the tracheostomy and his primary condition. The patient had an initial stable postoperative condition but started bleeding through the tracheostomy wound on the first post-operative day (see illustration). Attempts to obtain fresh whole blood transfusion were unsuccessful. He had an anaemic cardiac arrest about 30 hours after surgery and all resuscitative measures failed.

DISCUSSION

A difficult airway may be defined as one in which tracheal intubation with proper insertion of the endotracheal tube with conventional laryngoscope requires more than three attempts or takes more than ten minutes³. The inability to manage difficult airways is responsible for as many as 30% of deaths totally attributable to anaesthesia⁴. While endotracheal intubation is currently the most assured and common method of airway management during general anaesthesia, there is no consensus with regard to the best technique to intubate the tracheas of patients with difficult airways⁴.

The anatomical causes of difficult intubation were summarized by White and Kander in 1975. These included an increase in both anterior and posterior depths of the mandible, a reduction in the distance between the occiput and the spinous process of C1, and to a lesser extent the C1 – C2 interspinous gap. Reduced mobility of the mandible associated with temporo-mandibular joint arthritis was also included as a cause of difficult intubation. Several pathological syndromes have been associated with difficult intubation such as Marfan's syndrome⁶, Kippel – feil syndrome⁷ and acromegaly⁸. Acromegaly is particularly associated with decreased width of the cricoid arch and enlarged tongue which are predictors of difficult intubation⁹.

Skelton and Goodwin¹⁰ reported perinatal management of a neonate with airway obstruction due to rhabdomyosarcoma of the tongue diagnosed with prenatal ultrasound examination. Airway management in this neonate was by performing a tracheostomy after elective Caesarian section and following an action plan instituted by a multidisciplinary team.

The reported case presented with a massive oedema of the tongue following snake envenomation which resulted in severe upper respiratory tract obstruction. The presenting features were due to systemic effects of envenomation. The challenges posed were (a) difficult airway and severe upper airway obstruction due to massive oedema of the tongue, and (b) disseminated intravascular coagulation (DIC) resulting in severe anaemia.

In a recent study, Opadijo and Omotoso¹¹ reported 155 cases of snake bites in this environment. Local and systemic effects of envenomation as seen in this patient were reported in 36.1% of their series. Six of these cases died giving a mortality of 7.1%. The causes of death were due to disseminated intravascular coagulation in 4 cases and laryngeal obstruction in 2 cases. These local and systemic effects of envenomation are characteristic of bites by Viperidae group of snakes such as *Echis carinatus* which is the commonest in the Benue valley¹².

Disseminated intravascular coagulation as seen in this patient was initially diagnosed by the inability of the blood to clot after 1 hour (normal clotting time being 3 – 11 minutes). Laboratory tests of diagnostic importance in DIC include platelet count, serum fibrinogen and fibrinogen degradation product (FDP) which were not done in this patient. Thrombocytopenia, hypofibrinogenaemia and elevation of serum FDP are the hall marks of DIC¹³. Other clotting tests such as prothrombin time (PT) and partial thromboplastin time, kaolin (PTTK) are prolonged in DIC as a result of consumption of coagulation factors (II, V, VIII). These latter tests were not readily available when the patient presented at the hospital.

The first principle in the management of DIC is an attempt to alleviate the underlying cause. This was done in this patient by the administration of anti-snake venom. Treatment may include fresh frozen plasma, cryoprecipitate (fibrinogen, factor VIII and fibronectin) and platelets. In our environment where blood products are rarely available, fresh whole blood can be used in the management of DIC. Consequently, the patient had fresh whole blood transfusion on admission.

The second challenge posed by this patient was severe upper airway obstruction which had to be relieved in the presence of a difficult airway. The American Society of Anesthesiologists' (ASA) difficult airway algorithm for management of difficult airways begins with preoperative evaluation and recognition of the difficult airway¹³. An airway may be recognized as being difficult on a very obvious level such as was found in this case. Such cases have not been responsible for anaesthesia – related airway catastrophes because of adequate preoperative preparation.

The preoperative evaluation of patients having difficult airway problems should include adequate history and previous history of difficult airway management. Physical examination with special references to airway assessment of respiratory distress and the presence or absence of hypoxaemia should be sought. This patient was in severe respiratory distress with SaO_2 ranging between 85 – 89% (FiO_2 0.21) preoperatively. Cyanosis was obviously not present since the total haemoglobin was less than 5g/dl and it is only present if the amount of reduced haemoglobin is more than 5g/dl. Evaluation of difficult airway also includes mouth opening, size of tongue, mandibular size and depth, and neck movements. A popular, simple and quick test described by Mallampati *et al*¹⁴ is based upon the pharyngeal structures visible when the patient's mouth is wide open. Although the original paper described three classes, a fourth was added by Samsoon and Young¹⁴. The reported case was in class 4 since the tongue swelling occupied a sizeable proportion of the intra oral space with no pharyngeal structure visible.

According to the recommendation of the ASA difficult airway algorithm, if a difficult airway is recognized, then it is logical to secure the airway with awake tracheal intubation. However, this is not feasible in the uncooperative patient as was the reported case in whom tracheal intubation could only be attempted after the induction of general anaesthesia. In addition, the patient was in severe respiratory distress and to attempt awake intubation would be time consuming. Options for awake tracheal intubation include blind nasotracheal and guided fiberoptic tracheal intubation.

Anaesthesia was induced by the inhalation method in this patient. In the presence of respiratory tract obstruction, intravenous agents should not be used and anaesthesia should be induced with a volatile agent with 50% nitrous oxide in oxygen¹⁵. The reason for this is that minor degrees of respiratory tract obstruction may progress to complete obstruction when muscle tone decreases following loss of consciousness. The use of inhalational induction is beneficial as muscle tone diminishes gradually with progressive loss of consciousness, and if ventilation ceases because of total respiratory tract obstruction, the patient wakes up rapidly. Nasotracheal intubation was not attempted because of generalized airway oedema and the possibility of provoking uncontrollable epistaxis in this patient with DIC.

Laryngoscopic view was Grade IV, i.e no glottic structure was visible using the Cormack and Lehane grading¹⁶. A significant correlation had been noted between the ability to visualize the tonsillar pillars, soft palate and usual (Mallampati classification) and the ease of laryngoscopy^{14,16}. In patients with a class IV airway as was this case, the laryngoscopic view is grade III or IV 100% of the time^{9,17}. Since no laryngeal structure was visible despite optimal external laryngeal manipulation, it was not advisable to attempt to secure the airway bearing

in mind also, upper airway oedema.

In this patient where conventional laryngoscopy to secure the trachea was impossible, other alternative techniques where facilities and expertise are available could be used. These include fiberoptic laryngoscopy¹⁸, ventilation¹⁹. The fiberoptic laryngoscope is a very expensive and delicate equipment and competence in its use requires expertise. The LMA can function as an emergency airway except when local pathology in the pharynx or larynx as seen in this case precludes a reasonable chance of even limited gas exchange success.

The patient presented with acute upper airway obstruction which needed urgent intervention. Since facilities for alternative techniques to intubation were not available, the best option was to create a surgical airway through tracheostomy. In the co-operating patient with stable respiration, tracheostomy would have been done preferably under local anaesthetic infiltration. In this restless, uncooperative patient with severe respiratory distress, general anaesthesia was a better option. Apart from having a relaxed patient, patency of the airway and adequate oxygenation was also ensured during the procedure.

Maintenance of anaesthesia and patency of the airway was ensured by placing an endotracheal tube in the pharynx while spontaneous respiration was monitored with the movement of the reservoir bag. The polyvinylchloride endotracheal tube used was firm enough and did not kink under the weight of the oedematous tongue. Face mask anaesthesia with insertion of an oropharyngeal airway was not possible because of abnormal anatomy of the oral region (see illustration). Uncontrollable bleeding in the vicinity of the tracheostomy (see illustration) could lead to airway obstruction and respiratory difficulty. This could have been a likely cause of death in this patient but he had a stable respiration post-tracheostomy and actually died of anaemic cardiac arrest. The advantage of a metal tube used in this case was that the inner tube could be removed and cleared of crusts in order to prevent total tube blockage. A cuffed PVC tube has the advantage of preventing aspiration of blood or secretions. It was a better choice in this patient but was not readily available at the time the patient presented. However, removal of a PVC tube within the first 48 hours for the purpose of clearing crusts could result in the loss of the track which would not have been fully established within the period. To prevent crusting these tubes, very careful and thorough suction is needed.

CONCLUSION

Management of the difficult airway presents great challenges to the anaesthetist. When the factor responsible for the difficulty is along the path taken by the endotracheal tube and causes upper airway obstruction, the challenges become greater. Oedema of the tongue is not an uncommon condition and results from several causes.

Systemic envenomation from any animal bite in our environment should alert the practitioner of the possibility of severe respiratory distress and difficult airway which requires expert management.

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