Case Report

Postintubation Tracheal Stenosis: Surgical Management

N Ezemba, CP Echieh, EN Chime[1], CO Okorie[2], FG Okonna[2], FL Idoko, OA Arua

Division of Cardiothoracic Surgery, National Cardiothoracic Center, University of Nigeria Teaching Hospital, Departments of [1]Otolaryngology and [2]Anesthesia, University of Nigeria Teaching Hospital, Enugu, Nigeria

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ABSTRACT

Postintubation tracheal stenosis (PITS) is a known complication of endotracheal intubation or tracheostomy. It is the most common indication for tracheal resection/reconstructive surgery. Despite technological improvement and skilled patient care in the ICU, PITS still constitutes an important group of iatrogenic sequela after intubation. With increasing number of patients requiring ICU admission and mechanical ventilation in Nigeria, it is important that this complication is prevented from occurring. The care of such patients often is technically challenging. The successful management by resection and end-to-end anastomosis of a 37-year-old man presenting with 2 cm length of severe tracheal stenosis of 4 mm luminal diameter following prolonged endotracheal intubation and who had had repeated bronchial dilatation is presented.

KEYWORDS: *Postintubation tracheal stenosis, tracheal resection, tracheal stenosis*

INTRODUCTION

Most cases of tracheal stenosis result from endotracheal intubation, tracheostomy, or trauma.[1,2] The incidence of postintubation tracheal stenosis (PITS) in the developed world has decreased due to recognition of its etiology and improvements in intensive care procedures.[2] The rate of tracheal stenosis related to prolonged intubation varies between 0.6% and 21%.[2,3] However, in the tropical Africa, the incidence of PITS may be on the increase due to increased use of mechanical ventilation and improved survival rate of patients who have been on prolonged ventilation.

PITS remains the most common indication for tracheal resection and reconstruction.[4] This remains so despite identification of the causes of this lesion and development of techniques for its avoidance. PITS results from healing with fibrosis following stomal and ischemic cuff injuries, especially when a high pressure, low volume cuffed tube is used. Infection and hypotension may also contribute to the events that culminate in tracheal stenosis.[5] Most patients may remain asymptomatic with the pathology running an insidious course. Symptomatic patients present with features of airway obstruction with onset usually between 1 and 6 weeks after extubation.[2,3,6] Successful treatment is usually by resection and reconstruction as the gold standard, although there are several treatment modalities for those considered unfit, too risky for surgery or with complications of the surgery.[3,7-10]

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CASE REPORT

OS is a 37-year-old Nigerian trader resident in South Africa. He presented to us in January 2017 on account of recurrent difficult and noisy breathing and cough of 2 months duration. He was a victim of xenophobic attack and sustained severe head injury that required prolonged mechanical ventilation for 6 weeks in a South African Hospital. His respiratory symptoms appeared 2 weeks following extubation. The diagnosis of PITS was made while still in South Africa, and he had had five bronchoscopic tracheal dilatations prior to this presentation with the last being 2 weeks before admission. Clinical evaluation revealed a young man in severe respiratory distress with inspiratory and expiratory stridor with a respiratory rate of 25/minute and pulse oximetry of 92% at room air. There were no scars on the neck and no evidence of previous tracheostomy.

Address for correspondence: Dr. N Ezemba, Division of Cardiothoracic Surgery, National Cardiothoracic Center, University of Nigeria Teaching Hospital, Ituku/Ozalla, PMB 01129, Enugu 400001, Nigeria.
E-mail: ndubueze.ezemba@unn.edu.ng

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His Karnofsky performance score was 30%. The chest was symmetrical with equal excursion and globally reduced air entry but no crepitations or rhonchi. The other systems were normal. The diagnosis of PITS was sustained but with acute exacerbation secondary to upper respiratory tract infection as evidenced by a neck X-ray and a leukocytosis of 18.38 × 10^9/L with a neutrophilia of 92%, respectively.

Initial management was with a course of antibiotics, oxygen supplementation and salbutamol nebulization. Due to worsening symptoms, he had an emergency bronchoscopic assessment and dilatation with findings of a 2 cm length of tracheal stenosis 4 cm below the vocal cords with a luminal diameter of 4 mm. This was dilated to 8 mm which improved his symptoms to allow for further investigations including a CT-Neck [Figure 1].

Surgical procedure

Two weeks postdilatation, he underwent a tracheal resection surgery as herein described. After a repeat ventilatory rigid bronchoscopy, an armored endotracheal tube size 8 mm outer diameter was handy to secure the airway and was made to rest on the area of the stenosed segment and the neck positioned in hyperextension. Following a cervical collar incision, platysma-skin flap was raised up to the thyroid notch and inferiorly to the suprasternal notch. The trachea was mobilized with division of the thyroid isthmus. With the help of illumination from a pediatric flexible bronchoscope passed via the armored endotracheal tube, the proximal point of stenosis was identified and marked; the lower limit was identified as 2 cm distal to the proximal extent as earlier identified at bronchoscopy. Thereafter the trachea was transected distal to the lower end of the stenosis. At this juncture, a sterile south-facing 6.0 mm internal diameter non-armored endotracheal tube was inserted into the distal lumen of the severed trachea and ventilation continued therewith. The proximal endotracheal tube was pulled back slightly but not completely withdrawn. Resection of the stenosed segment was extended to about 0.5 cm proximal to upper limit. End-to-end anastomosis of the severed segments was effected using 4-0 polyglactin suture in interrupted manner with the knots on the outside of the tracheal lumen. With the neck now in about 30° flexion, the posterior sutures were tied and thereafter the distal endotracheal tube was completely withdrawn and the proximal tube advanced across the sutured posterior tracheal wall to the distal trachea and connected back to the ventilator. The anterior anastomosis was completed using the same suture technique. The rest of the wound was closed in the usual manner with a Redivac drain in the pretracheal space. Intraoperative blood loss was minimal. A chin-to-chest suture was used to keep the neck in flexed position.

Anesthetic technique

Induction was with ketamine and midazolam after atropinizing the patient. Repeat ventilatory bronchoscopy was under deep anesthesia with ketamine and midazolam and then laryngoscopy was facilitated with intravenous succinylcholine and tube position confirmed with capnograph. Isoflurane was used for maintenance, whereas intravenous fentanyl and pancuronium were used for analgesia and muscle paralysis, respectively. At the end of surgery, patient was extubated deep. His ICU and postoperative courses were uneventful and he was discharged on postoperative day 10. A cervical neck X-ray 3 months post-op with normal tracheal lumen is shown in Figure 2. He remains asymptomatic with a performance score of 100% 12 months later.

Discussion

In severe PITS, emergency procedure to relieve airway obstruction may be necessary. Whenever possible, bronchoscopic dilatation should be chosen. This has the

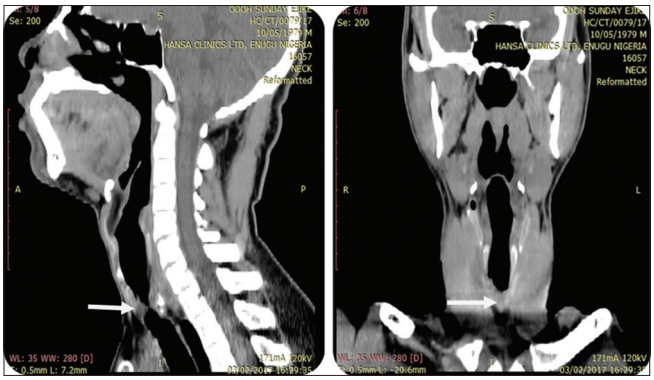

Figure 1: Computed tomography neck. There is 87% stenosis of the trachea with a luminal diameter of 3 mm as against 23 mm. Note also the dystrophic calcification of the trachea at the area of stenosis

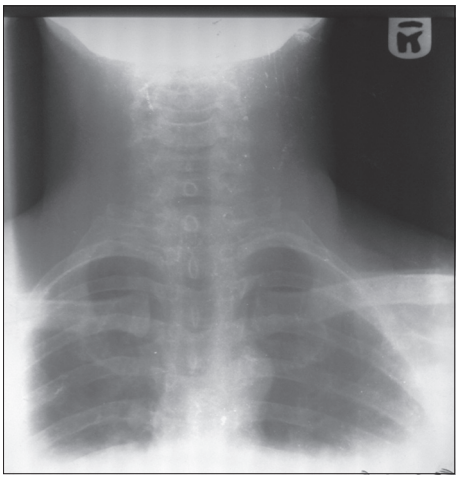

Figure 2: Neck X-ray, 3 months postoperation. The tracheal column of air is within normal

advantage of minimizing further increase in the stenosis length. However, like all other stricture dilatation, vigorous dilatation must be avoided to limit the degree of post dilatation restricture. This explains the rationale for the limited dilatation in our case. Some advocate the use of steroid in patients with PITS especially where surgery cannot be readily offered.[11] In the event of emergency tracheostomy in PITS, it is recommended the tube be inserted close to the stenotic segment since the length of resected tracheal segment, number of resected rings, and duration of surgery were significantly higher in PITS with tracheostomy compared with those without.[4]

Most cases of PITS occur in the cervical trachea and the vast majority of surgical repair is usually via a collar incision. The peculiar pattern of tracheal blood supply should be borne in mind during dissection. Precise dissection to avoid injury to the lateral blood supply and recurrent laryngeal nerves and resection of all scarred tissue while leaving enough length for anastomosis are essential.

It is known that up to 4.5 cm length of the trachea can safely be resected with end-to-end anastomosis easily effected.[7-9,11] Further segment can be removed with the addition of release procedures to relieve tension from the anastomosis, although these maneuvers should be avoided as much as possible. Fortunately, most cases of PITS are short segment as in our case and usually do not require additional release procedures. This case is presented to highlight the challenges associated with the management of a serious complication that is completely preventable. Any patient developing symptoms of airway obstruction and who had been intubated for over 24 hours within the previous 2 years must be considered to have an organic obstruction until proven otherwise. Lack of awareness of the lesion has often led to incorrect diagnosis of asthma often compounded by the fact that in most patients routine chest radiograms show normal lung fields.[6]

The key to successful surgical resection involves adequate preoperative assessment and localization of the lesion, intraoperative localization and identification of the area of the stricture, adequate mobilization and complete resection of stricture segment, and maintenance of tension-free anastomosis.[7] Anesthesia for tracheal reconstruction surgery requires careful planning. The goal of anesthesia is to maintain adequate airway ventilation and oxygenation, and easy clearance of blood and secretions. Various sizes of endotracheal tubes, cuffed and uncuffed, should be available and standard monitors as recommended by the American Society of Anesthesiologists are used. In our case, there was anticipated difficult airway because of the Mallampati III classification, but this was not the case intraoperatively. Inhalational anesthesia for induction was preferred, but there was no sevoflurane in the hospital, hence our choice of ketamine and midazolam. Histamine-releasing drugs, leading to excessive secretions and bronchoconstrictions, are generally avoided. Attention must be paid to minimize the risk of inhalational anesthetic leak during the "open airway portion" of the surgery.[12] A critical period is during emergence from anesthesia. Care must be taken to avoid laryngospasm, coughing and bucking as these bear negatively on the anastomosis with risk of disruption. This explains the rationale for the deep extubation.

Because tracheal surgeries are uncommon procedures and postintubation tracheal stenoses are preventable lesions, efforts must be geared toward their prevention. This is even more so with the increasing use of mechanical ventilation in Nigeria. Techniques to prevent their occurrence are well discussed in the literature and include the following: avoidance of prolonged inflation of cuffed endotracheal tubes, use of low-pressure cuffed tubes and scheduled deflation of cuff especially at episodes of hypotension.[11] There is also the need to train ICU nurses on the care of endotracheal tubes on mechanically ventilated patients.[13]

Conclusion

We suspect that the incidence of PITS in Nigeria may be higher, but the diagnosis is missed. Although tracheal reconstructive surgery offers the best treatment, it is a technically challenging procedure. It is hoped that this case while drawing attention to the occurrence of PITS will rather steer healthcare providers toward its prevention.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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