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Management Of Tracheal Stenosis After Accidental Corrosive Acid Ingestion

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Abstract

Although corrosive injury of the digestive tract is a well-known clinical entity, damages of the airway, a critically life-threatening condition, has not been clearly documented. Tracheal stenosis is very rare associated with corrosive acid ingestion. We report the case of a 4-year-old girl child who presented to the emergency department three week after accidentally drinking an acidic cleaning agent stored in unlabeled bottle. Rigid bronchoscopy was carried out to observe the stenosis. She was treated by serial dilation, repair of tracheal laceration, and placement of a temporary polyurethane-coated nitinol stent. Careful and accurate stent placement may provide significant and life-saving airway improvement as observed in the presenting pediatric case.

Key words: *Corrosive injury, tracheal stenosis, management*

Introduction

Corrosive acid poisoning commonly results in chemical injuries to the upper gastrointestinal tract. Corrosive mucosal erosion of the larynx and trachea may occur if the patient aspirates acid. Although corrosive injury of the digestive tract is an a well-known clinical entity, such damages of the airway, a critically life-threatening condition, has not been clearly documented (1). Tracheal stenosis is very rare associated with corrosive acid ingestion. Caustic ingestion results in thrombosis of small vessels with inflammation, the formation of granulation tissue with subsequent collagen deposition and fibrosis, thus stricture formation (2).

We report an incident of upper respiratory system corrosion after aspiration of the caustic acid agent. The patient survived the severe burns of the tracheal tract and the tracheal stenosis by dilation procedures and surgical repair of the iatrogenic tracheal laceration and treatment of the tracheal stenosis with a temporary polyurethane-coated nitinol stent. These impressive clinical features are presented and the management of caustic respiratory injury is discussed.

Case report

A 4-year-old girl child presented to the emergency department three weeks after accidentally drinking an acidic cleaning agent stored in an unlabeled bottle. The day of the incident the patient presented to an outside hospital where she was admitted for an upper endoscopy of the esophagus as well as laryngoscopy which were both found to be negative for acute injury. An initial chest X-ray taken the day of the incident was also found to be normal. After two days of observation the patient was discharged.

When patient admitted to our department, she continued to have a sore throat and upper chest pain with associated shortness of breath with inspiratory stridor. The patient denied fever, chills, weakness, bloody stools, or upper and lower gastrointestinal upset. On presentation, the patient vital signs were as follows: blood pressure of 98/57mmHg, pulse of 121, respiratory rate of 29, temperature of 36.7°C and oxygen saturation of 90% on room air. Her physical exam was

significant for pharyngeal and uvula erythema and edema without ulcers. Her lung exam demonstrated slightly diminished breathe sounds bilaterally with noted increased work of breathing. His abdomen including the epigastric region was soft without rebound or guarding. The remainder of his exam was normal.

An anterior chest X-ray was taken with showed clear lungs fields without effusion, infiltrate or aspiration, normal mediastinum, and no lymphadenopathy. The computed tomographic scan was significant for tracheal stenosis (Figure 1). Rigid bronchoscopy was carried out to observe the stenosis. After inspection and measurement, serial dilation was done with successively larger bronchoscopes. The patient recovered well after bronchoscopy and she was discharged. After 20 days, tracheal stenosis repeated. At that time, rigid bronchoscopy had revealed more than 70% luminal narrowing. Dilatation with rigid bronchoscopy was performed. Postoperative bilateral pneumothorax, subcutaneous emphysema developed (Figure 2). This time bronchoscopy revealed partial tracheal laceration in thoracic part of trachea. The tracheal injury consisted of a 2 cm tear extending from approximately 3 cm distal to the vocal cords and ending 1 cm proximal to the carina. Tracheal perforation was repaired with right thoracotomy. Bilateral chest drains were inserted and kept for 7 days. The inspiratory stridor continued in the patient. A 10-mm x 4-cm nitinol fully covered stent was placed in the trachea to just above the carina (Figure 3). The patient was discharged ten days later with good chest expansion and has been doing well for more two months without any subsequent problems.

Discussion

The accidental ingestion of easily available corrosive substances is a significant social problem. Although it rarely causes mortality, its morbidity lasts a lifetime. Corrosive injury of the upper gastrointestinal tract is a common clinical entity. Airway aspiration, instead of ingestion of the caustic substance, as in the presenting case is another mechanism of pulmonary injury, which causes direct burning of the respiratory system (1). Airway bleeding and obstruction with tissue slough are the early clinical clue of caustic aspiration. A key to alkaline injury is the fact that it causes liquefactive tissue necrosis leading to dissolution of cellular components and saponification of fatty tissues resulting in a liquid-gel amalgamation of dissolved cells and connective tissue. Ingestion of acidic media results in immediate denaturing of proteins which limits proteolysis of cellular constituents and leads to localized eschar formation which limits further tissue damage (3). Our patient presented to our department three week after accidentally drinking an acidic cleaning agent. We have linked the late manifestation of respiratory symptoms to the ingestion of corrosive acid agents.

Tracheal stenosis is uncommon in the pediatric age group. It may be due to congenital atresia, tracheomalacia or acquired stenosis. Acquired stenosis is mostly due to prolonged endotracheal intubation, faulty tracheostomy or external trauma (4). Tracheal stenosis is very rare associated with corrosive ingestion. Tracheal stenosis produces symptoms of dyspnea, stridor, and obstructive pneumonia and is frequently life-threatening, with patients having impending suffocation. Bronchoscopic management is the first step in providing a diagnosis, stabilizing the obstructed airway, and evaluating resectability. Tracheal stenosis is dilated with esophageal bougies, the bronchoscope, or appropriately sized angioplasty balloons. After inspection and measurement, serial dilation is done with successively larger bronchoscopes. Steady rotating pressure with the blunt-tipped Jackson bronchoscopes is provided passage with minimal mucosal trauma and risk of perforation. The procedure is repeated with the next larger bronchoscope until an adequate airway caliber had been established. If the lesion is too stenotic to accept the 3.5-mm Jackson bronchoscope, then esophageal bougies are used to enlarge the airway enough to allow bronchoscopic dilation. Pneumatic or hydrostatic balloon dilation with

angioplasty balloons are used whenever it is necessary to dilate larger than the 8 to 9 mm possible with bronchoscopic dilation (5).

Recurrent stenosis is an indication for endoluminal stenting or surgery. In our case, tracheal stenosis after bronchoscopic dilation repeated. Re-dilation with rigid bronchoscopy was performed. Postoperative bilateral pneumothorax, subcutaneous emphysema developed. This time bronchoscopy revealed partial tracheal laceration in thoracic part of trachea. Tracheal laceration was repaired with right thoracotomy. The inspiratory stridor continued in the patient. A nitinol fully covered stent was placed in the trachea to just above the carina.

With advancement in the field of thoracic medicine and development of technology, large numbers of patients are now being treated with tracheal stents. Advancement in stent design and development of both covered and uncovered expandable metallic stents have broadened both indications and durability (6). Endoluminal stent placement offers a rapid and effective means of opening up and maintaining narrowed airways, and result in excellent relief of symptoms and improvement in pulmonary function. However their use in the pediatric age group is uncommon due to the high incidence of complications, difficult removal and the unclear long-term effect on tracheal growth (7). Mostafa and Dessouky reported that endoluminal management of 13 pediatric tracheal stenosis and stenting is a viable option with an acceptable complication rate and minimal effect on tracheal and general growth. Many other studies had an acceptable complication rate with no stent related mortalities (8, 9).

Conclusion

It should be noted that ingestion of corrosive agents may cause damage to the upper respiratory tract. Admission for bronchoscopy and esophagoscopy to assess the extent of the injury is warranted in most cases. Tracheal stenosis is the major late complication of caustic airway injury. Careful and accurate stent placement may provide significant and life-saving airway improvement as observed in the presenting case.

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Figure 1: The computed tomographic scan showing tracheal stenosis as the result of acid ingestion.

Figure 2: Anterior-posterior chest X-ray demonstrating bilateral pneumothorax, subcutaneous emphysema after bronchoscopic dilation.

Figure 3: A 10-mm x 4-cm nitinol fully covered stent was placed in the trachea to just above the carina.