Performing a tracheostomy with thyroid cartilage and tracheal calcification

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Abstract
This case report describes an approach for performing a tracheostomy in a patient with in utero thalidomide exposure with a calcified thyroid cartilage and trachea. A PubMed literature search did not reveal any published case reports or descriptions of patients with a calcified thyroid cartilage and trachea requiring tracheostomy. There was been no established techniques of performing a tracheostomy in this setting. Our case report provides a safe and time efficient approach to perform a tracheostomy in a patient with a calcified thyroid cartilage and trachea.

Introduction
Tracheostomy is one of the oldest surgical procedures in the medical literature and dates back to 1500 BC. In the early period, tracheostomy was primarily performed for acute respiratory obstruction and had a high mortality rate. Today, the indications for tracheostomy have expanded to include prolonged ventilator support and pulmonary toilet. More than 100,000 tracheostomies are performed annually in the US according to the Healthcare Cost and Utilization Project 2007. Proper identification of surgical landmarks and the ability to be able to enter the airway efficiently are key steps to a successful tracheostomy. This case report will describe an approach for performing a tracheostomy in a patient with in utero thalidomide exposure with a calcified thyroid cartilage and trachea.

There were about 10,000 children in the world born with malformations associated to the use of thalidomide. Thalidomide was a drug that was first developed in 1954 and prescribed as a sedative, tranquilizer, and antiemetic for morning sickness (Figure 1).

Exposure of thalidomide in utero led to defects such as malformation of the limbs, spine, ears, eyes, internal organs, and central nervous system. The mechanism behind thalidomide-associated malformations and teratogenicity is still being deciphered, but largely centers on the drug’s interference with vasculogenesis and increase in oxidative stress.

Deformities of the ears, such as microtia and anotia, and eyes were seen in individuals exposed to thalidomide. The internal organs including kidney and heart were also affected in patients with thalidomide exposure in utero. Malformation of the limbs was the most commonly reported thalidomide-induced birth defect. Spinal changes in patient affected by thalidomide are similar to adolescent kyphosis and reported thalidomide teratogenicity is still being deciphered, but largely centers on the drug’s interference with vasculogenesis and increase in oxidative stress.

Methods and Materials
Patient
A 56 year old male with history of thalidomide exposure in utero with cerebral palsy and multiple congenital skeletal malformations including micrognathia, limb reductions, and cervical spine kyphosis was admitted to the ICU at Alameda County Medical Center in Oakland, California in May 2012 and intubated for respiratory distress secondary to pneumonia. The patient had a difficult airway and the initial intubation required taking the patient to the operating room for an awake fiberoptic intubation. He had a tracheostomy three years prior and was subsequently decannulated. A decision to perform a tracheostomy was made due to prolonged intubation and difficulty weaning from the vent. The sternal notch was difficult to palpate and the other anterior neck landmarks were replaced by hard bone. A calcified thyroid cartilage and trachea was seen on CT (Figure 2).

Surgical Technique
The patient was brought into the operating room and place on the table in supine position. The anterior neck landmarks were largely replaced by bone and the cricoid and thyroid cartilage was not able to be palpated. The sternal notch was identified. Thus, the incision was planned one centimeter above the sternal notch. 1% lidocaine with 1:100,000 epinephrine was infiltrated into the incision. The area was prepped and draped in sterile fashion.

An incision was made one centimeter above the sternal notch and scar tissue was encountered deep to the skin. The scar tissue was overlying firm bone and suggested that perhaps the patient had a tracheostomy prior. A periosteal elevator was used to mobilize scar tissue away from the underlying calcified trachea. Once the underlying calcified trachea was exposed and hemostasis of the surrounding soft tissue was achieved, a 4mm straight osteotome and mallet were used to make a tracheal window to enter the airway (Figure 4a). Rongeurs and rasps were used to remove sharp edges of bone along the tracheal window (Figure 4b). A size 6 bivona tracheostomy tube was placed and set at 7 millimeters at the skin (Figure 3).

Figure 2. a) Axial b) sagittal CT showing calcification pre-operatively

Figure 3. Post-operative CT showing tracheostomy tube through calcification

Discussion
The patient described in the case report not only had kyphotic spinal changes, but also exhibited calcification and fusion of the thyroid cartilage and trachea via abnormal mechanical forces causing bone formation. The presence of the calcification and fusion of the thyroid cartilage and trachea could also be due to the prior history of a tracheostomy. However, there was extensive of bony change that went beyond the planned tracheostomy site.

There are also many other etiologies causing calcification of the trachea. Tracheobronchopatia osteochondroplastica is a rare disorder of the large airways characterized by the development of submucosal cartilaginous and bony nodules. Idiopathic laryngotracheobronchial cartilage calcification is also an entity seen typically in females over the age of 60, but has also been identified in children. There have also been reports of warfarin induced tracheal calcification, which is usually seen among patients who have taken warfarin for many years. The mechanism is hypothesized that warfarin inhibits the formation of a vitamin K dependent protein that prevents calcification of cartilage.

Thalidomide was a popular drug used worldwide though it was never approved in the US by the Food and Drug Administration. The 10,000 children born with malformations associated with the use of thalidomide are now in their 50s and 60s and may be afflicted with many of the same health problems that affect individuals as they age if they have survived.

Conclusions
There are several small populations of patients with calcified thyroid cartilage and trachea in which traditional tracheostomy approach would not be sufficient. Our case report describes the steps to enter the airway in a patient with a calcified thyroid cartilage and trachea.

References

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Figure 1. Chemical structure of thalidomide.