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Case Report

**Successful Use of a Hand-Made Silicone Laryngeal Stent in Severe
Penetrating Laryngeal Trauma: A Case Report**

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Abstract

Laryngeal trauma is a rare but potentially life-threatening condition that can result in airway compromise, loss of voice, and impaired swallowing. Severe injuries often require surgical stabilization of the laryngeal framework using internal stenting. We report a unique case of a severe penetrating laryngeal injury successfully managed using a hand-made silicone laryngeal stent, innovatively fashioned from a Montgomery silicone tube. This three-stage approach not only saved the patient's life but also preserved long-term voice function. To our knowledge, this technique has not been previously reported in the literature. This case highlights the importance of surgical innovation, timely airway management, and internal laryngeal support in complex laryngeal trauma.

Keywords: *Laryngeal trauma, penetrating neck injury, laryngeal stent, silicone stent, airway reconstruction, voice preservation.*

Introduction

The larynx is a complex anatomical structure essential for respiration, phonation, airway protection, and swallowing. Trauma to the larynx, although uncommon, carries a high risk of morbidity and mortality if not promptly recognized and appropriately managed. Laryngeal injuries may result from blunt or penetrating trauma and can lead to airway obstruction, aspiration, vocal cord paralysis, and permanent voice loss.

Penetrating laryngeal injuries are particularly challenging due to cartilage fractures, mucosal disruption, and potential instability of the laryngeal framework. The primary goal in such cases is immediate airway stabilization, followed by restoration of laryngeal anatomy and function. Internal stenting plays a crucial role in maintaining airway patency, preventing cicatricial stenosis, and supporting healing of mucosal and cartilaginous structures.

Commercially available laryngeal stents may not always be accessible, affordable, or suitable for all injury patterns. In such scenarios, surgical innovation becomes essential. This case report describes a novel, hand-made silicone laryngeal stent created intraoperatively, which resulted in successful long-term preservation of both life and voice.

Classification of Laryngeal Injuries

Laryngeal injuries are commonly classified using the Fuhrman–Schaefer classification, which guides management:

1. Minor laryngeal hematoma, edema, or laceration without cartilage fracture
2. Edema, hematoma, mucosal disruption without exposed cartilage or displaced fractures
3. Significant edema, mucosal disruption with exposed cartilage, with or without vocal cord immobility and displaced fractures
4. Severe mucosal disruption with skeletal instability, multiple fractures, anterior commissure injury
5. Complete laryngotracheal separation

The present case represents a Type III injury, requiring surgical intervention and internal stabilization.

Case Report

A 32-year-old male presented to the emergency department in 2016 following a gunshot injury to the neck, associated with multiple traumatic injuries. Initial assessment followed Advanced Trauma Life Support (ATLS) principles, including airway, breathing, circulation, and disability evaluation.

Initial Management

The patient had a penetrating injury involving the left side of the larynx with active bleeding and signs of airway compromise. Immediate airway stabilization was achieved by emergency tracheostomy, and hemorrhage control was performed. Associated injuries included fractures of the thyroid cartilage and upper limb trauma.

Computed tomography (CT) imaging of the neck demonstrated multiple fractures of the thyroid cartilage with disruption of laryngeal architecture.

Surgical Management

Stage 1: Emergency Airway Stabilization

An emergency tracheostomy was performed to secure the airway and stabilize the patient.

Stage 2: Invention and Insertion of a Hand-Made Silicone Laryngeal Stent

Two weeks following stabilization, definitive laryngeal reconstruction was undertaken. Due to the severity of cartilage disruption and lack of suitable commercial stents, a custom hand-made silicone stent was innovatively fashioned from a Montgomery silicone tube.

The stent was inserted through an external vertical thyroid cartilage incision above the tracheostomy site. It was carefully positioned to support the laryngeal framework and maintain airway patency. The stent was secured to the neck skin using 2-0 nylon sutures to prevent migration. (Video documentation available.)

Stage 3: Stent Removal and Voice Rehabilitation

After six weeks, the stent was removed through the tracheostomy opening. The tracheostomy tube was temporarily reinserted. Within days, the patient was encouraged to phonate by occluding the tracheostomy tube manually. Progressive improvement in voice quality was observed.

Results

The three-stage surgical approach resulted in complete survival of the patient with preservation of airway patency and voice function. No major postoperative complications such as infection, granulation tissue formation, or airway stenosis were observed.

At long-term follow-up (now 10 years post-injury), the patient demonstrates:

- Stable airway without stenosis
- Functional voice adequate for daily communication
- Normal swallowing function

The patient has returned to full employment and is currently working as a taxi driver, indicating excellent functional recovery.

Video 1. Preoperative assessment and imaging of penetrating laryngeal injury

This video demonstrates the preoperative evaluation of a 32-year-old male patient presenting with a penetrating neck injury involving the larynx. Computed tomography imaging reveals multiple fractures of the thyroid cartilage with disruption of the laryngeal framework, consistent with a Fuhrman–Schaefer type III laryngeal injury. Emergency airway stabilization had been achieved with tracheostomy prior to definitive reconstruction.

<https://youtu.be/N0ZVKotTQfY>

Video 2. Intraoperative creation and insertion of the hand-made silicone laryngeal stent

This video shows the intraoperative technique for fabrication of a custom hand-made silicone laryngeal stent from a Montgomery silicone tube. The stent is inserted through an external vertical thyroid cartilage incision above the tracheostomy site and positioned to support the laryngeal skeleton. The stent is secured externally using nylon sutures to prevent migration.

<https://youtu.be/6tld0Uz6txo>

Video 3. Stent removal through tracheostomy site

This video documents the removal of the silicone laryngeal stent six weeks after insertion. The stent is carefully extracted through the tracheostomy opening, followed by reinsertion of the tracheostomy tube. The laryngeal lumen is observed to be stable without evidence of collapse or stenosis.

<https://youtube.com/shorts/Q2hyEJVem60?feature=share>

Video 4. Postoperative phonation and voice rehabilitation

This video demonstrates postoperative voice rehabilitation following stent removal. The patient is encouraged to phonate by manually occluding the tracheostomy tube. Functional voice production is evident, confirming preservation of vocal cord mobility and airway patency.

<https://youtube.com/shorts/TsJeJ94J0ZA?feature=share>

Video 5

Intraoperative management and innovative hand-made silicone laryngeal stent insertion in severe penetrating laryngeal trauma. This video clip demonstrates key steps in the surgical management of a patient with severe penetrating injury to the larynx. It begins with the airway exploration and exposure of laryngeal framework disruption, followed by fabrication of a custom hand-made silicone laryngeal stent fashioned intraoperatively. The stent is inserted through a vertical cervical incision and positioned to support the injured laryngeal structures. Final segments show stent stabilization techniques and confirmation of airway patency. This innovative technique was used to restore structural integrity, preserve the airway, and maintain voice function. Written informed consent was obtained from the patient for publication of this video.

https://youtu.be/92eFVa38qRI?si=HzDEuv_iZc8MaaDv

Discussion

Severe penetrating laryngeal trauma requires rapid airway control followed by meticulous reconstruction to prevent long-term functional impairment. Internal stenting is critical in maintaining laryngeal patency and preventing scar-related stenosis. However, commercially available stents may not always be feasible in emergency or resource-limited settings.

This case demonstrates the effectiveness of a hand-made silicone laryngeal stent, highlighting surgical creativity and adaptability. The use of a modified Montgomery tube allowed precise customization to the patient's anatomy and injury pattern. Long-term voice preservation in this patient underscores the importance of early internal support of the laryngeal skeleton.

To our knowledge, this innovative approach has not been previously described in published literature, making this case particularly valuable.

Conclusion

This case illustrates that timely airway management combined with innovative internal laryngeal stenting can save both life and voice in severe penetrating laryngeal trauma. The hand-made silicone laryngeal stent proved to be a safe, effective, and durable solution with excellent long-term outcomes. Surgical innovation remains a key component in managing complex airway injuries, especially in challenging clinical settings.

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