Case Report

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An improvised surgical reconstruction technique for repair of traumatic multi- fragmented fracture of first tracheal ring

Abstract

We report a case of 32-year-old female, a front seat passenger who sustained a neck injury in a road traffic accident. Patient was taken to a district hospital with progressive swelling of neck and face, breathing difficulty. She underwent endotracheal intubation ad mechanical ventilation was initiated. Her Chest X-ray showed subcutaneous emphysema and computed tomographic scan (CT) of her thorax revealed an upper anterior tracheal fracture, pneumomedistinum and subcutaneous emphysema. She was transferred to our tertiary care hospital. We performed exploratory surgery of the neck and found multiple fragmented fracture of the cartilaginous part of the first tracheal ring. We reconstructed the trachea using our improvised surgical reconstruction technique.

Volume 8 Issue 2 - 2018

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Received: March 07, 2018 | **Published:** March 29, 2018

Background

Cervical tracheal injury is a rare and potentially life threatening condition. This part of the airway is well protected due its anatomic position, mobility and cartilaginous support.[1] Cervical tracheal injuries can occur from striking cables while driving motorbikes or snow skate boarding. In road traffic accidents, cervical tracheal injuries may occur due to its direct impact from the dash board or steering wheel while the neck is in extension, leading to compression of trachea against the rigid cervical spines.[2,3] First tracheal ring fracture is extremely rare, often it is missed due to absence of any visible neck injury. If undetected and treated in a timely manner this can progress to life threatening airway condition.

Clinically, such patients an present with expanding subcutaneous emphysema, hemoptysis, cough, and change in voice, pneumomedistinum, or respiratory difficulty[4] Surgical resection of fractured tracheal ring with multiple fragments and end to end anastomosis has been described. Sometimes a tracheal stent can be used in selected patients.[5] We report an improvised reconstruction tracheal tissue preserving surgical technique for traumatic multi fragmented fracture of first tracheal ring presented with worsening subcutaneous emphysema and pneumomedistinum (Figure 1A) (Figure 1B).

Case presentation

A 32-year-old women a front car seat passenger, sustained neck injury in a road traffic accident. She was taken to a district hospital with progressive swelling of neck, face and breathing difficulty. The upper cervical trachea was exposed through a collar incision, upper skin flap was raised, and strap muscles were separated in the mid line. We found the total collapse of first tracheal ring with funnel shaped airway (Figure 1C) Thyroid isthmus was divided for better exposure. The upper cervical trachea was exposed with careful dissection and multiple traction sutures were placed in the collapsed first tracheal ring area using 2-0 vicryl. The second tracheal ring was anastomosed to cricoid cartilage using interrupted 4-0 polydioxanone sutures keeping the knots outside (Figure 1D) The collapsed part of the trachea was pulled out by traction sutures prior to tying the knots to prevent intraluminal entrapment of fragmented cartilaginous tissues. The operative procedure illustration is shown in (Figure 2A–2D) The patient was extubated on the following day as the subcutaneous emphysema markedly resolved (Figure 3A)(Figure 3B) She was discharged after five days.

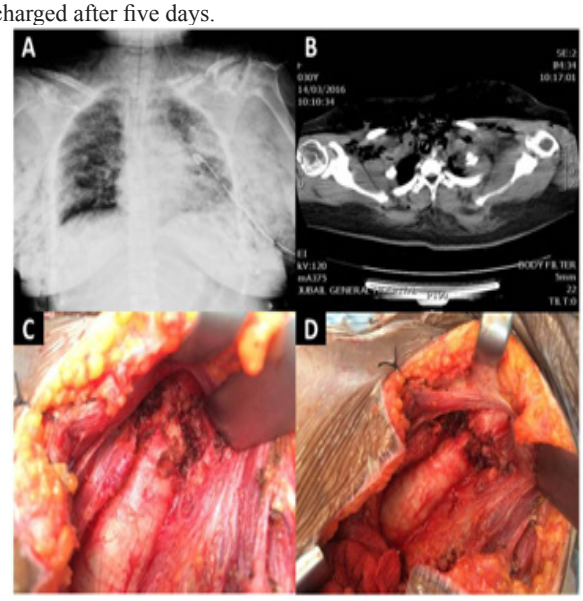

Figure 1 (A) Chest-x-ray showing subcutaneous emphysema. **(B)** CT scan thorax revealed anterior tracheal tear, pneumomedistinum and subcutaneous emphysema. **(C)** Operative finding: first ring fracture and funnel shape trachea. **(D)** Second tracheal ring anastomosed to cricoid cartilage.

Upon three follow up, she remained asymptomatic and repeat bronchoscopy did not show any granulation tissue on surgical site or airway constriction .She was discharged home after five days. Upon follow up, for two years she remained asymptomatic and repeat bronchoscopy was normal.

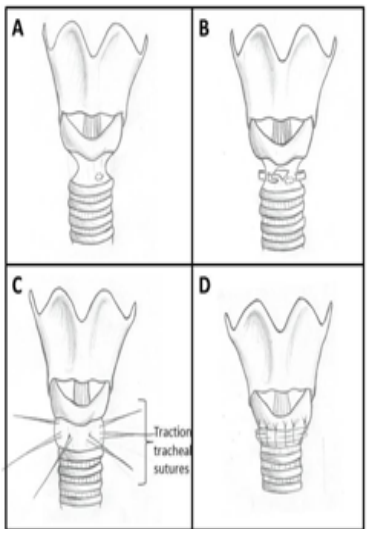

Figure 2 Illustrative drawing of improvised tracheal reconstruction technique. **(A)** And **(B)** Showing the tear and multi fragmented first tracheal ring. **(C)** Showing the traction sutures in the area of fractured first tracheal ring. **(D)** Second tracheal ring anastomosed to cricoid cartilage.

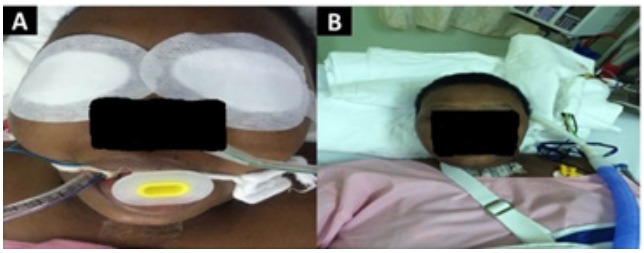

Figure 3 (A) Pre – operative picture of the patient showing subcutaneous emphysema. **(B)** Post-operative picture of the patient showing that subcutaneous emphysema has markedly resolved.

Discussion

The most common site of tracheobronchial injuries after the blunt chest trauma is 2.5-3 cm from the carina. This is the largest diameter of airway so more sheer force is exerted in this area as per the law of Laplace. Tracheal rupture occurs when tracheal intraluminal pressure with a closed glottis is greater than the elasticity of the membranous trachea[6] there are different theories proposed about the mechanism of such injuries. Sudden deceleration sheer forces can cause tracheal injury at the cricoid cartilage and carina, as these are two fixed points. One proposed hypothesis is that tracheal injury is due to increased intrathoracic pressure created by the upper chest compression against the closed glottis, or trachea which is compressed against the vertebral column. Another possible mechanism of tracheal injury is that due to trauma, the lateral diameter of chest increases, and lungs are pulled out laterally leading to the disruption of bronchus and trachea[7,8] after road traffic accident, if a victim presents with mediastinal and subcutaneous emphysema, pneumothorax, hemoptysis, difficulty in breathing, an airway injury should be ruled out. The clinical presentation can be misleading in partial or complete transaction or fragmentation of tracheal cartilages because the damaged area may continue to function as it is held together by supporting tissues only, providing an adequate airway, typically in those patients who have no other associated mediastinal or vascular injuries.[9] Resection and reconstruction of trachea is a technically very challenging task. The surgical circumferential dissection should be limited to devitalized and fibrotic tissues in order to preserve the tracheal blood supply and to avoid the post-operative anastomotic stricture and dehiscence, seen postoperatively in 5-6% of patients. Mortality of tracheal surgery varies from 4-30%.[10] The surgical outcome is excellent if the diagnosis and management are executed within 24 hours tracheal resection and reconstruction for tracheal ring fractures has been described.[11] We report an improvised surgical reconstruction technique to manage the multi fragmented fracture of first tracheal ring after blunt neck trauma. This is technically simple and seemingly safe to restore the airway integrity without any excision of fragmented tracheal cartilage and tracheal resection. The fragmented cartilaginous part is pulled out to avoid intraluminal entrapment and is in fact used as buttressing tissues to strengthen the anastomosis. In addition to that, there is no need for chin guard stitches and the recovery may be more rapid than the standard reconstructive technique.

Acknowledgments

None.

Conflict of interests

Author declares that there is no conflict of interest.

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