

Case report

Spontaneous longitudinal rupture of the thyroid cartilage: A management of the rare clinical case



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ABSTRACT

Introduction and importance: Non-traumatic rupture or other injuries to the larynx are very rare disorder. According to the published series, there are only 15 cases reported with such kind of injury to the larynx. Despite the rarity of the non-traumatic larynx fracture, it is important to elucidate adequate management for the patients with such emergency. The aim of the study is to demonstrate the features of clinical manifestations, examination, and surgical treatment of a case of spontaneous longitudinal rupture of the thyroid cartilage.

Presentation of case: A 54-year-old male patient presented with chief complaints of pain in the front surface of the neck, difficulty swallowing and breathing during physical exertion, hyperemia of the skin on the front surface of the neck, and the presence of subcutaneous emphysema. 20 h after the onset of the symptoms, the patient reported breathing difficulties that appeared during physical exertion, and the patient walked to the hospital. Computed tomography revealed a longitudinal rupture of the thyroid cartilage, emphysema of the neck, and the presence of air in the anterior-upper mediastinum. The defect of the ruptured thyroid cartilage was treated by suturing as well as by myoplasty using sternocleidomastoid muscle.

Clinical discussion: Our case report is in line with others, showing that patient with spontaneous rupture of the thyroid cartilage is the surgical emergency. Our approach of using myoplasty was not presented before.

Conclusion: This case report adds evidence and knowledge about such rare disorders as spontaneous rupture of the thyroid cartilage. It is useful to apply the technique of myoplasty with sternocleidomastoid muscle flaps, ensuring reliable sealing of the damaged area reducing the risk of failure, and inflammatory complications, and supporting neck functions in the postoperative period.

1. Introduction

Non-traumatic rupture or other injuries to the larynx are very rare disorders [1]. According to the published series, there are only 15 cases reported with such kind of injury to the larynx. Despite the rarity of such larynx trauma, including rupture of the thyroid cartilage, all patients are important, and adequate management must be applied for all surgical emergencies. Because of its rarity, non-traumatic ruptures of the larynx cartilages are not well evaluated, and its pathogenesis remains unclear [1,2]. However, such kind of trauma is usually severe, requiring

emergency management [3]. The study has been reported in line with the SCARE criteria [4]. The aim of the study is to demonstrate the features of clinical manifestations, examination, and surgical treatment of a case of spontaneous longitudinal rupture of the thyroid cartilage.

2. Presentation of case

A 54-year-old male patient presented with chief complaints of pain in the front surface of the neck, difficulty swallowing and breathing during physical exertion, hyperemia of the skin on the front surface of the neck,

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and the presence of subcutaneous emphysema.

The patient felt unwell for 20 h before admission, reporting a sudden onset of pain that appeared on the front surface of the neck in the projection of the thyroid cartilage after drinking water while simultaneously tilting the head and taking a sip. The patient took non-steroidal anti-inflammatory drugs, resulting in temporary pain relief. The patient's condition worsened during the next 8 h, with the appearance of subcutaneous emphysema and dysphagia. 18 h after the onset of the first symptoms, the patient reported hyperemia of the skin on the anterior surface of the neck, with increasing subcutaneous emphysema. 20 h after the onset of the symptoms, the patient reported breathing difficulties that appeared during physical exertion, and the patient went to the hospital by himself.

Upon admission, the patient's condition was moderate. Analyses of the patient's life history did not reveal any previous injuries to the neck

or chronic diseases or including absence of the rheumatological disorders. At the clinical examination, we found hyperemia of the skin on the anterior surface of the neck. During palpation, pain appeared in the projection of the thyroid cartilage, subcutaneous emphysema was widespread in the anterior-lateral parts of the neck on the upper part of the anterior chest wall. The routine clinical blood tests were performed before surgery, showing no specific changes. ECG was within normal limits.

Considering the data of the clinical and instrumental research, we recommended urgent surgical treatment to the patient. Computed tomography revealed a longitudinal rupture of the thyroid cartilage, emphysema of the neck, and the presence of air in the anterior-upper mediastinum (Fig. 1).

The patient underwent an urgent surgical operation to approach thyroid cartilage using a collar incision by Kocher, according to our

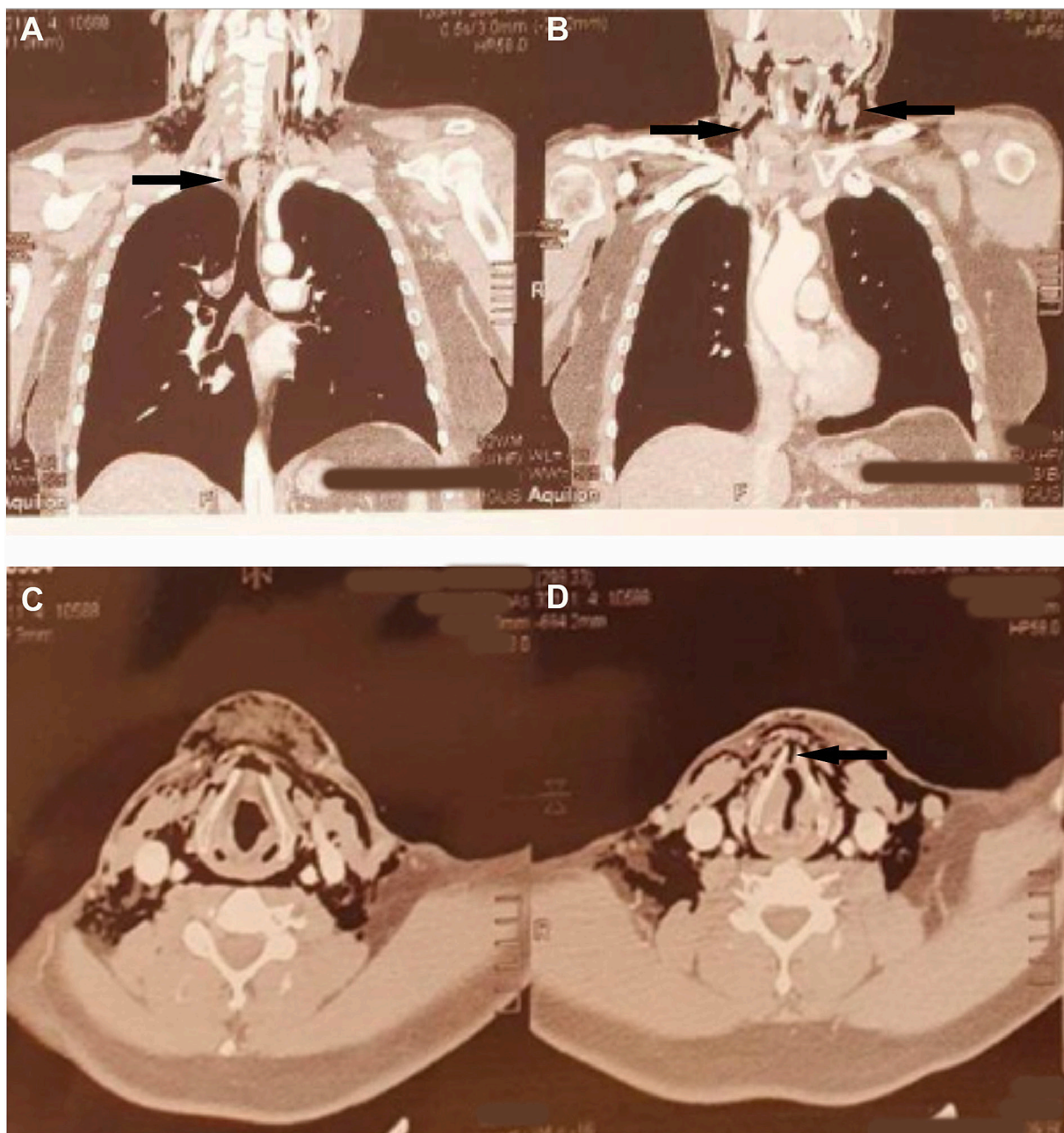


Fig. 1. A Computed tomography films showing emphysema in the (A) anterior-upper mediastinum and (B) in the neck as well as (C) normal tissue structures above the thyroid cartilage and (D) signs of longitudinal rupture of the thyroid cartilage,

surgical protocols for neck operations [5,6]. At revision, the longitudinal rupture of the thyroid cartilage was identified, followed by its mobilization and subsequent suturing (Fig. 2). The next stage of surgical treatment was myoplasty. Considering the localization of the damage, in this case, we applied myoplasty with two 15 * 7 cm strands, that were excised from the left and right sternocleidomastoid muscle. The abovementioned size of 15 * 7 cm is the specified volume to be sufficient for the effective closure of the damaged area, causing no negative impacts on the function of the remaining muscle (Fig. 3). The myoplasty was performed to improve aerostasis after suturing of the thyroid cartilage. The myoplasty was performed by fixing muscle strands with Vicryl 3.0 threads for the lower part of the muscle flap [7]. Such fixation allows us to achieve the expected hermeticity and cause no ischemia of the muscle flap, unlike through stitching. Air did not pass from the wound after the hydrotest. In the next stage, we performed draining of the area of the thyroid cartilage area as well as the area of the anterior-upper mediastinum, followed by wound closure (Fig. 4). A direct laryngoscopy in the postoperative period showed mild edema of the larynx as well as the presence of the tissue defect 5 × 4 mm in the largest dimension within the middle part of the laryngeal prominence. Thyroid cartilage calcifications were detected in the inferior horns. Other parts of the thyroid cartilage demonstrated low evidence of calcification, therefore suturing of the thyroid cartilage halves was performed normally and sutures integrity was sufficient. The absorbable sutures were chosen, because the application of non-absorbable material is associated with a higher risk of post-operative granulomas in the knot zone according to our observations.

The decision was made to apply three drainage tubes because of presence of the free air in the upper mediastinum. It is also worth mentioning, that two other drainage tube were place in the lateral zones next to the larynx, because of presence of cavities in that zones and our

considerations to maximally drain all exudate from that area. By doing myoplasty, we also separated of anterior upper mediastinum from the operative zone, achieving hermitization of the latter, therefore all draining tubes were functioning well.

The duration of the operation was 2 h. During 7 days postoperatively, the patient was administrated for antibacterial (third-generation cephalosporins) therapy and low-molecular heparins. The painkillers were administrated during 5 days after the surgery. There were no complaints of swallowing and breathing disorders in the early postoperative period. On the second day of the postoperative period, the patients started to drink water and eat liquid food. From the third day, the patients started to eat regular food. Subcutaneous emphysema of the neck and upper third of the chest regressed on the 4th day after operation. X-ray control of the chest was performed on the 4th day postoperatively, and air presence in the anterior-upper mediastinum was not identified. Draining tubes were removed from the anterior-upper mediastinum on the fifth day, and from the area of thyroid cartilage on the 7th day. The wound sutures were removed on the 10th day. The overall course of the postoperative period was without complications, including absence of the possible neck function disorders. The patient was discharged on the 10th day after the surgery.

3. Discussion

In this case report we demonstrated a rare case of the spontaneous rupture of the thyroid cartilage with a description of new clinical symptoms as well as our experience of the surgical management. Non-traumatic rupture of the larynx cartilage is rare [8,9]. According to analyses of the published reports in the PubMed and Google Scholar databases from 1950 to 2020 by Khalid et al., just 15 cases were presenting non-traumatic rupture or fractures of the larynx, and our case

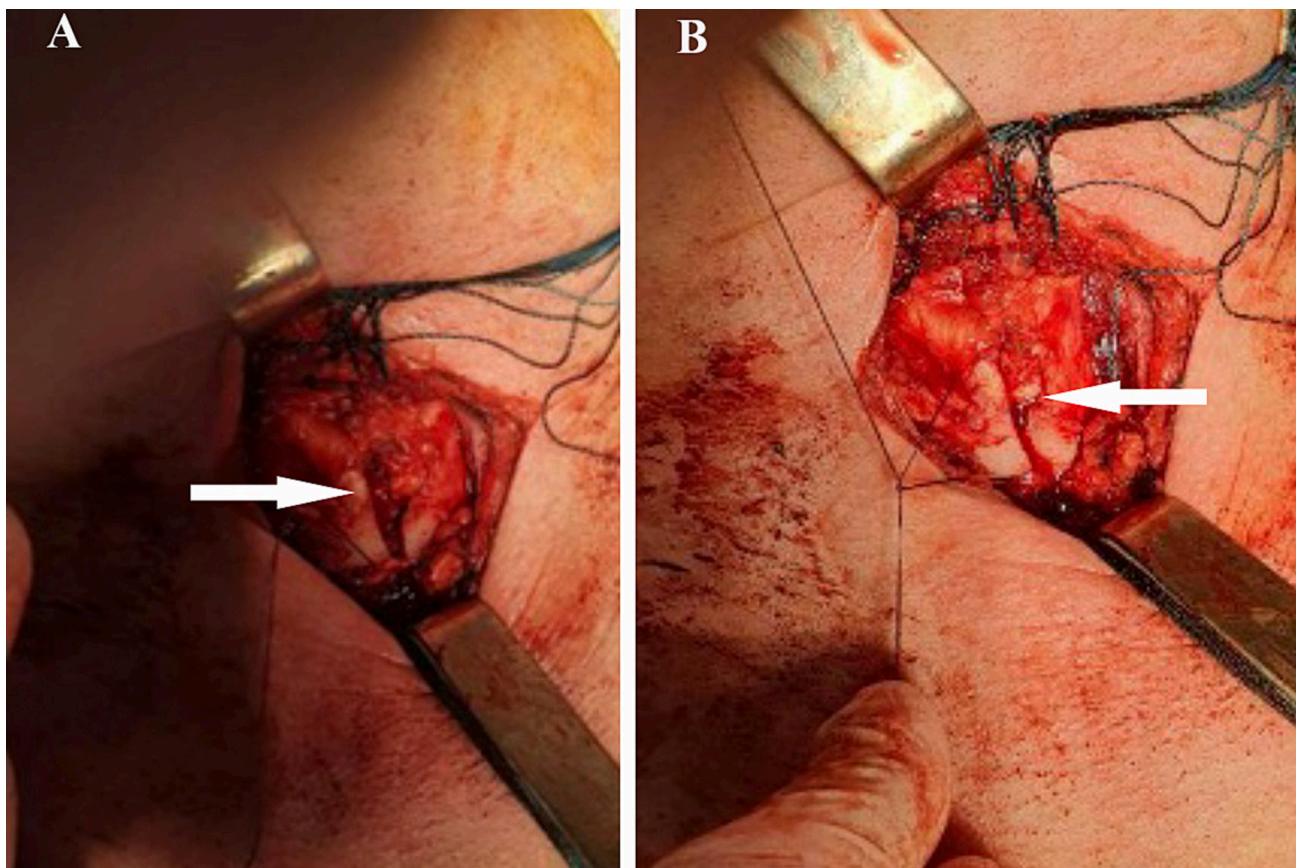


Fig. 2. Intraoperative photograph. (A) View of the thyroid cartilage after mobilization in the area of spontaneous rupture; (B) closing of the thyroid cartilage defect by the suturing.

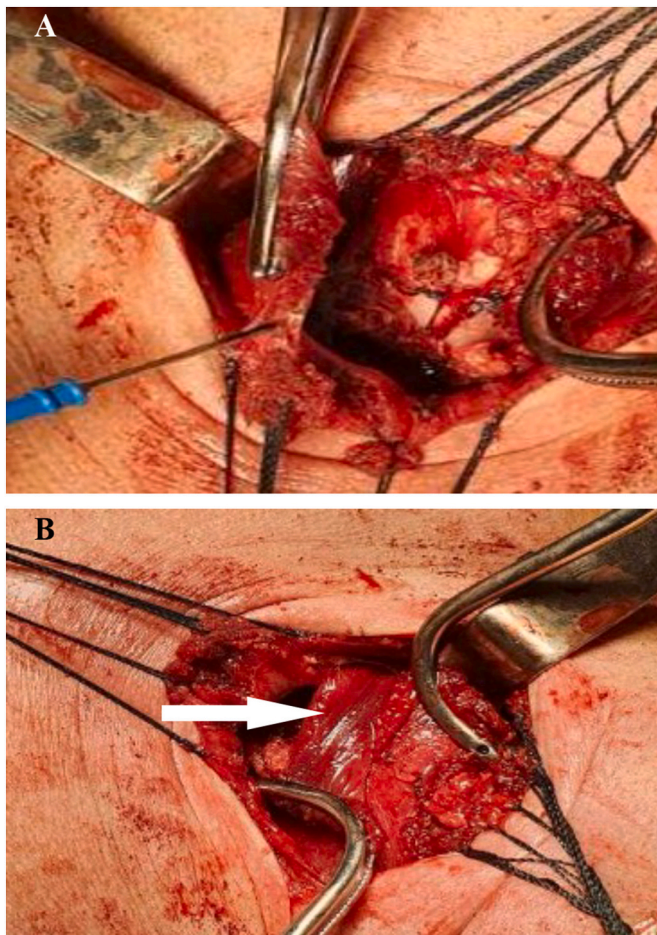


Fig. 3. Intraoperative photograph illustrating myoplasty stage of operation. (A) A 15 * 7 cm strand was excised from the left and right sternocleidomastoid muscles (fixed in surgical locking forceps) before the application to the area of thyroid cartilage rupture. (B) Illustration of the area of thyroid cartilage rupture after the myoplasty (B).

might be considered as 16th [1]. To our best knowledge, this case report is the first presentation of myoplasty by sternocleidomastoid muscle for the management of thyroid cartilage spontaneous rupture, indicating this method as a possible solution for others in case of similar cases. Having thoroughly analyzed all retrieved case reports, using article processing tools Case Report Guidelines (CARE Checklist) and the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Reports, the authors selected studies, summarizing data from 15 cases (14 patients of thyroid cartilage and 1 cricoid cartilage) of spontaneous ruptures for further discussion of the non-traumatic ruptures of larynx cartilages. Khalid et al. reported the following frequency of the symptoms for the spontaneous ruptures of the thyroid cartilages: sneezing in 64.3 %, coughing in 21.4 %, and swallowing problems in 14.2 % of patients, which is associated with a closed glottis causing a significant increase of the pressure inside the larynx [1]. Most of the cases analyzed by Khadid et al. were associated with external laryngeal trauma, which was evaluated by the Schaefer classification [1,2]. It is also worth mentioning, that among the various clinical manifestations, the most frequent signs of thyroid cartilage rupture areodynophagia, dysphonia, and local pain in the area of the thyroid cartilage. Our results are in line with Alexander et al. who described a case of spontaneous thyroid cartilage fracture after a coughing attack as well as with Balai et al. showing a case of spontaneous larynx fracture after swallowing [3,10]. A thyroid cartilage rupture after the sneeze was also a possible clinical case.



Fig. 4. Intraoperative photograph of the operative area. (A) Patient's neck before the operation (B) Postoperative area showing drainage tubes for vacuum drainage in the area of the thyroid cartilage as well as from the anterior-upper mediastinum.

According to Reuther et al., patients with ruptures of larynx cartilages might be treated conservatively (vocal and physical rest are mostly indicated). Surgery may primarily be required in the case of a complicated course and breathing failure or the case of significant displacement of thyroid cartilage fragments [1]. Summarizing the overall opinion regarding the management of such patients, the main point is the consideration of the function of breathing, requiring a priority action. Only after resolving the issue with stable respiratory protection, one proceed to further patient examination. Similar to others, we consider endoscopy and computer tomography as the gold standard for patients with ruptures of larynx cartilages [2,12].

Considering the possible pathogenesis of spontaneous larynx fracture occurrence, the leading factor can be a sharp increase in intralarynx pressure. For instance, at sneezing the pressure in the larynx might be increased over 40 times. However, such increasing is still less significant as compared to the cut-off value for the occurrence of a fracture [13,14]. To explain why and how the intralarynx pressure exceeds the threshold, Hasegawa et al. and Matrka et al. reasonably underlined a combination of several factors. First of all, the factor of increased intralaryngeal pressure during sneezing, coughing, and swallowing. Secondly, attempts to suppress sneezing, especially concerning the position of the neck (for example, the head is thrown back, etc.), which can mechanically potentiate the destructive effect of forces on the larynx cartilages [13,14]. We also agree with Reuther et al., about the possible

pathogenesis of thyroid cartilage rupture due to prompt elevation of subglottic pressure against a closed glottis, which is internal barotrauma [12]. Some authors suggested such hidden disorders as ossification and mineralization of the cartilages, associated with reduction of their mechanical stability, being to some extent a risk factor in case of sneezing or coughing [10,12]. We hypothesize that one of the possible causes of the spontaneous rupture of the thyroid cartilage might be associated with rheumatological disorders [11], however our patient had not had any history of any specific chronic diseases.

4. Conclusions

To sum up, this case report adds evidence and knowledge about such rare disorders as the thyroid cartilage rupture. It is useful to apply the technique of myoplasty with sternocleidomastoid muscle flaps, ensuring reliable sealing of the damaged area reducing the risk of failure, and inflammatory complications, and supporting neck functions in the postoperative period.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request

Ethical approval

This study was approved by the Ethical Committee at the Kharkiv National Medical University (Kharkiv, Ukraine).

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Author contribution

Igor Lurin - Conceptualization; Data curation; Formal analysis; Writing - original draft; Writing - review & editing, final approval; **Vitalii Makarov** - Formal analysis; Visualization; Writing original draft;

Writing – review & editing; **Volodymyr Nehoduiko** - Formal analysis; Visualization; Writing original draft; Writing – review & editing; **Kostiantyn Smolyanyk** - Writing - review & editing; editing figures; **Maksym Gorobeiko** - Writing - review & editing; editing figures; **Andrii Dinets** - Supervision; Writing - review & editing, critical revision of the manuscript, final approval.

Guarantor

Guarantor – Prof. Volodymyr Nehoduiko, MD, PhD.

Conflict of interest statement

The authors declare that they have no conflict of interest.

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