



## Case report

# Conservative management of a rare case of post thyroidectomy tracheal injury with coagulation abnormalities

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## ABSTRACT

**Background:** Tracheal injury is a rare but potentially serious acute complication of endotracheal intubation. Very few cases of tracheal injury associated with coagulation abnormalities have been reported in the literature. We present a rare case of a patient presenting with tracheal injury in combination with coagulation abnormalities following thyroidectomy.

**Case presentation:** A 58-year-old woman with a history of postoperative chemotherapy for breast cancer, gastric polyps, multiple colonic polyps, esophageal papillary adenomas, and thyroid adenomas presented with dyspnea following 10 ml hemoptysis on the third day after thyroidectomy; she was admitted to the intensive care unit and underwent tracheal intubation for maintaining the airway. Subsequent bronchoscopy revealed a nodular red neoplasm 5-cm from the carina in the trachea obstructing part of the lumen, with a small amount of fresh hemorrhage on the surface. Tracheal injury was considered the preliminary diagnosis. Fiberoptic bronchoscope guided tracheal intubation helped prevent rupture of the tumor, and the cannula was properly inflated to arrest the bleeding while blocking the lower part of the trachea. An emergency surgical evacuation of the cervical hematoma was performed for managing postoperative bleeding. The patient demonstrated persistent pancytopenia despite frequent transfusions. Laboratory examination results revealed abnormal coagulation parameters, anemia, and hepatic dysfunction. Following a multidisciplinary team discussion, pituitrin for hemostasis, tranexamic acid for strengthening hemostasis treatment, and nutritional support and anti-infection treatment were initiated. Endotracheal tube cuff inflation was performed to compress the bleeding site. Complete resolution of the subcutaneous hematoma was observed nine days after the tracheal injury; bronchoscopy revealed residual ecchymosis in the airway hematoma with no evidence of obstruction.

**Conclusion:** Conservative management of tracheal injury limited to the mucosa or submucosa without significant amount of active bleeding using endotracheal intubation is considered a practical and effective approach. Successful management was ensured by appropriate clinical suspicion, early multidisciplinary team discussion, and prompt diagnosis and interventions.

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## 1. Introduction

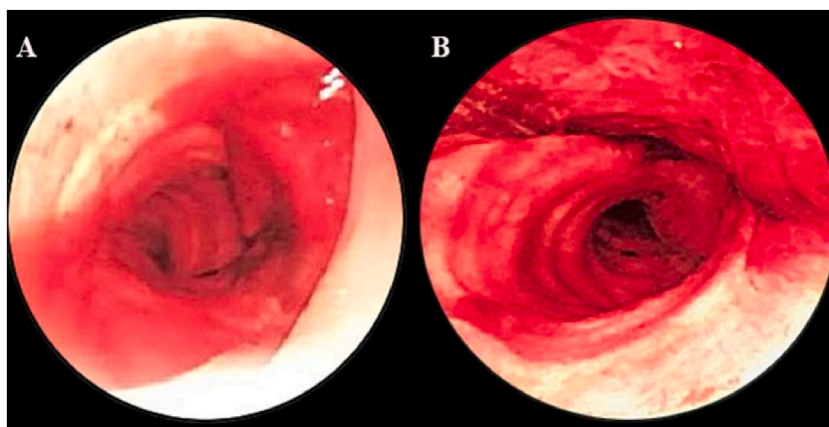
Tracheal injury, which is a rare but potentially serious acute complication of endotracheal intubation, accounts for less than 1% of all postoperative thyroidectomy complications [1]. The etiology of tracheal injury is presumably intertwined with various anatomical, mechanical, and uncertain factors. Dyspnea, subcutaneous or mediastinal emphysema, and hemoptysis, which are common clinical manifestations of tracheal injury, may present a delayed onset. Clinically significant injuries are often life-threatening; thus, suspected tracheal injury should be confirmed by bronchoscopy to determine the location and extent of the injury. Prompt diagnosis and treatment are key to avoid life-threatening complications [2].

This paper presents a rare case of tracheal injury with coagulation dysfunction following thyroid surgery and elucidates the clinical presentation and conservative management of this type of tracheal injury.

## 2. Case presentation

Written informed consent was obtained from the patient for the publication of this case report. A 58-year-old woman (weight: 44 kg, height: 167 cm, body mass index: 15.78) underwent thyroidectomy for the management of papillary thyroid carcinoma. B-ultrasound revealed a 4 × 4-mm solid nodule in the right inferior thyroid pole, with a Thyroid Imaging Reporting and Data Systems grade 4b, which met the indications for thyroidectomy (if nodules are considered malignant with suspected calcification, abnormal lymph nodes, rapid growth, or unclear boundaries, comprehensive management should be considered). The patient did not present any compressive symptoms or segmental tracheomalacia. No skin and subcutaneous tissue changes were observed following chemotherapy. The patient had previously undergone endoscopic mucosal resection for multiple gastric, intestinal, and esophageal polyps. Postoperative histological examination revealed an adenoma. The patient had previously undergone surgeries under general anesthesia for malignant breast tumor and received chemoradiation. In 2004, the patient underwent radical mastectomy for right breast cancer and began chemotherapy two weeks after surgery. TAC (docetaxel combined with doxorubicin hydrochloride and cyclophosphamide) regimen was adopted; eight chemotherapy treatment courses were performed, with the last being performed in 2005. No underlying polyglandular syndrome or familial gastrointestinal tumor syndromes, such as Gardner's syndrome or Carney complex, were reported based on the patient's medical records and follow-up.

The preoperative coagulation parameters, namely prothrombin time (PT), activated partial thromboplastin time (APTT), and thrombin time (TT), were within the normal range. Electrocardiography and echocardiography revealed no abnormality. A hemogram revealed mild anemia (hemoglobin, 110 g/L; platelet count,  $75 \times 10^9$ ), accompanied by low white blood cell count (white blood cells,  $2.89 \times 10^9$ /L); however, the patient reported no history of blood disease. Thyroid surgery was performed when the white blood cell count reached  $9.37 \times 10^9$ /L. After anesthesia induction, tracheal intubation with a 7.5-mm ID tube was performed without any difficulty (Cormack Lehane I level view). The patient underwent right thyroidectomy with isthmic thyroidectomy under general anesthesia. On the postoperative day 1 (POD 1), the patient complained of pain at the surgical incision and 30-ml fluid was observed in the drainage tube. The patient complained of bleeding in the throat the next day; hence, hemocoagulase agkistrodon was injected. Hemogram performed on POD 3, which revealed a hemoglobin level of 101 g/L and platelet count of  $95 \times 10^9$ ; coagulation parameters revealed an APTT of 24.3 s and fibrinogen levels of 1.13 g/L. 18.5 U of cryoprecipitate was injected for hypofibrinogenemia. Dyspnea was observed following a little hemoptysis. The wheezing sound was obvious and pulse oxygen saturation was 75%. The patient was admitted to the intensive care unit (ICU) and underwent tracheal intubation for maintenance of the airway. Bronchoscopy revealed blood in the trachea, which was cleared using an aspirator. Subsequent bronchoscopy revealed a pedunculated nodular red neoplasm (with a small amount of fresh hemorrhage on the surface) 5-cm from the carina in the trachea, which was approximately 2 × 3 cm in diameter, obstructing part of the lumen. An initial diagnosis of tracheal injury was considered (Fig. 1A and B). Fiberoptic bronchoscope



**Fig. 1.** The hematoma is located at the 5cm of the trachea Carina with a small amount of fresh bleeding, approximately 2 × 3cm in diameter, obstructing part of the lumen.

guided tracheal intubation aided in preventing rupture of the tumor, and the cannula was properly inflated to arrest the bleeding while blocking the lower part of the trachea.

A swelling on the left side of the neck was observed on POD 4. Follow-up plain film and contrast-enhanced computed tomography of the neck (Fig. 2) revealed a cervical mass with compressed stenosis of the trachea; postoperative bleeding was considered and an emergency surgical evacuation of the cervical hematoma under general anesthesia was performed. Bleeding (approximately 50 ml) was observed from the hematoma. No obvious signs of active bleeding were noted. The patient was referred to the ICU for further monitoring.

Changes in the hemoglobin levels, coagulation function, and other markers were observed. Owing to persistent pancytopenia, the patient received a red blood cell suspension, platelets, cold precipitation, and other intravenous infusions. The patient received an intravenous infusion of 4 U red blood cell suspension, 625 ml virus inactivated plasma, 1 U platelets, and 20 U cold precipitation. However, the patient demonstrated no obvious improvement of anemia despite frequent transfusions. Two days after the second procedure (POD 6), complete blood count revealed reduction of the red blood cell count to  $2.03 \times 10^{12}/L$ , hemoglobin concentration to 63 g/L, and platelet count to  $80 \times 10^9/L$  (Fig. 3); moreover, laboratory examination revealed abnormal coagulation parameters, anemia (Fig. 4), and hepatic dysfunction (Fig. 5). The patient received 2 U red blood cell suspension, 350 ml virus inactivated plasma, 1 U platelets, and 40 U cold precipitation owing to significant reduction in the hemoglobin, platelets, and fibrinogen levels. Based on the findings of the routine blood examination and coagulation function tests (Figs. 3 and 4), the patient was administered intravenous infusion of 2 U red blood cell suspension, 450 ml virus inactivated plasma, and 10 U cold precipitation daily until removal of the tracheal catheter.

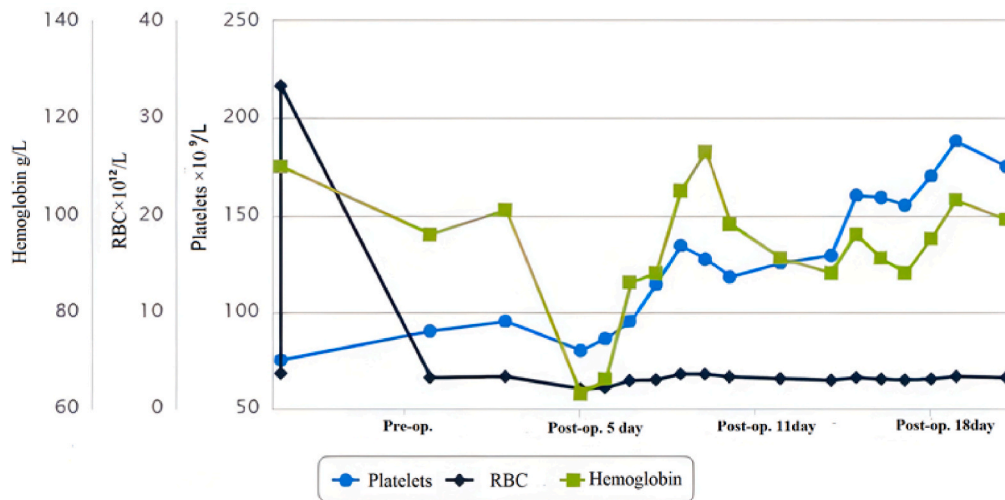
Following a multidisciplinary team discussion, pituitrin for hemostasis, tranexamic acid for strengthening hemostasis treatment, and nutritional support and anti-infection treatment were initiated. Endotracheal tube cuff inflation was performed to compress the bleeding site. Bronchoscopy revealed a small amount of dark red sputum in the trachea six days after the tracheal injury. The tracheal catheter was withdrawn above the bleeding focus, and partial resolution of the hematoma with no bleeding was observed. Nine days after the tracheal injury, the subcutaneous hematoma resolved completely; bronchoscopy revealed residual ecchymosis in the airway hematoma, with no evidence of obstruction. The tracheal catheter was successfully removed under the guidance of a bronchoscope. Overall, 210 U cryoprecipitate, 18 U erythrocyte, and 5100 ml plasma were transfused. The patient was satisfied with our treatment and was discharged 3 weeks after admission, with a hemoglobin level of 99 g/L, and referred to the hematology department for further treatment.

### 3. Discussion

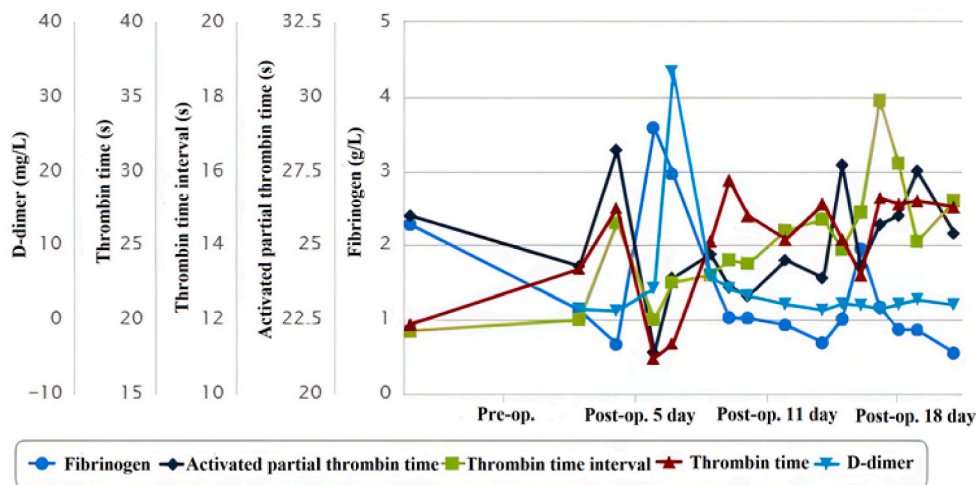
Tracheobronchial injury is a very rare complication of thyroid surgery. Gosnell et al. reported an incidence of less than 1% of postoperative complications of tracheal injury in a retrospective analysis of more than 11,000 thyroid surgeries [3]. The tracheal membrane was the most common location of tracheal injury [4]. Commonly reported initial symptoms include neck swelling and subcutaneous emphysema. The exact mechanism of tracheal injury is unknown. However, a series of risk factors contributing to trachea injury associated with endotracheal intubation can be classified as mechanical, patient, and anesthesiologist related factors (Table 1). Mechanical factors include elevated cuff pressure [5] and inappropriate size tube or double-lumen tube [6]. Patient factors include female sex [5], advanced age (age >50 years) [7], severe cough [8], tracheal anomalies [9], long-term use of steroids, and history of radiotherapy and chronic obstructive pulmonary disease [10,11]. Anesthesiologist-related factors include inexperience or improper handling of the endotracheal tube [12,13], repeat intubation [12], and repositioning of the tube without deflating the cuff



Fig. 2. Follow-up plain film and neck contrast-enhanced computed tomography demonstrated a cervical mass with compressed stenosis of the trachea.



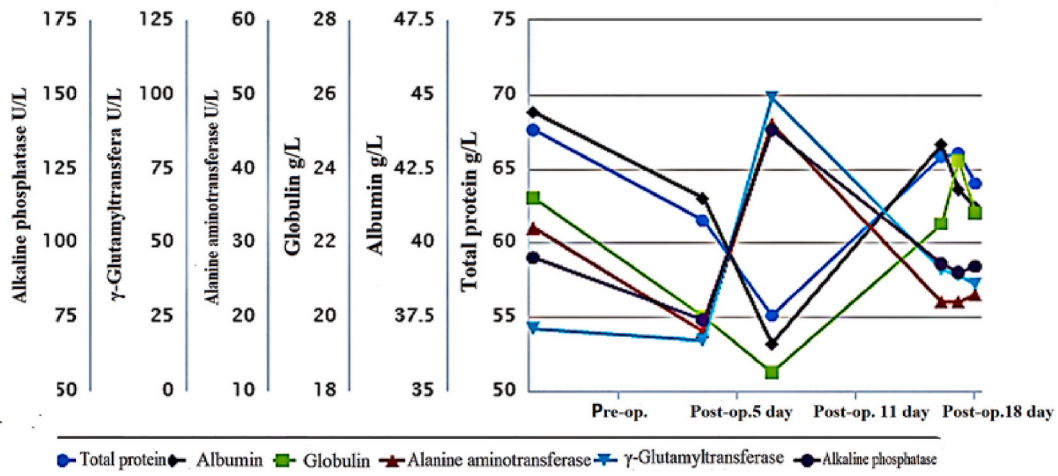
**Fig. 3.** RBC, hemoglobin and platelet counts reached a nadir of  $2.03 \times 10^{12}/L$ , 63g/L and  $80 \times 10^9/L$  at 5 days after surgery. RBC: Red blood cell, Pre-op.: preoperation, Post-op.: postoperation.



**Fig. 4.** The post-operative coagulation profile revealed prolongations in prothrombin and thrombin time, high D-dimer as well as decreases in fibrinogen from the day after tracheal injury. Pre-op.: preoperation, Post-op.: postoperation.

[14,15].

Tracheal hemorrhage with coagulation dysfunction following thyroid surgery is considered very rare. In the present case, we considered the following possible reasons for postoperative tracheal injury in the patient. First, preoperative endoscopic resection of the adenoma may have contributed to the inadequate nutritional intake resulting in obvious weight loss of the patient; thus, the quality of the tracheal cartilage tissue was poor and could not withstand the force attributed to the placement and use of a single-lumen tube. However, the patient was evaluated by an ENT specialist in the ICU, who confirmed the absence of tracheomalacia. Second, the patient had undergone postoperative chemotherapy for breast cancer; thus, vascular sclerosis could be present. Hardened blood vessels during endotracheal intubation could have resulted in intratracheal bleeding. Lastly, tracheal intubations were performed by an experienced anesthesiologist. An endotracheal tube with an internal diameter of 7.5 mm was employed with a high volume/low pressure cuff. Hence, the possibility of bleeding attributed to tracheal damage was minimal. Moreover, a retrospective study reported an incidence of less than 1% of tracheal injury during elective intubation performed by experienced anesthesiologists [16]. Considering the patient position in thyroid surgery, high-pressure jackets and catheters may damage the trachea when the patient is in a turn-over position or when the head and neck are suddenly twisted during intubation anesthesia.



**Fig. 5.** Liver dysfunction including alanine aminotransferase, glutamyltransferase, and alkaline phosphatase were increased on the 7th day after the first operation. Pre-op.: preoperation, Post-op.: postoperation

**Table 1**  
Multiple factors lead to tracheal injury after intubation.

| Mechanical factors   | Factors of patient   | Factors of anesthesiologists   |
|--|--|--|
| elevated cuff pressure [5]<br>tube (inappropriate size, double-lumen tube) [6] | Female gender [5] age>50 years [7]<br>Severe cough [8]<br>Long-term use of steroids, history of radiotherapy, chronic obstructive pulmonary disease [11]<br>Tracheal anomalies [9] | unskilled handling [13]<br>repeat intubation [12]<br>reposition tube without deflating the cuff [14] |

The patient, who underwent hemi-thyroidectomy, demonstrated coagulation abnormalities, including prolonged APTT, higher D-dimer levels, and lower platelet counts. Studies have reported low thyroid hormone concentrations to contribute to low coagulation and high fibrinolysis, which may impact the synthesis of coagulation factors in hypothyroidism [17]. Hyperthyroidism is predominantly associated with a hypercoagulable state and higher risk of venous thromboembolic events, whereas hypothyroidism is associated with a hypocoagulable state and higher risk of bleeding episodes [17,18]. However, the specific mechanism remains unclear. Concerning hypothyroidism and the impact of low thyroid hormone levels, studies have mainly described prolonged APTT with a decrease in the level of coagulation factor VIII and von Willebrand factor (vWF) [19,20]. A prospective study demonstrated patients with serious short-term hypothyroidism following partial thyroidectomy compared to those with normal thyroid function; the vWF and factor VIII (FVIII) levels were significantly decreased [21]. Fibrinogen, vWF, and FVIII reportedly play critical roles in the coagulation process. Studies have shown that a primary coagulation disorder similar to acquired von Willebrand disease as the most common coagulation disorder in hypothyroidism [22]. Moreover, patients with hypothyroidism show aberrant platelet function [23], which induces thrombocytopenia, defective platelet aggregation and agglutination, hyperfibrinolysis (shortened clot lysis time), and reduced clot lysis time prolongation dependent on thrombin-activatable fibrinolytic inhibitor.

In addition to the above mentioned reasons, the patient demonstrated postoperative hepatic dysfunction. Liver function plays an important role in coagulation. Liver damage impairs the synthesis of clotting factors rendering the clotting mechanism ineffective [24]. Hepatocytes contain nuclear thyroid hormone receptors, which may play an important role in the synthesis of coagulation factors [25]. Thus, the post-operative impaired liver function, coupled with the change in the thyroid hormone levels, significantly influenced the concentration of the coagulation factors.

Similarly, both tumor and surgical procedures may be associated with abnormal blood coagulation. Mi et al. [26] reported reduced clotting time (PT and APTT) and prolonged fibrinogen and D-dimer levels in patients with breast cancer; these findings were consistent with another study that reported prolonged APTT and fibrinogen and D-dimer levels; however, no statistically significant difference was observed in the PT [27]. The patient had a history of malignant breast cancer, which may have also contributed to the post-operative coagulation function of the patient to some extent.

Finally, postoperative anemia could be associated with blood transfusions as the use of sodium citrate as an anticoagulant can affect the mechanism of blood anticoagulation, which could further result in coagulation abnormalities [21].

In general, the procedure for treating patients with tracheal injury is practical and effective; clinicians believe that most retro-tracheal hematomas without extravasation can be easily managed by endotracheal intubation [28]. Thus, we opted for conservative management of the tracheal injury limited to the tracheal mucosa or submucosa; no pneumomediastinum or mediastinitis or



significant amount of active bleeding was noted.

Intratracheal bleeding and secretions are cleaned to prevent obstruction of the respiratory tract. For maintaining spontaneous breathing, inflation of the tracheal cuff was performed to gently compress the trachea for arresting the bleeding; methylprednisolone and aminophylline were administered with intravenous hemostatic drugs to prevent bronchospasm. Meanwhile, a multidisciplinary tracheal injury team, including head and neck surgeons with special expertise, anesthesiologists, chest physicians, critical care physicians, and interventional radiologists, was promptly established. Successful management was ensured by appropriate clinical suspicion, early multidisciplinary team discussion, and prompt diagnosis and interventions. However, we were unable to confirm the final diagnosis as the patient was lost to follow up.

#### 4. Conclusion

As very few cases of tracheal injury associated with coagulation abnormalities have been reported in the literature, our case report highlights conservative management of tracheal injury limited to the mucosa or submucosa without significant amount of active bleeding using endotracheal intubation as a practical and effective approach. Successful management was ensured by appropriate clinical suspicion, early multidisciplinary team discussion, and prompt diagnosis and interventions. Nevertheless, future studies are warranted to validate this treatment approach in clinical practice.

#### Funding

None.

#### Ethical approval

This report was approved by the institutional review board. Case Report is presented anonymously.

#### Informed consent

Informed consent was acquired from the patient and that the patient provided informed consent for the publication of the anonymised case details and images.

#### Data availability statement

Data sharing is not applicable to this report, because no datasets were generated or analyzed during the current study.

#### CRediT authorship contribution statement

**Zhenghuan Song:** Conceptualization, Data curation, Formal analysis, Resources, Writing – original draft. **Yueyi Jiang:** Data curation, Investigation, Writing – original draft. **Jing Tan:** Supervision, Writing – review & editing. **Lianbing Gu:** Supervision, Writing – review & editing. **Jiaqin Cai:** Data curation. **Yihu Zhou:** Data curation.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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