

# World Journal of *Clinical Cases*

*World J Clin Cases* 2021 December 6; 9(34): 10392-10745



## Contents

Thrice Monthly Volume 9 Number 34 December 6, 2021

### OPINION REVIEW

- 10392** Regulating monocyte infiltration and differentiation: Providing new therapies for colorectal cancer patients with COVID-19

*Bai L, Yang W, Qian L, Cui JW*

### REVIEW

- 10400** Role of circular RNAs in gastrointestinal tumors and drug resistance

*Xi SJ, Cai WQ, Wang QQ, Peng XC*

### MINIREVIEWS

- 10418** Liver injury associated with acute pancreatitis: The current status of clinical evaluation and involved mechanisms

*Liu W, Du JJ, Li ZH, Zhang XY, Zuo HD*

- 10430** Association between celiac disease and vitiligo: A review of the literature

*Zhang JZ, Abudoureyimu D, Wang M, Yu SR, Kang XJ*

- 10438** Role of immune escape in different digestive tumours

*Du XZ, Wen B, Liu L, Wei YT, Zhao K*

### ORIGINAL ARTICLE

#### Basic Study

- 10451** Magnolol protects against acute gastrointestinal injury in sepsis by down-regulating regulated on activation, normal T-cell expressed and secreted

*Mao SH, Feng DD, Wang X, Zhi YH, Lei S, Xing X, Jiang RL, Wu JN*

#### Case Control Study

- 10464** Effect of Nephritis Rehabilitation Tablets combined with tacrolimus in treatment of idiopathic membranous nephropathy

*Ly W, Wang MR, Zhang CZ, Sun XX, Yan ZZ, Hu XM, Wang TT*

#### Retrospective Cohort Study

- 10472** Lamb's tripe extract and vitamin B<sub>12</sub> capsule plus celecoxib reverses intestinal metaplasia and atrophy: A retrospective cohort study

*Wu SR, Liu J, Zhang LF, Wang N, Zhang LY, Wu Q, Liu JY, Shi YQ*

- 10484** Clinical features and survival of patients with multiple primary malignancies

*Wang XK, Zhou MH*

**Retrospective Study**

- 10494** Thoracoscopic segmentectomy and lobectomy assisted by three-dimensional computed-tomography bronchography and angiography for the treatment of primary lung cancer  
*Wu YJ, Shi QT, Zhang Y, Wang YL*
- 10507** Endoscopic ultrasound fine needle aspiration *vs* fine needle biopsy in solid lesions: A multi-center analysis  
*Moura DTH, McCarty TR, Jirapinyo P, Ribeiro IB, Farias GFA, Madruga-Neto AC, Ryou M, Thompson CC*
- 10518** Resection of bilateral occipital lobe lesions during a single operation as a treatment for bilateral occipital lobe epilepsy  
*Lyu YE, Xu XF, Dai S, Feng M, Shen SP, Zhang GZ, Ju HY, Wang Y, Dong XB, Xu B*
- 10530** Improving rehabilitation and quality of life after percutaneous transhepatic cholangiography drainage with a rapid rehabilitation model  
*Xia LL, Su T, Li Y, Mao JF, Zhang QH, Liu YY*
- 10540** Combined lumbar muscle block and perioperative comprehensive patient-controlled intravenous analgesia with butorphanol in gynecological endoscopic surgery  
*Zhu RY, Xiang SQ, Chen DR*
- 10549** Teicoplanin combined with conventional vancomycin therapy for the treatment of pulmonary methicillin-resistant *Staphylococcus aureus* and *Staphylococcus epidermidis* infections  
*Wu W, Liu M, Geng JJ, Wang M*
- 10557** Application of narrative nursing in the families of children with biliary atresia: A retrospective study  
*Zhang LH, Meng HY, Wang R, Zhang YC, Sun J*

**Observational Study**

- 10566** Comparative study for predictability of type 1 gastric variceal rebleeding after endoscopic variceal ligation: High-frequency intraluminal ultrasound study  
*Kim JH, Choe WH, Lee SY, Kwon SY, Sung IK, Park HS*
- 10576** Effects of WeChat platform-based health management on health and self-management effectiveness of patients with severe chronic heart failure  
*Wang ZR, Zhou JW, Liu XP, Cai GJ, Zhang QH, Mao JF*
- 10585** Early cardiopulmonary resuscitation on serum levels of myeloperoxidase, soluble ST2, and hypersensitive C-reactive protein in acute myocardial infarction patients  
*Hou M, Ren YP, Wang R, Lu LX*

**Prospective Study**

- 10595** Remimazolam benzenesulfonate anesthesia effectiveness in cardiac surgery patients under general anesthesia  
*Tang F, Yi JM, Gong HY, Lu ZY, Chen J, Fang B, Chen C, Liu ZY*

**Randomized Clinical Trial**

- 10604** Effects of lower body positive pressure treadmill on functional improvement in knee osteoarthritis: A randomized clinical trial study  
*Chen HX, Zhan YX, Ou HN, You YY, Li WY, Jiang SS, Zheng MF, Zhang LZ, Chen K, Chen QX*

**SYSTEMATIC REVIEWS**

- 10616** Effects of hypoxia on bone metabolism and anemia in patients with chronic kidney disease  
*Kan C, Lu X, Zhang R*

**META-ANALYSIS**

- 10626** Intracuff alkalinized lidocaine to prevent postoperative airway complications: A meta-analysis  
*Chen ZX, Shi Z, Wang B, Zhang Y*

**CASE REPORT**

- 10638** Rarely fast progressive memory loss diagnosed as Creutzfeldt-Jakob disease: A case report  
*Xu YW, Wang JQ, Zhang W, Xu SC, Li YX*
- 10645** Diagnosis, fetal risk and treatment of pemphigoid gestationis in pregnancy: A case report  
*Jiao HN, Ruan YP, Liu Y, Pan M, Zhong HP*
- 10652** Histology transformation-mediated pathological atypism in small-cell lung cancer within the presence of chemotherapy: A case report  
*Ju Q, Wu YT, Zhang Y, Yang WH, Zhao CL, Zhang J*
- 10659** Reversible congestive heart failure associated with hypocalcemia: A case report  
*Wang C, Dou LW, Wang TB, Guo Y*
- 10666** Excimer laser coronary atherectomy for a severe calcified coronary ostium lesion: A case report  
*Hou FJ, Ma XT, Zhou YJ, Guan J*
- 10671** Comprehensive management of malocclusion in maxillary fibrous dysplasia: A case report  
*Kaur H, Mohanty S, Kochhar GK, Iqbal S, Verma A, Bhasin R, Kochhar AS*
- 10681** Intravascular papillary endothelial hyperplasia as a rare cause of cervicothoracic spinal cord compression: A case report  
*Gu HL, Zheng XQ, Zhan SQ, Chang YB*
- 10689** Proximal true lumen collapse in a chronic type B aortic dissection patient: A case report  
*Zhang L, Guan WK, Wu HP, Li X, Lv KP, Zeng CL, Song HH, Ye QL*
- 10696** Tigecycline sclerotherapy for recurrent pseudotumor in aseptic lymphocyte-dominant vasculitis-associated lesion after metal-on-metal total hip arthroplasty: A case report  
*Lin IH, Tsai CH*

- 10702** Acute myocardial infarction induced by eosinophilic granulomatosis with polyangiitis: A case report  
*Jiang XD, Guo S, Zhang WM*
- 10708** Aggressive natural killer cell leukemia with skin manifestation associated with hemophagocytic lymphohistiocytosis: A case report  
*Peng XH, Zhang LS, Li LJ, Guo XJ, Liu Y*
- 10715** Chronic lymphocytic leukemia/small lymphocytic lymphoma complicated with skin Langerhans cell sarcoma: A case report  
*Li SY, Wang Y, Wang LH*
- 10723** Severe mediastinitis and pericarditis after endobronchial ultrasound-guided transbronchial needle aspiration: A case report  
*Koh JS, Kim YJ, Kang DH, Lee JE, Lee SI*
- 10728** Obturator hernia - a rare etiology of lateral thigh pain: A case report  
*Kim JY, Chang MC*
- 10733** Tracheal tube misplacement in the thoracic cavity: A case report  
*Li KX, Luo YT, Zhou L, Huang JP, Liang P*
- 10738** Peri-implant keratinized gingiva augmentation using xenogeneic collagen matrix and platelet-rich fibrin: A case report  
*Han CY, Wang DZ, Bai JF, Zhao LL, Song WZ*

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**RESPONSIBLE EDITORS FOR THIS ISSUE**

Production Editor: Yan-Xia Xing; Production Department Director: Yun-Jie Ma; Editorial Office Director: Jin-Lei Wang.

**NAME OF JOURNAL**

*World Journal of Clinical Cases*

**ISSN**

ISSN 2307-8960 (online)

**LAUNCH DATE**

April 16, 2013

**FREQUENCY**

Thrice Monthly

**EDITORS-IN-CHIEF**

Dennis A Bloomfield, Sandro Vento, Bao-Gan Peng

**EDITORIAL BOARD MEMBERS**

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

**PUBLICATION DATE**

December 6, 2021

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<https://www.wjgnet.com/bpg/gerinfo/242>

**STEPS FOR SUBMITTING MANUSCRIPTS**

<https://www.wjgnet.com/bpg/GerInfo/239>

**ONLINE SUBMISSION**

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## Tracheal tube misplacement in the thoracic cavity: A case report

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**Author contributions:** Li KX, Luo YT, and Zhou L collected medical records of the patient; all authors were involved in the drafting and revision of this manuscript and approved the final version to be published.

**Informed consent statement:** Informed written consent was obtained from the patient for publication of this report and any accompanying images.

**Conflict-of-interest statement:** The authors declare that they have no conflict of interest.

**CARE Checklist (2016) statement:** The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

**Country/Territory of origin:** China

**Specialty type:** Anesthesiology

**Provenance and peer review:** Unsolicited article; Externally peer reviewed.

**Peer-review report's scientific quality classification**  
Grade A (Excellent): 0

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### Abstract

#### BACKGROUND

Penetrating neck injuries require prompt recognition, diagnosis and management of critical airways. This case demonstrates an emergent situation that a "medical negligence" was avoided with the aid of end-tidal carbon dioxide (ETCO<sub>2</sub>) waveform.

#### CASE SUMMARY

We report a case of malposition of the endotracheal tube into the right hemithoracic cavity for cervical knife trauma, resulting in pneumothorax. Tube placement was not confirmed during emergency airway management, and the patient was directly transferred to the emergency operation room. Assisted by ETCO<sub>2</sub> and imaging examinations, the anesthetist timely noticed the absence of ETCO<sub>2</sub> waveform and resolved this urgent situation before anesthesia induction.

#### CONCLUSION

This case emphasizes the necessity of ETCO<sub>2</sub> waveform and/or X-ray confirmation of endotracheal intubation even in emergent situations.

**Key Words:** Penetrating neck injury; Tracheal injury; Endotracheal intubation; Malposition; Pneumothorax; Case report

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**Core Tip:** We report a case of malposition of the endotracheal tube into the right

Grade B (Very good): B  
 Grade C (Good): C  
 Grade D (Fair): 0  
 Grade E (Poor): 0

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**Received:** August 2, 2021

**Peer-review started:** August 2, 2021

**First decision:** September 1, 2021

**Revised:** September 9, 2021

**Accepted:** October 18, 2021

**Article in press:** October 18, 2021

**Published online:** December 6, 2021

**P-Reviewer:** Beşler MS, Masaki S

**S-Editor:** Yan JP

**L-Editor:** A

**P-Editor:** Yan JP



hemithoracic cavity for cervical knife trauma, resulting in pneumothorax. Fortunately, the anesthetist timely noticed the absence of end-tidal carbon dioxide (ETCO<sub>2</sub>) waveform and reviewed the thoracic computed tomography scanning just before anesthesia induction. This case highlights the role of ETCO<sub>2</sub> waveform and/or chest radiography in confirmation of emergency endotracheal intubation, especially for junior doctors and emergency physicians.

**Citation:** Li KX, Luo YT, Zhou L, Huang JP, Liang P. Tracheal tube misplacement in the thoracic cavity: A case report. *World J Clin Cases* 2021; 9(34): 10733-10737

**URL:** <https://www.wjgnet.com/2307-8960/full/v9/i34/10733.htm>

**DOI:** <https://dx.doi.org/10.12998/wjcc.v9.i34.10733>

## INTRODUCTION

Penetrating neck injuries (PNI) are neck injuries penetrating the platysma and represent 5% to 10% of all traumatic events with a high mortality rate due to unprotected airway and proximity to vital vascular structures and trachea[1,2]. PNI requires anesthesiologists and surgeons to maintain vigilance on timely recognition, diagnosis, and management[2-4]. Challenging airway management is inevitable[5]. End-tidal carbon dioxide (ETCO<sub>2</sub>) monitoring non-invasively detects the concentration of CO<sub>2</sub> at the end of expiration[6]. And the appearance of ETCO<sub>2</sub> waveform is regarded as the golden standard for proper intubations. However, intubation without confirmation tends to happen, especially in urgent situations, such as PNI. Here we report a rare case of misplaced endotracheal tube into the thoracic cavity.

## CASE PRESENTATION

### Chief complaints

A 28-year-old female patient was admitted to the emergency department with knife injury to the neck for 12 h.

### History of present illness

The patient was found to have tracheal injury 1cm below the thyroid cartilage with severe pain, active bleeding (the specific amount of blood loss was unknown) dyspnea, chest distress, shortness of breath and dysphonia. She was managed with compression packing at a local hospital and was transferred to our hospital for further management.

### History of past illness

The patient had a disease-free personal and family history.

### Personal and family history

The patient had not the special personal or family history.

### Physical examination

On admission, the patient was awake with stable vital signs: temperature 36.6 °C, pulse rate 98 bpm, respiratory rate 22/min and blood pressure 118/70 mmHg. Tissue deficits were identified on the left sternocleidomastoid muscles. Breath sounds were slightly diminished, and dry and moist rales were noticed on both upper lobes.

### Laboratory examinations

Leucocyte count was  $12.79 \times 10^9/L$ , where neutrophils accounted for 86.8%. And other examinations were all normal, such as hematocrit and hemoglobin count. Urine analysis was also normal. Prothrombin, partial thromboplastin times, and d-dimers were within normal ranges. Electrocardiogram showed a sinus rhythm.



### Imaging examinations

After the endotracheal tube was inserted, the patient underwent urgent imaging examinations for operation preparation. Computed tomographic angiography (CTA) showed that there was no leakage, occlusion or expansion of cervical blood vessels and branches. Emergent cervical computed tomography (CT) scan revealed extensive gas accumulation in the mediastinum and underneath the cervical tissue, and continuous interruption in the anterior part of trachea. Chest CT scan demonstrated that the right hemithoracic cavity with limited pleural effusion was collapsed by 70% approximately. The patchy lesions and shadows suggested slight infection in the right hemithorax.

### FINAL DIAGNOSIS

The patient was diagnosed with cervical knife trauma and tracheal injuries, which should be managed by emergency operation.

### TREATMENT

The emergency medicine physician inserted a 6.5# endotracheal tube into the wound, and inflated the cuff to prevent bleeding from the lumen into the ruptured trachea. Right chest tube was placed for preventing suspected pneumothorax. The patient was immediately transferred to the operating room for exploration after CT scan was performed, but without final reading and confirmation.

### OUTCOME AND FOLLOW-UP

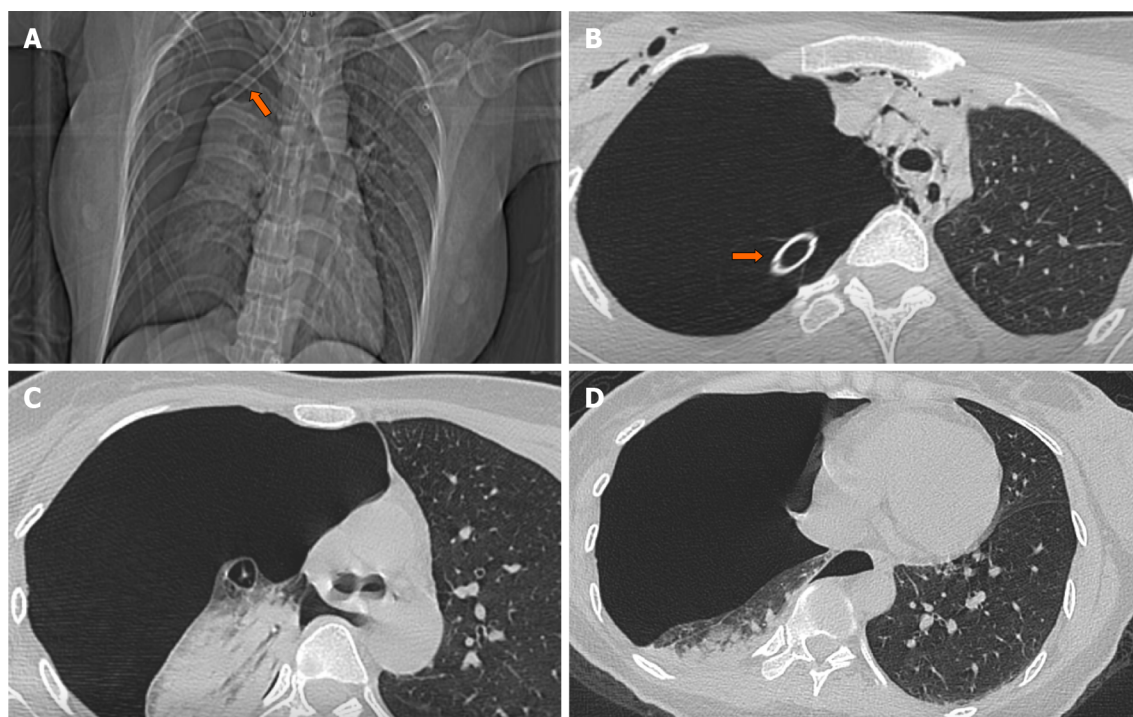
The anesthetist was informed that the airway was secured without aspiration risks. However, the patient was agitated and in respiratory distress with 85% pulse oxygenation on room air. After the tracheal tube was connected with anesthesia circuit, the breathing bag of the anesthesia machine was expanding and shrinking during patient's spontaneous breathing (25/min). However, ETCO<sub>2</sub> waveform was absent. CT scan was reviewed immediately and revealed that the endotracheal tube entered into the right hemithoracic cavity and the right lung was collapsed by 70% approximately due to extensive pneumothorax (Figure 1).

The anesthesiologist and otolaryngologist immediately reinserted the tracheal tube, connecting it to the ETCO<sub>2</sub> monitor. The tube placement was confirmed carefully before final fixation. Next, the patient underwent open neck exploration, tracheal end-to-end anastomosis, recurrent laryngeal nerve reconstruction and tracheotomy thereafter. The subsequent clinical course was uneventful, the patient was transferred into intensive care unit and discharged after two-week hospitalization.

### DISCUSSION

We presented a case of tracheal tube misplacement into the thoracic cavity for neck injury. Although the emergency medicine physicians promptly evaluated and attempted to manage the airway with an awake endotracheal intubation, the tube was inserted into the thoracic cavity and produced pneumothorax. Because the patient was on spontaneous breathing and a chest tube was placed on the same side, breath sounds were heard bilaterally. The patient was sent immediately to the operating room assuming successful airway establishment. Successful airway management should have been confirmed with clinical evaluation, chest radiography, and ETCO<sub>2</sub> detection[4].

Iatrogenic tracheobronchial injuries by intubation have been reported[6-8], including tracheal laceration[9,10] and subcutaneous emphysema[11-13]. Incorrect tube sizes and reintubation may contribute to iatrogenic injuries with direct laryngoscopy after endotracheal intubation[14]. Therefore, some studies recommended awake intubation, flexible fiberoptic bronchoscopy, or direct ultrasound visualization to avoid false passage and tracheal injury[15-18]. When dealing with tracheal trauma from PNI, confirmation of the endotracheal tube placement by ETCO<sub>2</sub> waveform



**Figure 1** X-ray and computed tomography findings after insertion of endotracheal tube and right chest tube. A and B: X ray (A) and computed tomography (CT, B) scan images revealed that there was a tracheal tube inserted into the right hemithorax (orange arrow); C and D: CT scan images showed that right pulmonary markings were absent, and right lung was condensed. The right lung was condensed by 70% and the mediastinum shifted to the right side.

and/or X-ray/CT scan is mandatory.

## CONCLUSION

Airway establishment is the priority option for tracheal injuries, which was an extremely urgent situation for PNI. Emergent evaluation and treatment are challenging. Negligence is inevitable, especially in emergency situations. This case highlights the role of ETCO<sub>2</sub> waveform and/or chest radiography in confirmation of emergent endotracheal intubation after emergent intubation, especially for junior doctors and emergent physicians.

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