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Contents

Thrice Monthly Volume 9 Number 32 November 16, 2021

REVIEW

- 9699 Emerging role of long noncoding RNAs in recurrent hepatocellular carcinoma
Fang Y, Yang Y, Li N, Zhang XL, Huang HF

MINIREVIEWS

- 9711 Current treatment strategies for patients with only peritoneal cytology positive stage IV gastric cancer
Bausys A, Gricius Z, Aniukstyte L, Luksta M, Bickaite K, Bausys R, Strupas K

ORIGINAL ARTICLE

Case Control Study

- 9722 Botulinum toxin associated with fissurectomy and anoplasty for hypertonic chronic anal fissure: A case-control study
D'Orazio B, Geraci G, Famà F, Terranova G, Di Vita G
- 9731 Correlation between circulating endothelial cell level and acute respiratory distress syndrome in postoperative patients
Peng M, Yan QH, Gao Y, Zhang Z, Zhang Y, Wang YF, Wu HN

Retrospective Study

- 9741 Effects of early rehabilitation in improvement of paediatric burnt hands function
Zhou YQ, Zhou JY, Luo GX, Tan JL
- 9752 Intracortical screw insertion plus limited open reduction in treating type 31A3 irreducible intertrochanteric fractures in the elderly
Huang XW, Hong GQ, Zuo Q, Chen Q
- 9762 Treatment effects and periodontal status of chronic periodontitis after routine Er:YAG laser-assisted therapy
Gao YZ, Li Y, Chen SS, Feng B, Wang H, Wang Q
- 9770 Risk factors for occult metastasis detected by inflammation-based prognostic scores and tumor markers in biliary tract cancer
Hashimoto Y, Ajiki T, Yanagimoto H, Tsugawa D, Shinozaki K, Toyama H, Kido M, Fukumoto T
- 9783 Scapular bone grafting with allograft pin fixation for repair of bony Bankart lesions: A biomechanical study
Lu M, Li HP, Liu YJ, Shen XZ, Gao F, Hu B, Liu YF
- 9792 High-resolution computed tomography findings independently predict epidermal growth factor receptor mutation status in ground-glass nodular lung adenocarcinoma
Zhu P, Xu XJ, Zhang MM, Fan SF

- 9804** Colorectal cancer patients in a tertiary hospital in Indonesia: Prevalence of the younger population and associated factors

Makmun D, Simadibrata M, Abdullah M, Syam AF, Shatri H, Fauzi A, Renaldi K, Maulahela H, Utari AP, Pribadi RR, Muzellina VN, Nursyirwan SA

- 9815** Association between *Helicobacter pylori* infection and food-specific immunoglobulin G in Southwest China

Liu Y, Shuai P, Liu YP, Li DY

- 9825** Systemic immune inflammation index, ratio of lymphocytes to monocytes, lactate dehydrogenase and prognosis of diffuse large B-cell lymphoma patients

Wu XB, Hou SL, Liu H

Clinical Trials Study

- 9835** Evaluating the efficacy of endoscopic sphincterotomy on biliary-type sphincter of Oddi dysfunction: A retrospective clinical trial

Ren LK, Cai ZY, Ran X, Yang NH, Li XZ, Liu H, Wu CW, Zeng WY, Han M

Observational Study

- 9847** Management of pouch related symptoms in patients who underwent ileal pouch anal anastomosis surgery for adenomatous polyposis

Gilad O, Rosner G, Brazowski E, Kariv R, Gluck N, Strul H

- 9857** Presepsin as a biomarker for risk stratification for acute cholangitis in emergency department: A single-center study

Zhang HY, Lu ZQ, Wang GX, Xie MR, Li CS

Prospective Study

- 9869** Efficacy of Yiqi Jianpi anti-cancer prescription combined with chemotherapy in patients with colorectal cancer after operation

Li Z, Yin DF, Wang W, Zhang XW, Zhou LJ, Yang J

META-ANALYSIS

- 9878** Arthroplasty vs proximal femoral nails for unstable intertrochanteric femoral fractures in elderly patients: a systematic review and meta-analysis

Chen WH, Guo WX, Gao SH, Wei QS, Li ZQ, He W

CASE REPORT

- 9889** Synchronous multiple primary malignancies of the esophagus, stomach, and jejunum: A case report

Li Y, Ye LS, Hu B

- 9896** Idiopathic acute superior mesenteric venous thrombosis after renal transplantation: A case report

Zhang P, Li XJ, Guo RM, Hu KP, Xu SL, Liu B, Wang QL

- 9903** Next-generation sequencing technology for diagnosis and efficacy evaluation of a patient with visceral leishmaniasis: A case report

Lin ZN, Sun YC, Wang JP, Lai YL, Sheng LX

- 9911** Cerebral air embolism complicating transbronchial lung biopsy: A case report
Herout V, Brat K, Richter S, Cundrle Jr I
- 9917** Isolated synchronous Virchow lymph node metastasis of sigmoid cancer: A case report
Yang JQ, Shang L, Li LP, Jing HY, Dong KD, Jiao J, Ye CS, Ren HC, Xu QF, Huang P, Liu J
- 9926** Clinical presentation and management of drug-induced gingival overgrowth: A case series
Fang L, Tan BC
- 9935** Adult with mass burnt lime aspiration: A case report and literature review
Li XY, Hou HJ, Dai B, Tan W, Zhao HW
- 9942** Massive hemothorax due to intercostal arterial bleeding after percutaneous catheter removal in a multiple-trauma patient: A case report
Park C, Lee J
- 9948** Hemolymphangioma with multiple hemangiomas in liver of elderly woman with history of gynecological malignancy: A case report
Wang M, Liu HF, Zhang YZZ, Zou ZQ, Wu ZQ
- 9954** Rare location and drainage pattern of right pulmonary veins and aberrant right upper lobe bronchial branch: A case report
Wang FQ, Zhang R, Zhang HL, Mo YH, Zheng Y, Qiu GH, Wang Y
- 9960** Respiratory failure after scoliosis correction surgery in patients with Prader-Willi syndrome: Two case reports
Yoon JY, Park SH, Won YH
- 9970** Computed tomography-guided chemical renal sympathetic nerve modulation in the treatment of resistant hypertension: A case report
Luo G, Zhu JJ, Yao M, Xie KY
- 9977** Large focal nodular hyperplasia is unresponsive to arterial embolization: A case report
Ren H, Gao YJ, Ma XM, Zhou ST
- 9982** Fine-needle aspiration cytology of an intrathyroidal nodule diagnosed as squamous cell carcinoma: A case report
Yu JY, Zhang Y, Wang Z
- 9990** Extensive abdominal lymphangiomatosis involving the small bowel mesentery: A case report
Alhasan AS, Daqqaq TS
- 9997** Gastrointestinal symptoms as the first sign of chronic granulomatous disease in a neonate: A case report
Meng EY, Wang ZM, Lei B, Shang LH
- 10006** Screw penetration of the iliopsoas muscle causing late-onset pain after total hip arthroplasty: A case report
Park HS, Lee SH, Cho HM, Choi HB, Jo S

- 10013** Uretero-lumbar artery fistula: A case report
Chen JJ, Wang J, Zheng QG, Sun ZH, Li JC, Xu ZL, Huang XJ
- 10018** Rare mutation in MKRN3 in two twin sisters with central precocious puberty: Two case reports
Jiang LQ, Zhou YQ, Yuan K, Zhu JF, Fang YL, Wang CL
- 10024** Primary mucosal-associated lymphoid tissue extranodal marginal zone lymphoma of the bladder from an imaging perspective: A case report
Jiang ZZ, Zheng YY, Hou CL, Liu XT
- 10033** Focal intramural hematoma as a potential pitfall for iatrogenic aortic dissection during subclavian artery stenting: A case report
Zhang Y, Wang JW, Jin G, Liang B, Li X, Yang YT, Zhan QL
- 10040** Ventricular tachycardia originating from the His bundle: A case report
Zhang LY, Dong SJ, Yu HJ, Chu YJ
- 10046** Posthepatectomy jaundice induced by paroxysmal nocturnal hemoglobinuria: A case report
Liang HY, Xie XD, Jing GX, Wang M, Yu Y, Cui JF

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Adult with mass burnt lime aspiration: A case report and literature review

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Abstract

BACKGROUND

Foreign body aspiration mainly occurs in children, which can cause a severe concurrent syndrome and even death without timely treatment. As a rare foreign body, aspiration of lime is seldom reported, and most cases involve a small amount of hydrated lime. Although the symptoms are usually severe, the prognosis is good after suitable treatment. Experience of treatment for lime aspiration is lacking, and this report provides novel evidence for treatment of mass burnt lime aspiration using bronchoscopy.

CASE SUMMARY

We report an adult with a large amount of burnt lime aspiration. Because of delay in clearance of the inhaled lime in the trachea and bronchus at the local hospital, he suffered several severe complications, including complete occlusion of the right primary bronchus, aeropleura, aerodermelectasia, pneumomediastinum, secondary infection and hypoxemia at 4 d after injury. After transferring to our department, bronchoscopy was immediately carried out to clear the lime in the major airway, using foreign body forceps, biopsy forceps, puncture needle, and hairbrush. The patient's condition recovered rapidly and at 3-months' follow-up, he demonstrated good recovery of the bronchus and lung parenchyma.

CONCLUSION

After mass lime aspiration, flexible fiberoptic bronchoscopy is suggested as early as possible, using clamping, flushing or cryotherapy.

Key Words: Burnt lime; Aspiration; Bronchial obstruction; Flexible fiberoptic bronchoscopy; Computed tomography; Case report

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Core Tip: Aspiration of lime is seldom reported, especially in adults, and most cases involve small amounts of hydrated lime. We report an adult with a large amount of burnt lime aspiration. Because of delay in clearance of the inhaled lime in the airway, he suffered severe complications. Bronchoscopy was immediately carried out to clear the lime by mechanical methods such as clamping, washing and freezing. The treatment target was to release airway obstruction. After removal of most of the lime, the condition improved rapidly, and follow-up showed good recovery.

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INTRODUCTION

Foreign body aspiration mainly occurs in children, and can cause a severe concurrent syndrome and even death without timely treatment. As a rare foreign body, aspiration of lime is seldom reported, and most cases involve a small amount of hydrated lime. Although the symptoms are usually severe, the prognosis is good after suitable treatment. We report an adult with a large amount of burnt lime aspiration. Because of delayed clearance of the inhaled lime in the trachea and bronchus at the local hospital, he suffered several severe complications, including complete occlusion of the right primary bronchus, aeropleura, aerodermelectasia, pneumomediastinum, secondary infection and hypoxemia at 4 d after injury. After transferring to our department, bronchoscopy was immediately carried out to clear the lime by mechanical methods such as clamping, washing and freezing. After removal of most of the lime in the airway, the condition improved rapidly, and follow-up showed good recovery. There is a lack of experience of treatment for lime aspiration. To our knowledge, searches of databases, including PubMed, Wanfang and China National Knowledge Infrastructure (CNKI), have only revealed six reports including eight cases (seven adolescents and one adult) who suffered lime aspiration, and most of them inhaled hydrated lime. Bronchoscopy is suggested as early as possible after mass lime aspiration, and the treatment target is mainly to clear the airway. Moreover, electroexcision or laser dissection should be avoided to clean the lime. Instead, we suggest combining several mechanical methods, such as clamping, flushing and cryotherapy. The prognosis is usually good when treatment is timely.

CASE PRESENTATION

Chief complaints

A 24-year-old man was transferred to our department with the complaint of dyspnea for 5 d after burnt lime aspiration after an accidental high fall.

History of present illness

The patient fell head down 5 d before admission from a height of 2 m into a truck of burnt lime and inhaled a large amount. He had severe dyspnea and was immediately admitted to a local hospital. Computed tomography (CT) showed a high-intensity mass in the right principle bronchus, and pneumomediastinum (Figure 1). Blood gas analysis demonstrated severe hypoxemia [partial pressure of oxygen (PaO₂) 70 mmHg, fraction of inspired oxygen (FiO₂) 50%]. Bronchoscopy and mechanical ventilation were carried out. Because of limited conditions, clearance of lime from the airway was not performed. The patient's condition became more severe with additional symptoms such as disturbance of consciousness and fever (maximum 38.0°C). Follow-up CT at 1 d before admission showed a high-intensity mass in the right primary bronchus, right pulmonary atelectasis, right aeropleura, and pneumomediastinum. Blood gas analysis demonstrated severer hypoxemia (PaO₂ 48 mmHg, FiO₂ 100%). He then underwent closed drainage of the right thorax and was transferred to our department.

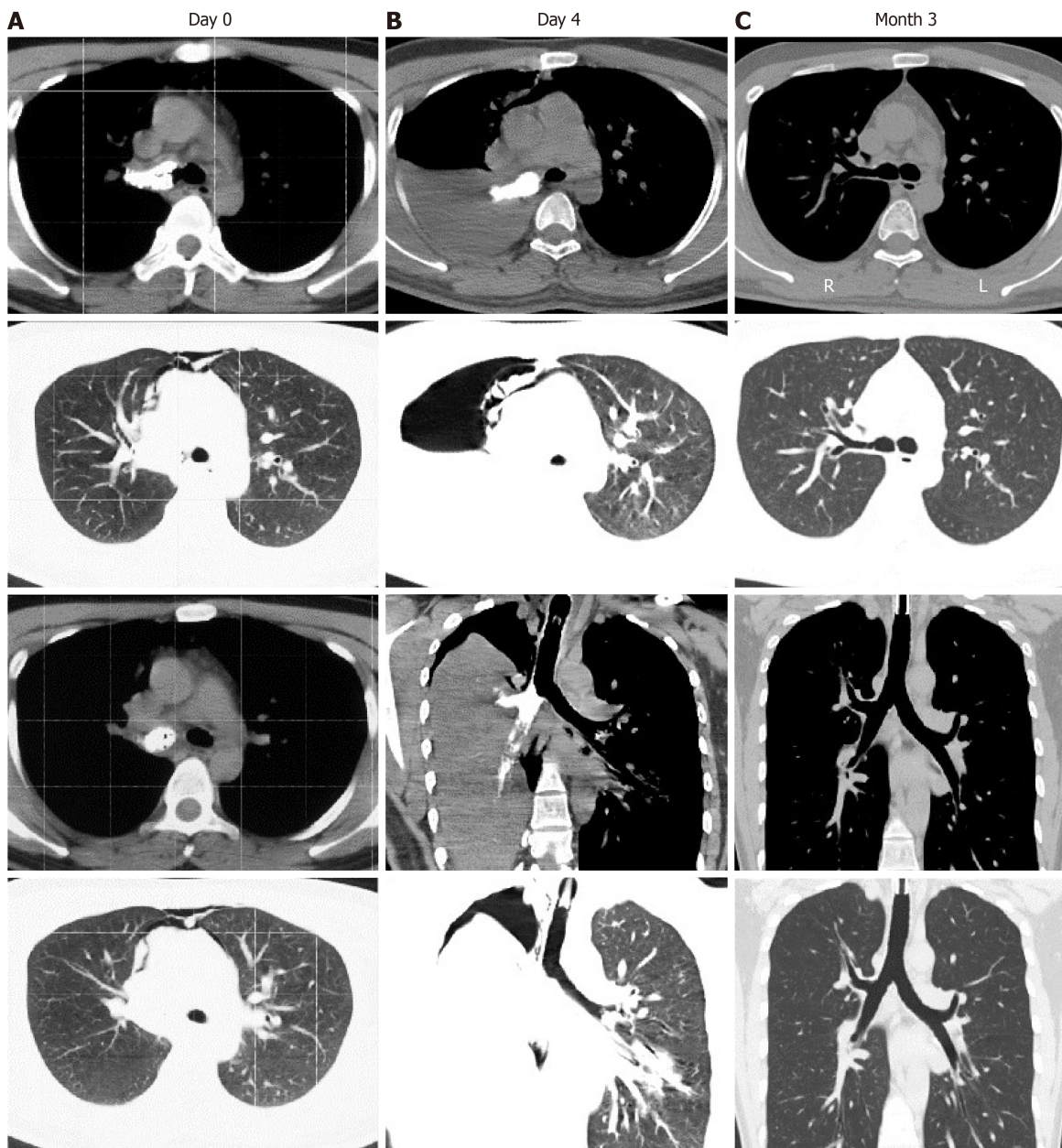


Figure 1 Computed tomography (CT) manifestation of the patient's lung with lime aspiration. A: CT after lime aspiration showed a high-intensity mass in the right principle bronchus, and pneumomediastinum; B: Follow-up CT at 1 d before bronchoscopy showed secondary right pulmonary atelectasis, and aeropleura; C: Follow-up CT at 3 mo showed anatomical recovery of the bronchus and lung.

History of past illness

The patient had no history of illness.

Personal and family history

The patient had no medical history.

Physical examination

The patient had dysphoria and was delirious. His body temperature was 39.5°C, respiratory rate 35–40 breaths/min, blood pressure 130/65 mmHg, pulse oxygen saturation (SpO₂) 60% (FiO₂ 100%), missed respiratory sound in the right lung, crude respiratory sound in the left lung, no visible injury of the body skin, and conjunctival suffusion.

Laboratory examinations

Blood gas analysis demonstrated severer hypoxemia (PaO₂ 48 mmHg, FiO₂ 100%).

Imaging examinations

CT showed a high-intensity mass in the right principle bronchus and pneumomediastinum (Figure 1A). Follow-up CT showed a high-intensity mass in the right primary bronchus, right pulmonary atelectasis, right aeropleura, and pneumomediastinum.

FINAL DIAGNOSIS

Aspiration airway injury with respiratory failure caused by burnt lime aspiration.

TREATMENT

Bronchoscopy showed that the mucosa of the trachea and left bronchus had hyperemia, edema and erosion; the lime powder was deposited diffusely on the mucosa; and the entry of the right principle bronchus was completely obstructed by the lime (Figure 2A). Using foreign body forceps, biopsy forceps, puncture needle, and hairbrush, the lime deposits were loosened and removed. Three hours later, the right primary bronchus was reopened (Figure 2B), and the patient's oxygenation immediately improved. Although some lime powder was also deposited on the mucous membrane, we did not clean it in case of membrane impairment. After therapy, hypoxia was immediately recovered as identified by blood gas analysis (PaO₂ 154 mmHg, FiO₂ 50%). After bronchoscopy, methylprednisolone 40 mg/d intravenously was administered for 3 d. At day 2 after admission, the ventilator was removed. At day 8 after admission, re-examination of the blood gas analysis showed PaO₂ 79 mmHg (without oxygen uptake). After extracting the tracheotomy tube, the patient left hospital.

OUTCOME AND FOLLOW-UP

Three months after treatment, follow-up bronchoscopy showed cicatricial adhesion at the posterior wall of the pharynx and aryepiglottic fold, restricted abduction of bilateral vocal cords, and disappeared right pyriform sinus and most of the nasal septum. The mucosa at all bronchial levels was smooth and no stenosis or occlusion was found in the bronchi (Figure 2C). Chest CT demonstrated anatomical recovery of the bronchi and lung (Figure 1C).

DISCUSSION

To our knowledge, searches of databases, including PubMed, Wanfang and CNKI, have revealed only six reports including eight cases (seven adolescents and one adult) who suffered lime aspiration. Most of them inhaled hydrated lime and all received endotracheal treatment within 3 d. The conditions of these cases were severe and seven patients underwent bronchoscopy, endotracheal intubation or tracheotomy with mechanical ventilation[1-6]. Among them, seven cases were treated with bronchoalveolar lavage, and one was also treated with foreign body extraction under rigid bronchoscopy. The postoperative prognosis was good, and only one case developed distal bronchial stenosis.

The present case was different; the adult patient inhaled a large amount of lime powder and received airway intervention after 5 d. The patient was treated with tracheotomy and mechanical ventilation, as well as foreign body forceps, biopsy forceps, puncture needles, brush and repeated alveolar irrigation under bronchoscopy, and dozens of lime particles were removed by forceps. Our treatment target was to keep the airway open and not to completely remove the lime. The prognosis was good.

The consequence of lime aspiration is different from those of normal one, especially for burnt lime. The reaction from CaO (burnt lime) to CaO(OH) (hydrated lime) can generate a large amount of heat, which could impair the bronchial mucosa, increase gland secretion, and even cause necrotizing fasciitis. The secretions, indeciduous necrotizing fasciitis and lime blocks are easy to obstruct the airway, causing lethal conditions, which frequently occur at 3–5 d after aspiration[3]. As a result, for patients with large amounts of lime aspiration (especially burnt lime), early tracheoscopy and

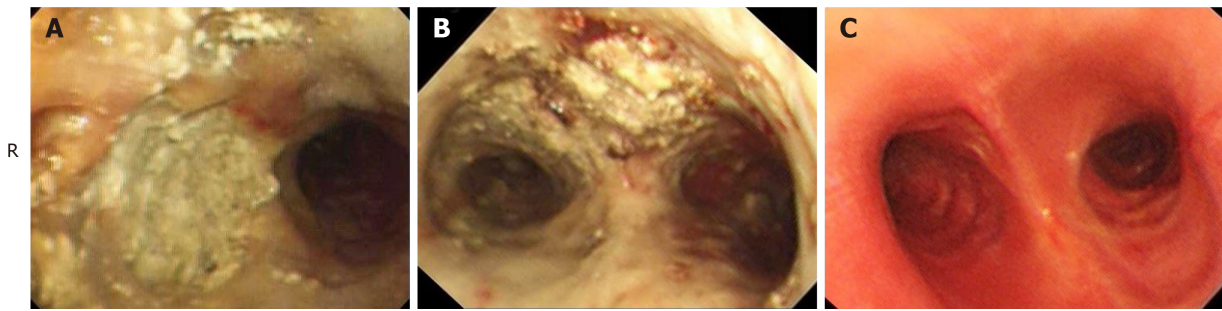


Figure 2 Bronchoscopy of the bronchial bifurcation before and after lime clearance. A: Before lime clearance, bronchoscopy showed the entry of the right principle bronchus was completely obstructed by lime. Hyperemia, edema and erosion were seen in the tracheal mucosa and left bronchus; B: After mechanical clearance of the lime, the right primary bronchus was reopened; C: Three months later, the mucosa at all bronchial levels was smooth and no stenosis or occlusion was found in the bronchus.

lime clearance are necessary.

Lime aspiration is usually accompanied by impairment of the oral cavity and respiratory tract; the lime powder can also obstruct the distal segments of the bronchi; and an artificial airway has usually been constructed before bronchoscopy. All these factors restrict the use of rigid bronchoscopy. In the review of the references, all cases used flexible bronchoscopy and one jointly used both the flexible and rigid approaches [3].

According to the location of the foreign body, a rigid or flexible fiberoptic bronchoscope is selected for its removal from the airway[7]. Rigid bronchoscopy is often used for the removal of foreign bodies in the main airway, which has the advantages of maintaining airway ventilation, treatment of hemoptysis, shorter interventional time, and acquisition of large biopsy specimens. However, it may cause damage to the larynx, trachea and bronchi. Selection of the mode of operation is mostly based on touch, and success of the procedure is determined by experience of the operator. The disadvantages of rigid bronchoscopy are that it is not easy to teach or popularize, it has a long operation time and high demand for anesthesia, and has surgical complications[8]. Compared with rigid bronchoscopy, flexible fiberoptic bronchoscopy is a fast, economic and safe procedure that does not require general anesthesia[9]. At present, rigid bronchoscopy combined with flexible fiberoptic bronchoscopy is also used to remove airway foreign bodies[10].

The methods for removing foreign bodies using bronchoscopy are varied depending on the characteristics of the foreign bodies[11-13]. According to the size, shape and texture of the foreign body, various forceps[14], fetching baskets[15] and balloon catheters[16] can be selected. For soft and fragile foreign bodies, frozen electrodes are often used[17-19]. Different interventional treatment techniques can be used according to different chemical characteristics of the foreign bodies. For example, inhalation of tablets often causes local airway inflammation and airway obstruction, so balloon dilatation, argon plasma coagulation and airway stents are often used to relieve airway obstruction[20]. Airway burns can be caused by high temperature physical burns and chemical injuries, and are often diagnosed by bronchoscopy and early alveolar lavage[21]. For airway stenosis caused by chronic granulomatous changes caused by long-term foreign body residues, airway dilatation can be performed by foreign body forceps, holmium laser, freezing, balloon dilatation and other techniques[22,23]. Some rare benign airway diseases, such as tracheobronchopathia osteochondroplastica[24], complicated by severe airway stenosis and recurrent obstructive infection, endoscopic excision and laser ablation are often used to release the airway obstruction. Because of the chemical reaction properties of burnt lime, electroexcision and laser dissection are not suitable[25,26]. Because the texture of the lime particles in the bronchi was soft, it was hard to clamp the particles. Instead, we loosened the lime particles using a puncture needle, cryotherapy and a brush, then clamped the large particles using biopsy and foreign body forceps, and flushed and removed the small particles. The aim of treatment was only to release the airway obstruction; therefore, there was no need to remove all the lime particles on the mucosa, which would fall off naturally and be discharged by coughing.

After aspiration of some chemicals (such as ammonia and oil-based substances), pulmonary fibrosis is generated[27-29]. In the present case, although edema and erosion were seen in the bronchial mucosa at the acute stage, the mucosa recovered completely and showed no pulmonary fibrosis during 3 months' follow-up. Chlorine

inhalation can cause airway inflammation, airway remodeling and stenosis[30]. In the eight previous reports, only one 2-year-old child suffered stenosis of the right medium-lower lobar bronchus[3], which indicates that the bronchi are more susceptible to foreign body aspiration than in adults.

For patients with suspected airway foreign bodies, CT is currently recommended to diagnose and determine the location and size of the foreign bodies[31,32]. For patients with airway foreign bodies complicated with respiratory failure, it is essential to ensure ventilation. Some patients were treated with bronchoscopy under laryngeal mask general anesthesia[33]. Most patients were treated with endotracheal intubation or tracheostomy ventilation combined with endotracheal interventional therapy, and some patients were even treated with endotracheal interventional therapy assisted by extracorporeal membrane oxygenation[34].

CONCLUSION

Flexible fiberoptic bronchoscopy is suggested as early as possible after lime aspiration, and the treatment target is mainly to keep the airway open and not to completely remove the lime. Moreover, electroexcision or laser dissection should be avoided to remove the lime. Instead, we suggest combining several mechanical methods, such as clamping, flushing and cryotherapy. The prognosis of the patients is usually good when treatment is timely.

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