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Intraoperative resuscitation for complete left main bronchus atresia caused by mediastinal mass: A case report

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Case Report

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Abstract

Background

Airway compression by mediastinal masses is a high-risk anesthetic condition, and fatal airway collapse may occur following anesthetic induction. Most existing clinical reports focus on cases of tracheal compression. Compound-risk cases featuring unilateral main-bronchus compression caused by mediastinal masses together with contralateral pulmonary consolidation are rarely documented. Preoperative symptoms in such patients are easily overlooked. Given poor oxygenation of the contralateral lung, acute occlusion of the compressed bronchus after anesthesia can trigger rapid severe hypoxia and create substantial rescue difficulties.

Case report

A 31-year-old female patient with diffuse large B-cell lymphoma presented with imaging evidence of a right-sided mediastinal mass compressing the left main bronchus, as well as extensive consolidation of the right lung. Declining awake intubation, the patient underwent fiber-optic bronchoscopic alveolar lavage under intravenous anesthesia with spontaneous respiration preserved. Complete occlusion of the left main bronchus occurred after induction, accompanied by severe hypoxia and circulatory depression. Conventional tracheal intubation failed to achieve satisfactory ventilation. Based on preoperative imaging, emergency right-lateral positioning relieved external mass-related bronchial compression, leading to rapid restoration of oxygenation. The patient was admitted to the intensive-care unit, experienced no hypoxic brain injury, and was discharged one week later.

Conclusion

Patients with unilateral bronchial compression from mediastinal masses plus contralateral pulmonary consolidation carry extremely high airway risks. Emergency positional adjustment guided by imaging assessment serves as a vital rescue measure for acute extrinsic bronchial occlusion occurring after anesthetic induction. This case also highlights the necessity for thorough preoperative evaluation of airway status and pulmonary reserve in this patient population.

1 Case Presentation

A 31-year-old female patient weighing 55 kg was admitted with a 6-day history of cough and expectoration. She had a previously confirmed diagnosis of diffuse large B-cell lymphoma and had received regular chemotherapy. Pre-operative electrocardiogram, echocardiography and laboratory examinations revealed no significant abnormalities. Pre-operative chest computed tomography (Figs. 1a, 1b) demonstrated a soft-tissue mass in the right mediastinum measuring approximately 30 mm × 42 mm × 68 mm, which was suspicious for lymphoma infiltration. Partial consolidation and destruction of the right upper lung lobe, a small amount of right-sided pleural effusion, and stenosis of the left main bronchus (Fig. 2) were also noted. Given right-lung infection, fiber-optic bronchoscopic alveolar lavage

was planned under intravenous anesthesia. Pre-anesthetic assessment indicated airway compression by the mediastinal mass with risk of difficult airway. The patient was fully informed of the relevant risks of awake intubation versus general-anesthesia induction, but she declined awake intubation. The procedure was therefore performed under intravenous-anesthesia induction. Alternative ventilation strategies included tracheal intubation, fiber-optic-guided tracheal intubation across the obstruction for one-lung ventilation, and airway establishment via rigid bronchoscopy.

The patient fasted for 8 hours and had nil-per-os clear fluids for 4 hours preoperatively. Standard monitors were applied on arrival in the operating room: non-invasive blood pressure 125/63 mmHg, heart rate 83 beats/min, peripheral oxygen saturation (SpO_2) 98%. The anaesthetic induction regimen comprised cypofol 10 mg and remifentanil 40 μg; mask pre-oxygenation was performed while preserving spontaneous ventilation. Progressive desaturation ensued after induction. Jaw-thrust manoeuvres were applied to assist ventilation, and the operator advanced a fibre-optic bronchoscope transnasally via an endoscopic facemask. Two-percent lidocaine was sprayed onto the glottis and trachea. Upon advancing the scope to the carina, complete occlusion of the left main bronchus orifice was visualised, precluding left-lung ventilation (Fig. 3).

SpO_2 declined precipitously. The bronchoscope was immediately withdrawn, and high-concentration-oxygen mask bag-valve ventilation was initiated; nevertheless, oxygenation could not be sustained. SpO_2 fell rapidly to 23%, heart rate decreased to 20 beats/min, and blood pressure dropped to 52/30 mmHg. Intravenous adrenaline 1 mg was administered immediately, and chest compressions were commenced at approximately 110 compressions per minute. Rocuronium 35 mg was injected intravenously to facilitate urgent tracheal intubation with a 7.0-mm internal-diameter tracheal tube. Two peripheral intravenous accesses were secured, and 100 mL of 5% sodium bicarbonate solution was infused. After approximately 3 minutes of cardiopulmonary resuscitation, heart rate recovered to sinus tachycardia at 135 beats/min. Arterial blood-gas analysis yielded pH 7.123, partial pressure of carbon dioxide ($PaCO_2$) 68.6 mmHg, partial pressure of oxygen (PaO_2) 49.3 mmHg.

After successful intubation, mechanical ventilation with 100% inspired oxygen was instituted. Pressure-controlled ventilation with incremental inspiratory pressures and titrated positive-end-expiratory pressure (PEEP) failed to improve oxygenation, with SpO_2 persisting at 50–55%. Fibre-optic-guided attempts to advance the tracheal tube into the left main bronchus across the obstruction were unsuccessful on two occasions because the bronchial orifice was completely obliterated. Although rigid bronchoscopy was a pre-planned rescue option, it would require tracheal-tube removal and carry procedural time-delay. Based on preoperative CT findings (Figs. 1a, 1b,2), the resuscitation team prioritised positional adjustment to shift the mediastinal mass and mitigate extrinsic compression. After turning the patient to the right-lateral decubitus position, fibre-optic bronchoscopy identified a ventilatory gap at the previously occluded left main-bronchus orifice. Within approximately one minute, SpO_2 rose to 95%, obviating rigid-bronchoscopy placement.

Following successful resuscitation, the patient was transferred to the respiratory intensive-care unit. No hypoxic-ischaemic encephalopathy developed during hospitalisation. Right-sided pulmonary infection resolved with antimicrobial therapy, and the patient was discharged one week later.

2 Discussion

Mediastinal-mass-related central-airway compression constitutes a high-risk anaesthetic situation in which fatal extrinsic airway collapse may occur after induction[1]. Existing literature predominantly addresses isolated tracheal stenosis in patients without severe pre-existing pulmonary disease, for whom awake fibre-optic intubation is the standard approach[2]. Our patient presented with complete left-main-bronchus obliteration caused by mediastinal-mass compression superimposed on extensive right-lung consolidation, representing a composite high-risk state combining airway obstruction and severely impaired pulmonary oxygen reserve. Reports of comparable complex cases are scarce, and our resuscitation experience may inform management of similarly challenging difficult-airway scenarios.

Urgent positional adjustment represented the cornerstone of successful resuscitation in this case. Augmenting ventilatory pressures or adjusting PEEP can only modify intraluminal ventilation and cannot relieve mechanical extrinsic compression exerted by the mass[3]. Since the predominant mass component resided within the right mediastinum, right-lateral positioning allowed gravitational shift of the mass toward the right hemithorax, releasing compression on the left main bronchus and restoring airway patency with rapid oxygenation improvement. Positional effects on mass-mediated bronchial compression are well-recognised; most published experience describes pre-induction identification of safe body positions[4]. In our case, however, position change was deployed as an emergency intervention after intra-induction bronchial atresia. Body positioning must be guided by tumour anatomy, as inappropriate repositioning may worsen airway compromise[5].

Awake fibre-optic intubation was not performed primarily because of patient refusal. The absence of resting dyspnoea and stable baseline vital signs also contributed to underestimation of the occult high-airway risk. Although preoperative airway evaluation and CT imaging were completed, and rescue strategies including fibre-optic-guided single-lung ventilation across stenosis and rigid bronchoscopy were pre-emptively formulated[6–7], static supine CT only depicts airway anatomy under awake supine conditions and cannot predict anaesthesia-associated airway collapse. In addition, the magnitude of oxygen-reserve impairment from right-lung consolidation was insufficiently appreciated. Consequently, intravenous-anaesthesia with preserved spontaneous ventilation was selected. Induction was followed by rapid complete occlusion of the functioning bronchus, circulatory arrest, and extremely challenging resuscitation, illustrating the concealed anaesthetic hazards in patients with combined airway and parenchymal-lung compromise.

Our clinical lessons emphasise heightened prudence when planning anaesthesia for patients with concurrent airway compression and impaired pulmonary reserve. Pre-operative high-flow nasal oxygen (HFNO) pre-oxygenation may prolong safe apnoea time and create a time buffer for difficult-airway

rescue[8], though this modality was unavailable in our setting. Static supine imaging has clear limitations for risk stratification, as the supine posture itself narrows airways in mediastinal-mass patients. Multi-posture imaging (supine, upright, lateral decubitus) may characterise positional effects on bronchial calibre and identify optimal ventilatory positions pre-operatively to reduce collapse risk[9]. Rigid bronchoscopy should be readily available. A rigid scope can be carefully advanced to the compressed left main bronchus, gently splinting externally compressed bronchial walls to permit jet ventilation through side ports[10]. This technique carries risks including bronchial injury and potential failure to relieve obstruction. Therefore, whenever clinically feasible, awake fibre-optic intubation under adequate topical anaesthesia remains preferred to establish definitive airway access across obstruction and avoid catastrophic intra-induction airway compromise[11].

In conclusion, patients with mediastinal masses causing unilateral bronchial compression plus contralateral pulmonary consolidation harbour insidious yet catastrophic airway risk. Pre-operative evaluation must integrate characteristics of airway compression and functional pulmonary reserve to individualise airway-securing strategies. For sudden complete functioning-bronchus atresia following anaesthetic induction, anatomy-guided positional manoeuvres constitute a valuable rescue measure for such difficult-airway emergencies.

Declarations

Ethics and consent to participate

Ethics approval for this case report was waived by the Institutional Review Board of Affiliated Hospital of Guangdong Medical University ethics committee, because this study is a retrospective case report focusing on clinical emergency management and does not involve prospective intervention. Written informed consent was obtained from the patient for participation in this case report.

Consent to publish

Written informed consent was obtained from the patient for publication of relevant clinical data, including disease course, peri anaesthetic findings and rescue procedures in this case report.

Availability of data and materials

All data generated or analysed during this case report are included within this published article. No additional raw datasets are available.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

C.J.H. and C.D.Q. wrote the main manuscript text. All authors reviewed the manuscript.

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Authors' information

Not applicable.

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Figures

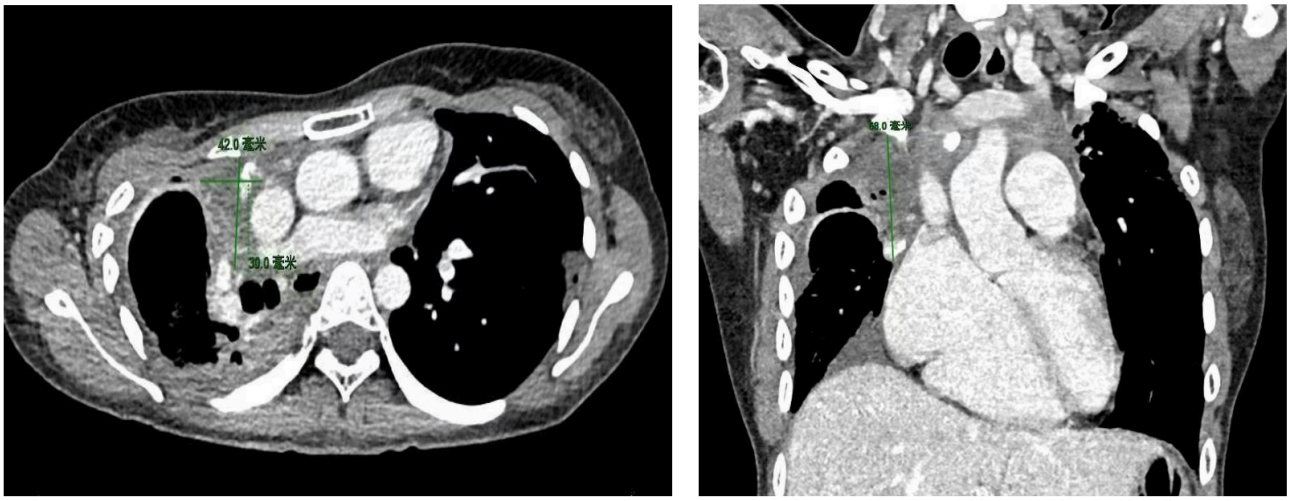


Figure 1

Figures 1a, 1b Pre-operative chest computed tomography (CT): the mass is predominantly located within the right mediastinum. approximately 30 mm × 42 mm × 68 mm

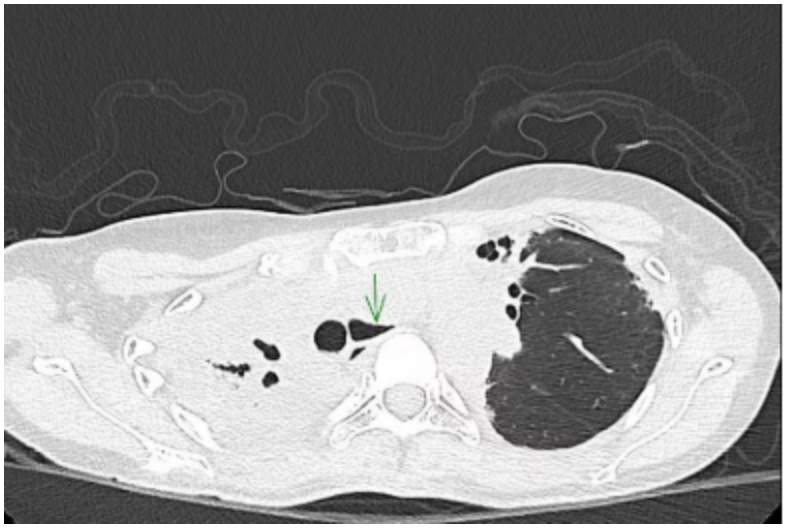


Figure 2

Compression-induced stenosis of the left main bronchus combined with severe right-lung infection.

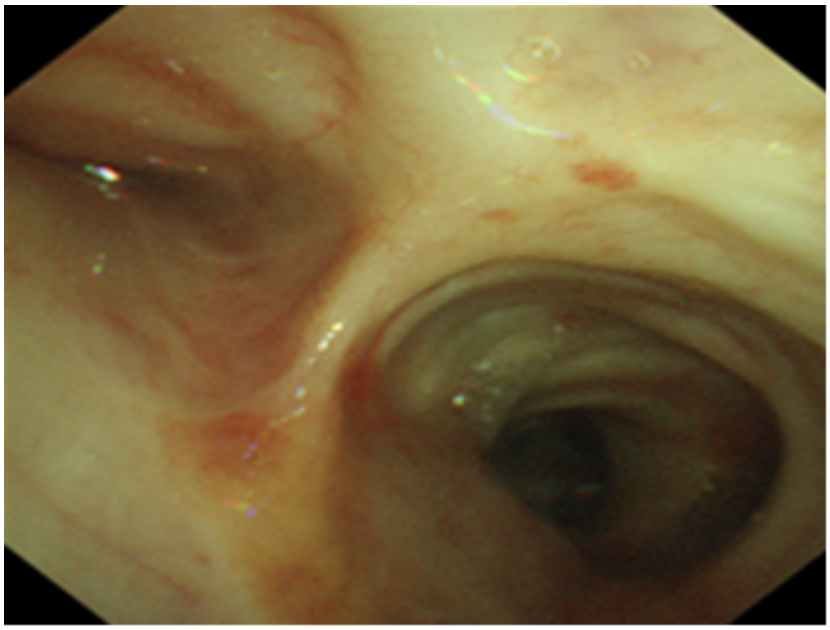


Figure 3

Fibre-optic bronchoscopic findings: The orifice of the left main bronchus was completely occluded.