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CLINICAL INFORMATION

Selective left mainstem bronchial intubation in the neonatal intensive care unit

Anthony M.H. Ho[a], **Michael P. Flavin**[b], **Melinda L. Fleming**[a], **Glenio Bitencourt Mizubuti**[a,*]

[a] *Queen's University, Kingston General Hospital, Department of Anesthesiology and Perioperative Medicine, Kingston, Ontario, Canada*
[b] *Queen's University, Department of Pediatrics, Kingston, Ontario, Canada*

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KEYWORDS
Bullous emphysema;
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Abstract
Background: Selective neonatal left mainstem bronchial intubation to treat right lung disease is typically achieved with elaborate maneuvers, instrumentation and devices. This is often attributed to bronchial geometry which favors right mainstem entry of an endotracheal tube deliberately advanced beyond the carina.
Case summary: A neonate with severe bullous emphysema affecting the right lung required urgent non-ventilation of that lung. We achieved left mainstem bronchial intubation by turning the endotracheal tube 180° such that the Murphy's eye faced the left instead of the right, and simulated a left-handed intubation by slightly orientating the endotracheal tube such that its concavity faced the left instead of the right as in a conventional right-handed intubation.
Conclusion: Urgent intubation of the left mainstem bronchus with an endotracheal tube can be easily achieved by recognizing that it is the position of the endotracheal tube tip and the direction of its concavity that are the chief determinants of which bronchus an endotracheal tube goes when advanced. This is important in critically ill neonates as the margin of safety and time window are small, and the absence of double-lumen tubes. Use of fiberoptic bronchoscope and blockers should be reserved as backup plans.

PALAVRAS-CHAVE
Enfisema bolhoso;
Intubação endobrônquica;
Recém-nascido

Intubação seletiva do brônquio principal esquerdo em unidade de terapia intensiva neonatal

Resumo
Justificativa: A intubação seletiva neonatal do brônquio principal esquerdo para tratar a doença pulmonar direita é tipicamente realizada com elaboradas manobras, instrumentação

* Corresponding author.
E-mail: gleniomizubuti@hotmail.com (G.B. Mizubuti).

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e dispositivos. Isso é frequentemente atribuído à geometria brônquica que favorece a entrada principal direita de um tubo endotraqueal (TET) deliberadamente avançado para além da carina.

Resumo do caso: Recém-nascido com enfisema bolhoso grave afetando o pulmão direito que precisou com urgência da não ventilação desse pulmão. Conseguimos a intubação brônquica esquerda fazendo uma rotação de 180° do TET, de forma que o olho de Murphy ficasse voltada para a esquerda e não para a direita, e simulamos uma intubação à esquerda orientando ligeiramente o TET, de modo que sua concavidade virasse para a esquerda em vez de para a direita, como em uma intubação convencional à direita.

Conclusão: A intubação urgente do brônquio principal esquerdo com um TET pode ser facilmente obtida reconhecendo-se que é a posição da ponta do TET e a direção de sua concavidade que determinam para qual brônquio o TET irá quando avançado. Isso é importante em neonatos criticamente doentes diante da margem de segurança e janela de tempo pequenas e na ausência de tubos de duplo lúmen. O uso de broncofibroscópio e bloqueadores deve ser considerado como planos de segurança.

Introduction

Single-lung ventilation may be needed in neonates with unilateral lung disease.[1–5] This can be achieved by intubating the contralateral mainstem bronchus with an Endotracheal Tube (ETT), or by blocking the ipsilateral main-stem bronchus with a balloon-tipped bronchial blocker. Bronchoscopy is usually needed to guide and/or confirm placement. Bronchial blockers are seldom used in the Neonatal Intensive Care Unit (NICU). Passage of an ETT into the left mainstem bronchus often requires special maneuvers and equipment. In urgent/emergent situations, the timely availability of such equipment may be limited. We herein discuss the management of a neonate who required urgent left mainstem bronchial intubation, and present options available for selective left-lung ventilation in the NICU setting. For clarity purposes, it is important that the reader be familiar with the ETT tip design, in particular the Murphy's eye which is the oval structure located at the distal end and opposed to the ETT's bevel, as the technique described herein will focus around its position within the trachea.

Case report

Written parental consent was provided for the publication of this case. This report complies with HIPAA Privacy Regulations and the appropriate EQUATOR checklist.

An 11 week-old 2100 g boy born at 24 weeks gestation had respiratory distress syndrome, interstitial emphysema and bronchopulmonary dysplasia. He developed expanding right lower lobe bullous emphysema with mediastinal shift (Fig. 1). High frequency ventilation resulted in desaturation. Ventilation was via an uncuffed ETT-ID 3 mm.

The decision was made to stop ventilating the right lung. The steps were: (1) the depth of the in situ ETT was noted on the latest chest X-ray and at the gum line, and an estimate was taken on the ETT tip-carina distance; (2) the ETT was rotated 180° so that it was slightly concave to the left and its Murphy's eye facing left; (3) the ETT was advanced to the desired distance, confirmed by auscultation, X-ray and fiberoscopy (Fig. 1).

There was a tiny gas leak around the ETT at 25 cm H_2O based on auscultation of the right chest. Subsequent X-rays showed that ETT remained in position and the left upper lobe well aerated. The right sided bullae shrank (Fig. 1) and the ETT was withdrawn to the mid-trachea position after 6 days. The patient was extubated to low-pressure BiPAP 13 days later. At follow-up the right lung bullous emphysema had resolved but there was complete left lung consolidation/atelectasis and compensatory emphysema of the right lung. He required 0.25 $L \cdot min^{-1}$ of supplemental oxygen at home and was thriving. The infant's breathing continued to improve and he was weaned off oxygen at 9 months of age. Rigid bronchoscopy at 12 months for persistent left lung atelectasis revealed no scarring of the left bronchus mucosa and a fish-mouth occlusion of the bronchus suggesting severe bronchomalacia.[6] Chest computerized tomography showed external bronchial compression.

Discussion

Some NICU staff and anesthesiologists might consider left mainstem intubation a challenge. This is often attributed to the bifurcation of the carina (32° on right to midline vs. 51° on left in neonates)[7] which favors right mainstem bronchial intubation of a deeply placed ETT. Left lung ventilation to treat right pulmonary disease in neonates typically includes use of a stylet and/or flexible or rigid bronchoscopy or fluoroscopy to guide an ETT into the left mainstem bronchus or to guide a balloon-tipped bronchial blocker into the right bronchus.[1–3] Passing an ETT into the left mainstem bronchus

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