Cardiology in the Young

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Stent intervention for children with CHD and tracheal stenosis

Yang Yang[1], Xiaofeng Li[1] and Anxia Jiao[2]

[1]Cardiac Surgery, Beijing Children's Hospital, Capital Medical University, National Center for Children's Health, Beijing, China and [2]Interventional Pulmonary Surgery, Beijing Children's Hospital, Capital Medical University, National Center for Children's Health, Beijing, China

Abstract

CHD is closely related to respiratory system diseases (Mok Q, Front Pediatr 2017; 5: 2296–2360). Flexible fibreoptic bronchoscopy will diagnose anatomical lesions of the trachea and perform interventions at the same time for children with indications. We report a case of pulmonary artery sling with severe tracheostenosis in a 11-month-old boy. Tracheal stents were placed with good prognosis.

Brief Report

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Author for correspondence:
Xiaofeng Li, PhD, Cardiac surgery ward, Beijing Children's Hospital, No.56 Nanlishi Road, Xicheng District, Beijing, China.
Tel: +8613021104761.
E-mail: xiaofengl2000@163.com

Case report

A 11-month-old boy, weighing 7.6 kg, was referred to our hospital with cough, wheezing and fever for 3 days. Chest CT (Fig 1A) showed the carina was high and the left main bronchus became narrow with diameter just about 1.66 mm. The right middle segment bronchus originated from the left main bronchus. Cardiac CT showed pulmonary artery sling.

Diagnosis

(1) Severe pneumonia; (2) CHD, pulmonary artery sling, ventricular septal defect, atrial septal defect, patent ductus arteriosus; (3) tracheobronchial stenosis; bridging bronchi.

Treatment and follow-up

Continuous positive pressure ventilation was given immediately after admission. Cardiac surgery was performed after tracheal intubation on the second day. Based on surgical findings, the left pulmonary artery originated from the right pulmonary artery. It passed through and surrounded the back of the main trachea. The left bronchus was compressed. Ventricular septal defect was 0.5 cm. Atrial septal defect was large, with a diameter of 1.5 cm. The diameter of patent ductus arteriosus was 0.5 cm. Patent ductus arteriosus was ligatured, the left pulmonary artery was anastomosed to the left of the normal main pulmonary artery, and the defect was sutured. Cardiac deformity correction was satisfactory, so the tracheal tube was removed quickly. On the 10th day, the child had difficulty in breathing with severe inspiratory dyspnoea. Bronchoscopy (Fig 2 A–C) showed stenosis of the main trachea and the left main bronchus. The patient was assisted by ventilator again with peak inspiratory pressure of 28–35 cmH_2O, respiratory acidosis with pH 7.183 and $PaCO_2$ 92.5 mmHg. To save his life, interventional therapy with a bronchoscope was performed. Three renal artery stents (Boston Scientific) were placed: two at the narrow upper part of the trachea (6 × 20 and 6 × 15 mm), one at the narrow part of the left main trachea (4 × 15 mm) (Fig 2D–F). After stent implantations, no obvious stenosis or obstruction was found in the right middle segment bronchus and right main bronchus, but CO_2 retention was persistent because of tracheal stent restenosis, blockage of the trachea due to mucosa necrosis material falling off, and proliferation of granulation tissue. In order to maintain airway patency, interventional therapy of bronchoscopy was performed many times, such as: balloon dilatation, frozen granulation tissue, clamp removal of necrotic tissue and tracheal lavage. (Percutaneoustransluminalangioplasty balloon dilatation catheter of Boston Scientific was used and the dilatation pressure was generally between 6–14 atm). Eventually the child was extubated after a stay in the hospital for 52 days. Repeat CT scans (Fig 1B) and bronchoscopy showed the diameter of the trachea was satisfisfactory. Following discharge, bronchoscopy and CT were performed every 3–6 months (Fig 1C). The latest bronchoscopy (Fig 2 G-I) showed normal trachea diameter and normal endodermis of the stent.

Discussion

Presently, the treatment of tracheal stenosis with stent placement under a bronchoscope is popular, but these stents are unsuitable for children as their diameter may be too big to fit inside the airway. Currently, only vascular balloon-expandable metallic stents are feasible for the

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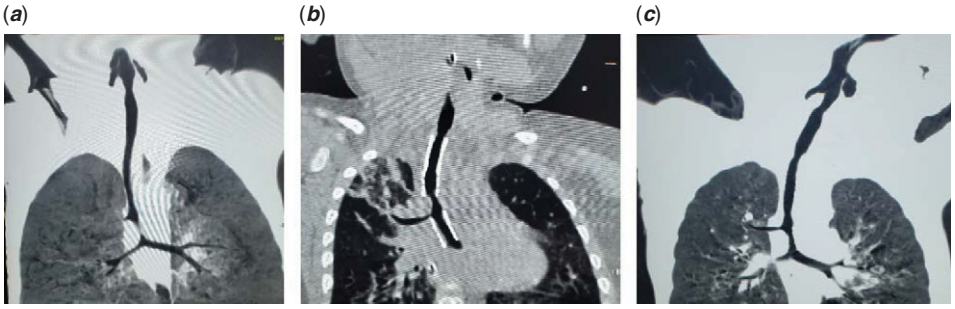

Figure 1. Chest CT. (***a***) before operation; (***b***) tracheal stents; (***c***) 6 months after flexible fibreoptic bronchoscopy.

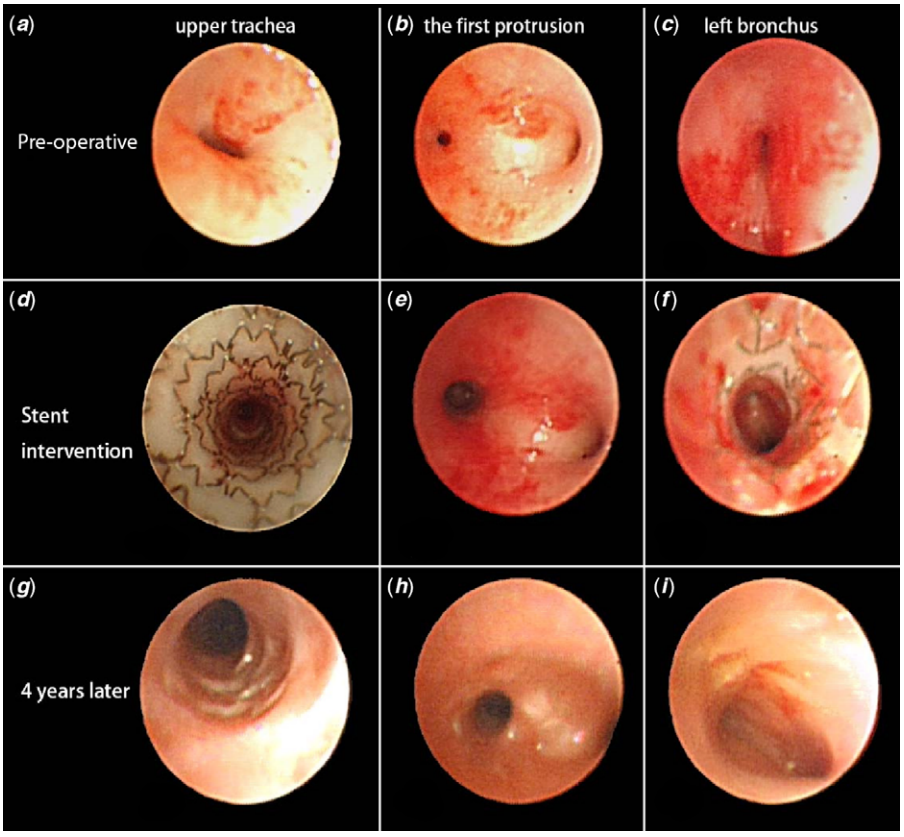

Figure 2. Flexible fibreoptic bronchoscopy. (***a–c***) pre-operative; (***d–f***) intervention; (***g–i***) 4 years after stent placement.

treatment of tracheal stenosis in children. Their safety as a vascular stent has been well described in previous studies.[1,2] They are smaller than conventional airway stents and can also be safely and easily deployed using a bronchoscope.[3,4] To avoid possible serious complications, tracheal stent placement in children would be applied only as a last resort when no other alternatives exist.[5] In most children with pulmonary artery sling and tracheal stenosis, the narrow trachea could be relieved after heart operation. In the present case, there were many complications and uncertain effects of trachea operation, so we did not perform tracheostomy at the time of heart operation. Moreover, the patient's tracheal stenosis was not well relieved after the operation, and many attempts to remove the tracheal intubation failed. In general, if the inner diameter of the trachea could allow a flexible fibreoptic bronchoscope with an outer diameter of 2.7 mm to pass through, balloon dilation could be carried out. However, for children with severe tracheal stenosis, balloon dilatation alone is not recommended, because it might easily tear the trachea. We suggest that stent placement be performed directly. Therefore, stent placement was used to save the life of the child and to improve the quality of his life. We placed three renal artery stents at the narrowest part of the trachea. Tracheal stenosis was significantly alleviated. Though there was no obvious infection in this child, we started intravenous antibiotics for several days to prevent micro-infections at the stent. Meanwhile, we also recommend atomisation of budesonide and bronchoscopic lavage so that endodermisation of the tracheal stent would be very fast and time of hospitalisation would be shortened.

During the follow-up, after achieving complete stent endothelialisation, tracheal re-stenosis has been rare. If it happened, balloon dilation was necessary to make the stent expand again and to accomplish endodermisation of the tracheal stent. Its application in some children had also been successful.

Although there are still many challenges in tracheal stent placement in children, whose indications and contraindications are under exploration, the present case of a child reporting to our centre with CHD and severe tracheal stenosis was managed

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successfully and followed up for 4 years. The long-term outcome is confirmed, and the prognosis of this child is beyond our expectation.

Conclusion

We believe that tracheal stent placement with the aid of a bronchoscope could be the last resort for children with severe tracheal stenosis.

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Conflicts of Interest. None.

Ethical Standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national guidelines on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008, and approved by institutional committees (ethical code 2019-k-375).

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