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Inflammatory Endobronchial Polyps in Childhood: Clinical Spectrum and Possible Link to Mechanical Ventilation

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Summary. Inflammatory polyps of the airways are now regarded as histopathologically distinct nonneoplastic endobronchial lesions, which in adults are associated with a variety of chronic inflammatory insults. However, their clinical presentation in the pediatric population is extremely rare, with the etiology of such polyps poorly defined. The clinical and histopathological data from four pediatric patients, identified in the histopathology files of the Royal Brompton Hospital, were retrospectively reviewed.

Three out of 4 patients had a history of mechanical ventilation in the neonatal period. In these 3 patients, the polyps were all situated in the proximal airways on the right side. These 3 patients presented at 6 weeks, 7 weeks, and 2 years, respectively, and were successfully treated by polypectomy at rigid bronchoscopy, with subsequent return to normality. One patient, presenting at 12 years of age without history of iatrogenic intervention, underwent a left lower lobectomy for a polyp sited in a segmental bronchus. Presentation in 3 of the 4 patients was with lobar collapse. The fourth patient presented with hyperinflation.

We conclude that inflammatory endobronchial polyps may be associated with a history of mechanical ventilation in the neonatal period, polyp formation perhaps being secondary to airway trauma. The small caliber of the main airways in neonates may also be a contributory factor in presentation. **Pediatr Pulmonol. 2002; 34:79–84.** © 2002 Wiley-Liss, Inc.

Key words: bronchus; polyps; mechanical ventilation; neonatology.

INTRODUCTION

Until recently, the classification of benign pulmonary endobronchial lesions was complicated by varied terminology for similar lesions, but this has now been standardized by the newly published World Health Organization/International Association of the Study of Lung Cancers (WHO/IASLC) classification of lung and pleural tumors.[1] Within this group, the various benign endobronchial polypoid lesions have been grouped into papillomas of squamous, glandular, or mixed types, hamartomas, and adenomas. These are considered distinct from inflammatory polyps, which are lesions considered nonneoplastic in nature, and are differentiated histopathologically on the basis of granulation tissue-like stroma and abundant inflammation.[2] Inflammatory polyps in adults may be seen in various chronic inflammatory conditions,[3,4] including foreign body aspiration,[5,6] asthma,[7,8] chronic sinusitis,[9] chronic smoke inhalation, and mycobacterial infections.[10,11]

In contrast, polyps are rare in children, and their etiology is unknown. We present 4 cases of solitary endobronchial inflammatory polyps causing obstructive symptomatology in children. All of these polyps required surgical excision. In 3 cases, there was a history of neonatal mechanical ventilation.

MATERIALS AND METHODS

Between January 1990 and January 2000, the files of the Department of Histopathology, Royal Brompton Hospital, were reviewed for cases of airway inflammatory polyps. Four cases were identified which fulfilled the

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histopathological criteria set in the WHO/IASLC classification of lung and pleural tumors.[1] These cases were subsequently reviewed by two pathologists (A.G.N., W.D.T.), and clinical data were collected from the patients' notes.

RESULTS

Case 1

A female infant, born at 30 weeks of gestation by emergency cesarean section for premature labor, presented at 37 weeks corrected age for investigation of a hyperinflated right lung. She had not required intubation at birth, but was ventilated at a few hours of age for a mixed metabolic-respiratory acidosis for a total of 10 hr. Subsequently, she remained well until 6 weeks of age, when she suffered intermittent respiratory distress. A chest X-ray at the time showed hyperinflation of the right lung (Fig. 1). A computed tomography (CT) scan of chest confirmed overexpansion of all lobes of the right lung. At flexible bronchoscopy, the right bronchus intermedius was obstructed by an endobronchial polyp, 3 mm in diameter, arising from a long stalk attached to the membranous part of the termination of the right main bronchus. This was moving in and out of the entrance to the bronchus intermedius with respiration. The polyp was removed in its entirety without complication, using a rigid bronchoscope. Histopathology showed a polyp comprising arborizing capillaries which arose from its stalk, the capillaries interspersed with xanthomatous histiocytes towards its center and inflamed granulation tissue towards its periphery (Fig. 2). These features were classified as a benign inflammatory polyp. The patient made a full recovery, and follow-up bronchoscopy at 9 months was entirely normal. She remains asymptomatic.

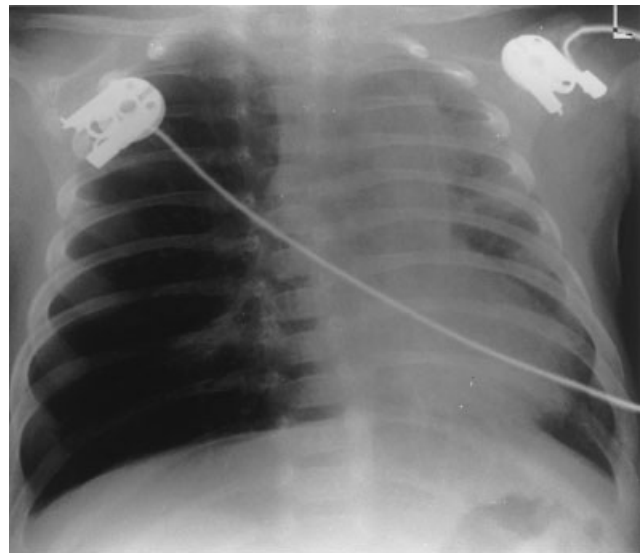

Fig. 1. Chest X-ray of case 1 shows overinflation of right lung with marked mediastinal shift at left. Small area of atelectasis is in medial segment of right middle lobe, and left lower lobe is partially collapsed.

Case 2

A 2.5-year-old male was admitted with a 3-week history of intermittent cough, wheeze, and pyrexia. There was no obvious history of aspiration, although this could not be completely ruled out. A chest X-ray showed right middle and lower lobe collapse. He had been born at term and had not required resuscitation. There was a past history of neonatal orchidectomy for testicular torsion, although the duration of ventilation at the time of this procedure was not known. At bronchoscopy, a polypoid lesion was identified and removed from the right bronchus intermedius. Histology revealed a polyp, 2 mm in diameter, comprising arborizing capillaries interspersed with fibroblastic stroma within which was a marked acute and chronic inflammatory cell infiltrate. Its surface consisted of granulation tissue, and there was no evidence of any foreign material. A second course of antibiotics was given, and chest X-ray at 1 week was normal, as was a repeat bronchoscopy. The patient remains asymptomatic at 7 years.

ABBREVIATIONS

A.G.N.	A.G. Nicholson
CPAP	Continuous positive airway pressure
CT	Computed tomography
IASLC	International Association of the Study of Lung Cancers
W.D.T.	W.D. Travis
WHO	World Health Organization

Case 3

An ex-premature male infant, born at 27 weeks of gestation, was admitted for investigation of persistent right lung collapse at 6 weeks uncorrected age. He had been intubated at delivery and was initially ventilated for 6 hr. He appeared to make good progress, but at 16 days of age deteriorated with frequent apneas and bradycardias, which were associated with metabolic acidosis. Chest X-ray showed a right upper lobe collapse, and he was intubated and ventilated. This period of ventilation was complicated by a right pneumothorax, which was treated with an intrapleural drain. He was ventilated for 1 week before being extubated to nasal CPAP. The chest X-ray showed complete collapse of the right lung, with a blind-ending right main bronchus (Fig. 3). At bronchoscopy, an inflammatory polyp, 3 mm in diameter, was found completely obstructing the right main bronchus. This was resected, the histology showing a polyp comprising arborizing capillaries interspersed with loose

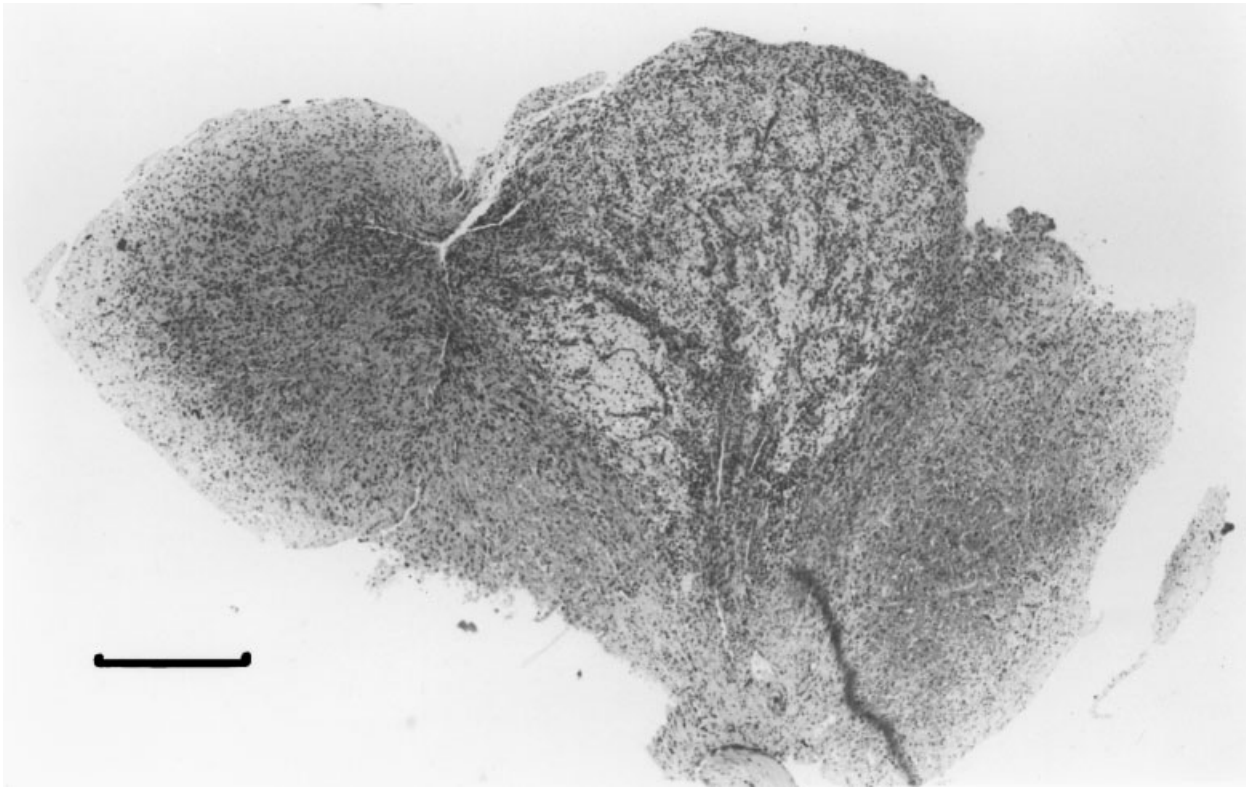

Fig. 2. Polyp from case 1 shows arborizing capillaries which arise from its stalk; capillaries are interspersed with xanthomatous histiocytes towards its center and inflamed granulation tissue towards its periphery (scale, 2 cm = 400 μm).

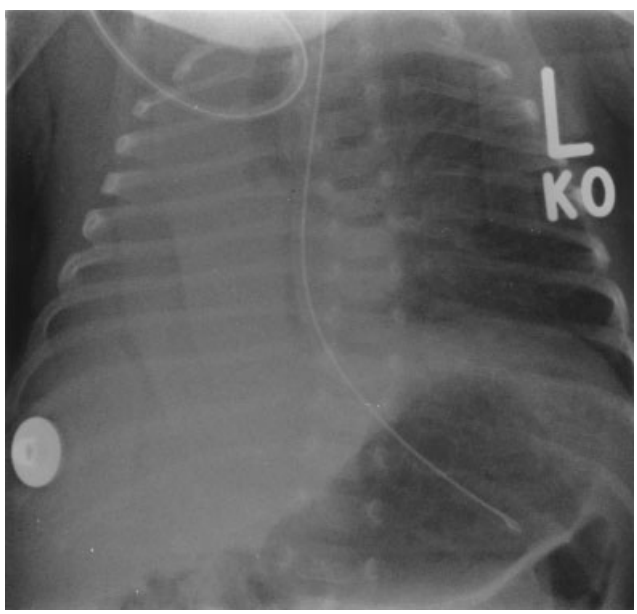

Fig. 3. Chest X-ray of case 3 shows complete collapse of right lung. Air bronchogram shows abrupt cutoff of right main bronchus, indicating site of polyp. Remaining vertical translucent stripes projecting over right hemithorax represent skin folds.

fibroblastic stroma within which was a moderate acute and chronic inflammatory cell infiltrate (Fig. 4). The surface of the polyp consisted of granulation tissue. A chest X-ray performed postoperatively was normal. The patient remains asymptomatic at 4 years.

Case 4

A 12-year-old boy was admitted with a 6-month history of cough and pyrexia. He had been treated for left basal pneumonia 5 months prior to admission. Chest X-ray revealed persistent left basal consolidation. A CT scan revealed a probable obstructive lesion causing collapse of the left lower lobe (Fig. 5). There was no other past medical history of note. Bronchoscopy revealed obstruction of the left lower lobe bronchus by a polypoidal gelatinous lesion, initially thought to be a mucus plug. However, attempts at removal by suction failed and the lesion was biopsied, showing an edematous stroma covered by a combination of respiratory-type mucosa and squamous epithelium. The differential diagnosis was squamous papilloma or inflammatory polyp. Because of its location and size, together with evidence of significant destruction in the distal lung parenchyma, the patient

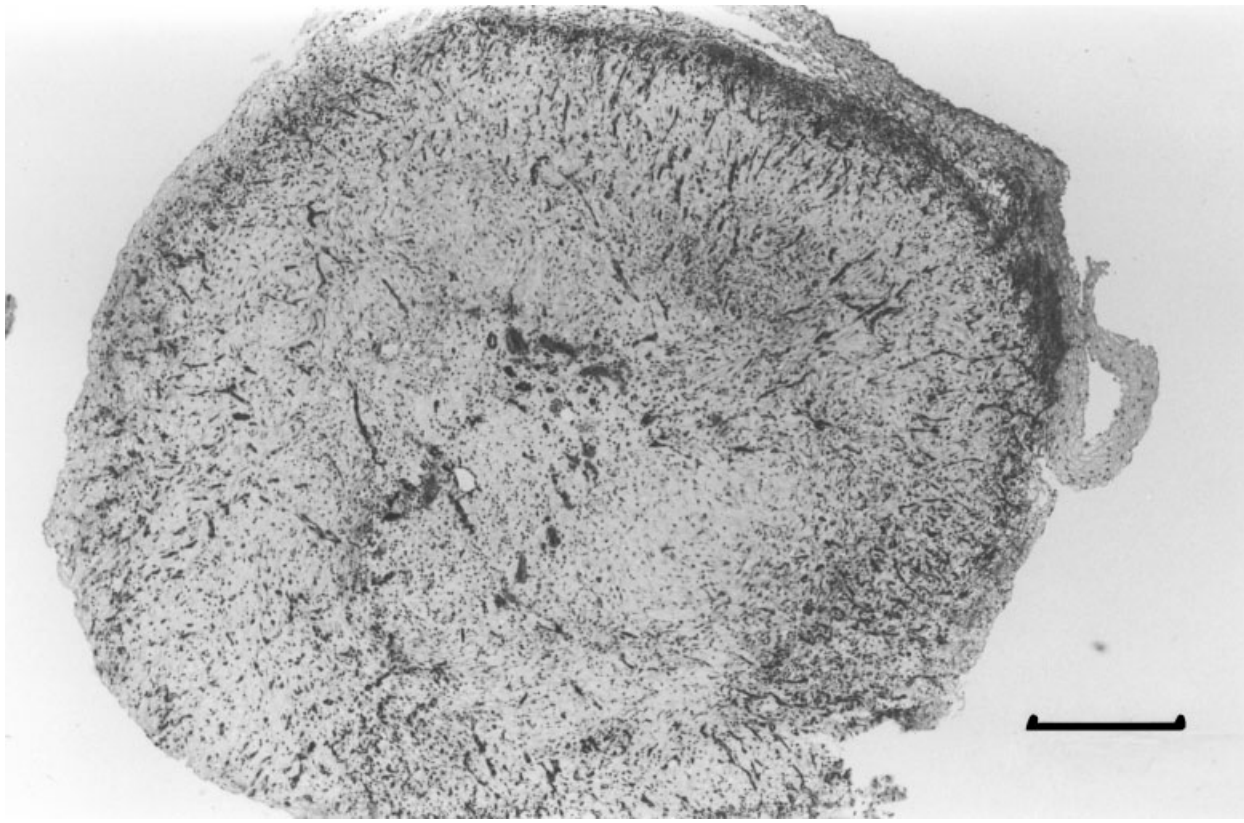

Fig. 4. Polyp from case 3 shows arborizing capillaries interspersed with loose fibroblastic stroma, within which is an acute and chronic inflammatory cell infiltrate. Polyp is covered by granulation tissue (scale, 2 cm = 400 μm).

underwent lobectomy. The excised specimen contained a polyp measuring 22 mm in length, arising from a segmental bronchus and extending into the lobar bronchus. The polyp comprised an edematous stroma containing a mild acute and chronic inflammatory cell infiltrate. Focally dilated seromucinous glands were present in its stalk, and the lesion was predominantly covered by respiratory type-epithelium with only focal squamous metaplasia (Fig. 6). On the basis of these findings, the lesion was classified as a benign inflammatory polyp. The patient remains well and free of disease for 4 years.

Clinical data from the above reports are presented in Table 1.

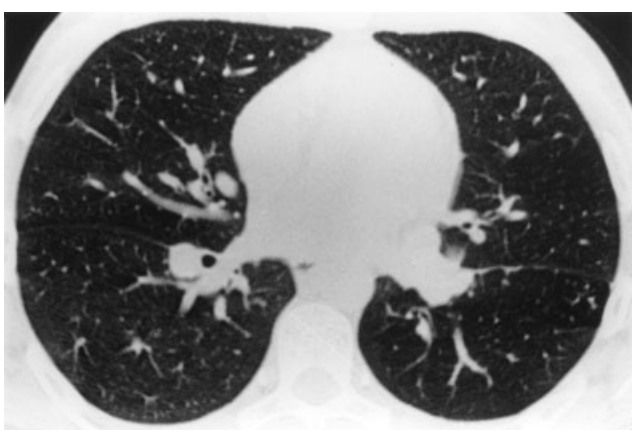

Fig. 5. CT scan from case 4 through lower zones shows complete occlusion of left lower bronchus, but no adjacent mass. There is some associated volume loss of left lower lobe, and more caudal sections show extensive bronchiectatic changes, with mucus plugging of dilated bronchi.

DISCUSSION

Inflammatory endobronchial polyps are recognized as distinct nonneoplastic tumors in the recently published WHO/IASLC classification of lung and pleural tumors.[1] In adults, they may be single or multiple, and their etiology is well-documented.[3–11] However, clinical presentation in the pediatric population is extremely rare, with the etiology of such polyps poorly defined.

One risk factor for bronchial damage, particularly in the neonatal population, is prolonged intubation and mechanical ventilation,[12,13] and in 3 of our cases, there was a history of mechanical ventilation during the neonatal period. Suctioning during mechanical ventilation

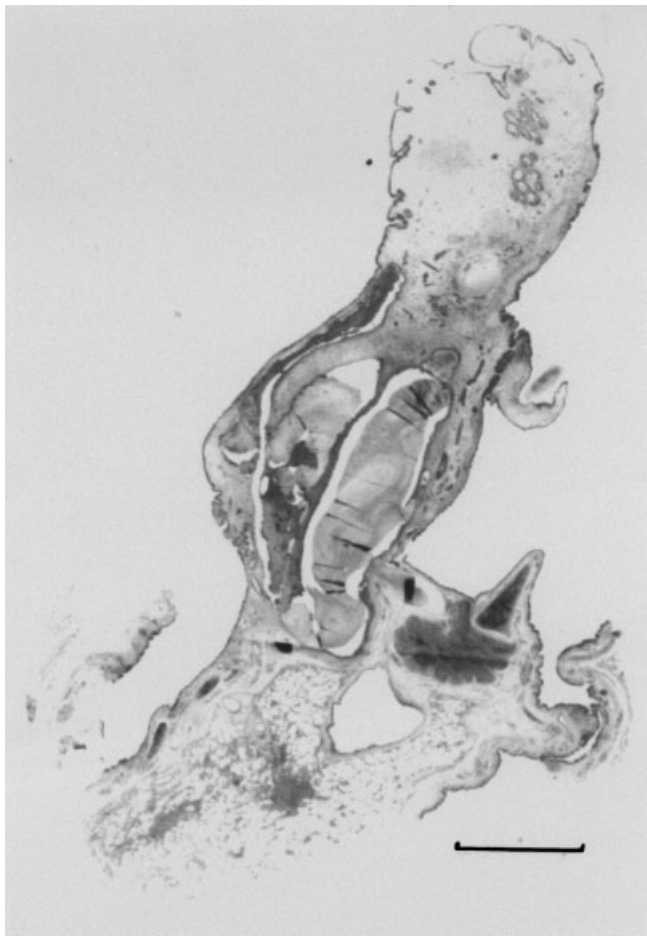

Fig. 6. Polyp from case 4 comprises edematous fibrovascular core containing focally dilated seromucinous glands and a mild acute and chronic inflammatory cell infiltrate. Polyp is covered predominantly by respiratory-type epithelium (scale, 2 cm = 400 μm).

may also cause airway damage. Indeed, trauma is thought to be associated with inflammatory polypoid lesions at other sites, such as polyps/contact ulcers in the larynx,[14,15] and inflammatory papillary hyperplasia in the oral cavity related to denture irritation.[16]

In support of this hypothesis, it was shown that with the head in midline position, a suction catheter will almost certainly enter the right main bronchus.[17] Similarly, a long endotracheal tube will also usually intubate the right main bronchus. The right main bronchus is more commonly injured than the left, because of the angle at which it leaves the trachea. In the 3 cases where intubation and mechanical ventilation occurred, the inflammatory polyp was found in either the right main bronchus or bronchus intermedius. We postulate that airway trauma may have occurred during the period of mechanical ventilation, either from suctioning or from endotracheal tube placement, and that this trauma contributed to the development of these inflammatory polyps. It may well

TABLE 1—Clinical Data on Patients With Inflammatory Polyps

Case	Gender	Age	Premature	History of intubation	Imaging	Symptoms	Site	Treatment
1	F	7 weeks	Yes (30 weeks)	Yes	Hyperinflation of right lung	Respiratory distress	Right main bronchus	Polypectomy
2	M	2 years	No	Yes	Right middle and lower lobar collapse	Cough, wheeze, pyrexia	Right bronchus intermedius	Polypectomy
3	M	6 weeks	Yes (27 weeks)	Yes	Right lung collapse	Apnea	Right main bronchus	Polypectomy
4	M	12 years	No	No	Lobar consolidation	Cough, pyrexia	Left lower lobe segmental bronchus	Left lower lobectomy

be that such polyps are not as rare as indicated in the literature, but that they have only come to light in a pediatric population whose narrow airway diameter leads to obstructive symptoms, the lesions themselves being no more than 3 mm in maximum diameter.

However, given that there was no iatrogenic insult to the airways in case 4, it is clear that these polyps may arise in the pediatric population secondary to other causes, although no identifiable ''adult'' risk factors for inflammatory polyp formation were identified in case 4. However, this individual was considerably older than the 3 patients whose polyps were associated with ventilation. Case 4 also differs in that the lesion was sufficiently large that it could not be snared and removed by bronchoscopy, and that lobectomy was eventually required. Given that the distal lung parenchyma was severely scarred, it is clear that the lesion had been present for a considerable time, while in the 3 younger patients, rigid bronchoscopic polypectomy led to immediate return to normality of the affected lobes, with no residual defect on follow-up.

Finally, although previously described cases as well as 3 of our 4 cases presented with symptoms due to airway obstruction and radiological evidence of lobar collapse, case 1 presented with hyperinflation, presumably caused by a ball-valve effect of the polyp within the right main bronchus. This most unusual presentation led to a pre-operative differential diagnosis that initially included both congenital lobar emphysema of the right lung and an obstructive lesion in the left lung causing compensatory hyperinflation of the right lung. Although considered in the differential diagnosis, congenital lobar emphysema was deemed unlikely, as although characterized by hyperinflation, it is usually restricted to a single lobe, most commonly the left upper lobe, with compression of the remaining lobes.[18] Nevertheless, bronchoscopy should always be performed prior to considering lobar resection, in order to exclude an endobronchial lesion causing hyperinflation.

In conclusion, we have described 4 patients with inflammatory endobronchial polyps, 3 of whom had a history of mechanical ventilation in the neonatal period that most likely contributed to polyp formation secondary to airway trauma. The relative narrowness of the airways in this age group may also be a contributory factor in their presentation. In the pediatric population, endobronchial polyps remain a rare but important cause of persistent lobar collapse and hyperinflation. Bronchoscopy should be performed in all such patients prior to any definitive surgery being undertaken, to avoid unnecessary lobar resection.

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