Excision of bronchogenic cysts in children using an ultrathin fibreoptic broncho-

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Purpose: *We report the use of an ultrathin fibreoptic bronchoscope (Olympus N20: external diameter: 2.2 mm) as the means of airway endoscopic monitoring during anaesthesia for the excision of mediastinal bronchogenic cysts in two young children.*

Clinical features: *The first, a four-month old boy, presented with stridor and wheezing due to a subcarinal bronchogenic cyst compressing the two main bronchi. The second, an eight-day-old girl whose trachea was intubated, presented with respiratory noise in relation to a bronchogenic cyst compressing the end of the trachea. In both cases, airway endoscopy was performed during anaesthesia with the ultra thin fibreoptic bronchoscope. Endoscopic monitoring allowed, first, a good evaluation of the degree of cyst compression on the airways. Second, the endotracheal tube could be positioned or repositioned with precision in order to avoid severe compression or spilling of liquid into the airways and to allow protection of the suture. Finally, video transmission helped the surgeon to visualize the surgical repair from the inside.*

Conclusion: *When added to the classical monitoring using SpO_2, $PETCO_2$ and airway pressure, peroperative endoscopic control provides complementary information which can help to detect possible complications more rapidly. This technique could be extended to all airway surgery on very young children.*

Objectifs: *On rapporte l'utilisation d'un fibrobronchoscope ultrafin (Olympus N20 diamètre externe 2.2 mm) pour la surveillance endobronchique au cours de l'exérese de kyste bronchogénique médiastinal chez deux jeunes enfants.*

Eléments cliniques: *Le premier sujet est un garçon de quatre mois présentant un stridor et un wheezing liés à l'existence d'un kyste bronchogénique médiastinal comprimant les deux bronches souches. Le deuxième est une fille agée de huit jours, intubée, qui présentait un bruit respiratoire en rapport avec une compression de l'extrêmité inférieure de la trachée par un kyste bronchogénique. Dans les deux cas, des contrôles endoscopiques répétés des voies aériennes ont été effectués au cours de l'acte chirurgical à l'aide du fibroscope ultrafin. Ce contrôle endoscopique a permis, tout d'abord, une ultime évaluation du degré de compression des voies aériennes par le kyste. De plus, la sonde d'intubation a pu être repositionnée avec précision au cours de l'intervention de façon à obtenir une meilleure ventilation, une protection des voies aériennes contre une éventuelle rupture du kyste ainsi qu'une protection des sutures en fin d'intervention. La retransmission vidéo a permis également au chirurgien de contrôler la qualité endotrachéale des sutures.*

Conclusion: *En s'ajoutant aux renseignements apportés par le monitorage classique (SpO_2, $PETCO_2$, pression dans le circuit), le contrôle endoscopique peropératoire donne une sécurité supplémentaire en dépistant une éventuelle complication et en pouvant y remédier rapidement. Cette surveillance pourrait s'étendre à toute chirurgie des voies aériennes chez le jeune enfant.*

Key words

AIRWAY: obstruction;
ANAESTHESIA: paediatric;
EQUIPMENT: bronchoscope fibreoptic;
SURGERY: pulmonary.

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Bronchogenic cysts, located in the mediastinum, provoke early symptoms of wheezing and cough, due to compression of major airways. Thus, there is an indication for their excision in young children. However, surgery on such small airways, is delicate due to the risk of rupture of the cyst in the airways, or aggravation of the compression by a rapid increase in its volume. Moreover, pressure of the cyst on the airways, may lead to tracheo- and/or bronchomalacia. In the perioperative period, respiratory monitoring (SpO_2, PCO_2, airway

pressure) provides only indirect information concerning the airways. We report two cases of mediastinal bronchogenic cysts where the anaesthetic procedure during excision was facilitated by the use of an ultrathin fibreoptic bronchoscope.

Case reports

Fibreoptic bronchoscopy

We used an ultrathin fibreoptic bronchoscope Olympus N20 (external diameter: 2.2 mm; two-way bending section; no operating channel) connected to a video camera (Sopro 27 Marseille France). The view obtained is of good quality. Due to the absence of an operating channel, cleaning the distal end of the bronchoscope is possible, either using the classical method of rubbing the distal end against the airway wall, or simply by withdrawing the bronchoscope as often as necessary. It is recommended that secretions are aspirated before introduction of the bronchoscope. When the internal diameter of the endotracheal tube is small (2.5 mm), the examination is brief and repetitive: resistance is too high to ventilate the lungs with the bronchoscope in place. From 4 mm internal diameter, artificial ventilation is possible. The bronchoscope is introduced through the connector piece between the ventilator and the tube. The quality of vision is adequate and introduction of the bronchoscope in the tube is extremely rapid. It takes only few seconds to examine the main airways without producing severe oxygen desaturation. Video recording allows instant replay to analyse the data. Intubation with an ultrathin bronchoscope is possible with endotracheal tubes from 2.5 to 4 mm internal diameter and above 4.5 mm, the use of a paediatric bronchoscope (external diameter 3.6 mm) is possible.

CASE #1

A four-month old boy weighing 5,700 g was hospitalized for stridor and wheezing. A subcarinal bronchogenic cyst with compression of the two main bronchi was diagnosed by bronchoscopy and CT scan. Excision of the cyst was planned through a right thoracotomy. An intravenous anaesthetic regimen was chosen using midazolam, fentanyl and atracrium. Artificial ventilation was administered by an SV 900 D Siemens-Elema ventilator supplying an air-oxygen mixture via an endotracheal tube with internal diameter of 4 mm. Heart rate and non invasive blood pressure were monitored, as well as end tidal CO_2 by a side-stream system and arterial oxygen saturation by pulse oxymetry. Surgery consisted of dissecting the cyst from the carinal wall. The optimal position for the endotracheal tube and the control of the main airways were obtained by repeated bronchoscopic examinations. When the child was in the recumbent position, anaesthesia did not modify the degree of compression by the mass, compared with examination whilst awake. However, when the child was placed in the lateral position for thoracotomy, the mass shifted nearly to obstruct the left main bronchus. The endotracheal tube was re-positionned in the trachea, just above the carina where the best SpO_2 value was obtained. During dissection, endoscopy verified that neither the carina nor the cyst had ruptured. The postoperative period was uneventful and extubation was performed two days later.

CASE #2

An eight-day-old girl weighing 2,900 g was admitted for benign hyaline membrane disease with an endotracheal tube *in situ*. A persistant respiratory noise was noted in spite of the intubation. A bronchogenic cyst, compressing the end of the trachea beyond the endotracheal tube was diagnosed by bronchoscopy and CT Scan. Excision of the cyst was planned through a left thoracotomy. The same anaesthetic and ventilatory protocols were chosen. Tracheal re-intubation was performed by slipping a reinforced tube (internal diameter: 3.5 mm) along the ultrathin fibreoptic bronchoscope Olympus N20. Endoscopy showed that the cyst had ruptured into the trachea. The endotracheal tube was located above this fistula, and the cyst was excised. The fistula was then stitched closed and coated with part of the cyst wall. During surgery, fibreoptic examination was used to ensure that repair of the fistula produced neither leakage nor stenosis of the trachea lumen. At the end of the repair, the endotracheal tube, under ultrathin fibreoptic bronchoscopic control was slipped over the suture to protect it. The postoperative course was uneventful; extubation was performed one week later due to tracheomalacia.

Discussion

Mediastinal location of a bronchogenic cyst is not rare[1] and the potential consequences of a cyst in this location require its immediate excision.[2] There are few recommendations for the anaesthetic management of these children, who are generally very young.[3,4] The problems most often met with during anaesthesia are threefold. First, there are difficulties linked with administration of anaesthesia to a patient with a mediastinal mass.[5,6] Second, there is risk of rupture of the mass spilling liquid into the airways. Finally, during dissection, the surgeon may twist the airways and/or aggravate the compression momentarily, or may provoke rupture of the airways. In addition, there are difficulties in monitoring.

Because manual ventilation is often necessary, information usually provided by the ventilator is not available. Furthermore, signals such as SpO_2, $PETCO_2$, airway pressure that inform the anaesthetist of possible complications have a delay and are imprecise.

Endoscopic control of the airways is useful at the different stages in the anaesthetic management of these children. Progression of the cyst can be rapid either to rupture (case #2) or to an increase of volume (case #1). In the preoperative period, prior to induction of general anaesthesia, endoscopy can evaluate the ultimate position and aspect of the cyst in relation to the airways. In addition, endoscopy is the only examination which gives the information necessary to analyse the consequences of compression on the airways due to the mass. First, the presence of the mass on the tracheobronchial wall provokes local malacia thus decreasing further the airway lumen. Second, both the compression itself and the malacia may trap secretions below the point of compression. These secretions in the bronchi provoke inflammation which contributes further to lumenal narrowing.

Fibreoptic bronchoscopy may also reduce the problems of intubation. The endotracheal tube should be chosen carefully. If the compression is severe, a reinforced tube will be required (case #2). Since general anaesthesia may aggravate the compression (as with anterior mediastinal tumours), it is recommended that the tube be introduced with the patient awake. In our experience, fibreoptic intubation in an awake patient with simple premedication, is the safest and most successful technique. During the intervention, the position of the tube can be modified, to improve oxygenation (case #1) and/or protect the airway (case #2). The ultra thin fibreoptic bronchoscope Olympus N20 is particularly well suited to this type of monitoring because the surgery is performed in young children with endotracheal tubes <4.5 mm (case #1: 4 mm case #2: 3.5 mm). Due to its small size, examination with an ultrathin fibreoptic bronchoscope is less traumatic in the young child and can be performed without sedation or local anaesthesia. Nevertheless the view is excellent and the airways can be seen very well. Placement of a small endotracheal tube (internal diameter <4.5 mm) is easier with an ultrathin fibreoptic bronchoscope[7] than with the technique using a pediatric flexible bronchoscope and guide wire.[8] The most important advantage of using an ultrathin fibreoptic bronchoscope to facilitate intubation is that it remains in place in the airways until the end of intubation and the correct placement of the tube. Mobilization of the tube during the intervention is only possible with the ultra thin bronchoscope and we found that movement inside the tube was easy and did not disturb ventilation.

In conclusion, during airway surgery on very young children, repeated endoscopic control of the airways using an ultra thin fibreoptic bronchoscope is helpful in managing complications during surgery by providing visualization of the problem.

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