

Paediatric Bronchology

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In the last 20 years paediatric bronchoscopy developed through a continuous medical and technological progress has allowed bronchial endoscopies to be performed safely in children of younger age. This progress was due to the availability of smaller instruments and new strategies allowing to extend the use of bronchoscopy in children.

An efficient instrumental approach needs, however, professional expertise with the use of technical devices and also an anesthesiological support to monitor vital functions before and after bronchoscopy.

The anatomy of a child's airway, particularly that of newborns, displays characteristics requiring diagnostic and therapeutic approaches, having risks requiring a precise evaluation.

Paediatric bronchoscopy may be performed by rigid or/and flexible instrument. In fact both of these instruments allows complementary techniques; the use of the rigid instrument is required during interventional approaches in general anaesthesia; the second technique, using the flexible instrument, is crucial in the diagnosis of infectious disease and airways abnormalities [1-6].

Rigid Bronchoscopy

Equipment and Methods

The availability of optical fibers (Hopkins type) has allowed the construction of rigid bronchoscope which are very small in size yet are able to visualise clear images with a wide angle of visibility and permit safe ventilation. These instruments are available in different sizes and length (the smaller rigid bronchoscope has an external diameter of 2.5 mm) thus allowing a safe exploration of airways in newborns [3, 7, 8]. The use of this technique requires a general anaesthesia (usually gaseous anaesthesia) administered by an experienced anaesthesiologist with proven experience in the field [3, 4, 7, 9, 10]. Some centres administer

midazolam i.v or propofol i.v during bronchoscopy using a rigid instrument [11]. The equipment should include rigid bronchoscopes with different diameters, considering the size of the patient, and should connect to a light source with the possibility of capturing pictures and videos. Bronchoscopy has to be performed in a surgery room or in a room equipped so as to be able to monitor vital functions of patients. The principal advantage of rigid bronchoscopy is the possibility of a complete control since it is not an obstructive instrument, allowing for accurate ventilation. Moreover it allows for better vision than the flexible bronchoscope and better use of devices to extract foreign bodies or mucous plug, or to easily control severe bleeding without compromising the ventilation. Interventional bronchoscopy has to be performed only using the rigid bronchoscope. The only limit of this instrument is the difficulty in positioning and examining the distal airways, especially in the upper lobes.

Flexible Bronchoscopy

Equipment and Methods

Currently, the paediatric flexible bronchoscopes are composed of optical fibers connected to a distal light, thus processing the images and visualising them on a monitor. In fact non operational and operational fiberbronchoscopes are available: the first ones (without a suction channel) with distal end of 2.2 mm and the second ones with distal end of 3.2-3.9 mm and operational channel of 1.2 mm of diameter.

Recently videobronchoscopes have been marketed which are of similar size but with a better quality of images. The optimal place to perform a paediatric bronchoscopy with flexible instrument depends on clinical state of the patients, on technical skills of the professional and on the availability of suitable instruments and experienced nurses. The paediatric bronchoscopy with flexible instru-

ment does not always require general anaesthesia. Moreover the local anaesthesia may be useful in visualising the tracheobronchial tree in normal breathing, allowing for both anatomical and functional evaluation. In younger children the bronchoscopy may be performed in general anaesthesia introducing flexible bronchoscope through an endotracheal tube of suitable size or using laryngeal mask visualising, in the latter, the larynx and vocal cords. The only absolute contraindication is lack of informed consent by parents of children [3]. Relative contraindications are pulmonary hypertension, severe hypoxia and severe coagulation disorders. The flexible bronchoscope is not indicated to remove foreign bodies. The new ultra-thin flexible instruments allow a bronchoalveolar lavage (BAL) and bronchial biopsies to be performed more easily [1, 2, 7, 9, 12].

The main indications for bronchoscopy in children are:

- Cough and wheezing of unknown cause.
- Recurrent haemoptysis in absence of suggestive clinical and radiological signs.
- Foreign bodies inhalation.
- Chemical and thermic damage of bronchial mucosa.
- Tracheobronchial fistula.
- Tracheobronchial stenosis.
- Radiological impairment of uncertain cause (recurrent lung infiltrates, atelectasis etc.).
- Diagnosis of pulmonary infections in immunocompromised children.
- In patients with Cystic Fibrosis for microbiological purpose.
- In Intensive Care Unit: assisted intubation and assisted tracheotomy procedure.
- Tracheal stents positioning.

A bronchoscopy with a flexible instrument is indicated in ventilated children suffering from severe wheezing especially if associated to other symptoms as apnoea, cough or severe crying due to an unknown cause. Differential diagnosis should be carried out between bronchomalacia, anatomical alterations of upper airways, trachea and main bronchus (laryngocele, haemangioma, epiglottis bifida / hypertrophic, vascular malformations, congenital cysts, foreign bodies inhalation) [5, 6, 8, 13]. The bronchoscopy with a rigid instrument is mandatory if foreign bodies inhalation is suspected, because of an easier and safer management of the airways and a greater availability of specific forceps and it has to be performed early by experienced professionals in a suitable setting [14].

The diagnostic yield can be increased by performing BAL and bronchial biopsy. BAL can be useful to diagnose persistent or recurrent pulmonary infiltrates, allowing samples for microbiological and cytological purposes. BAL is particularly indicated as a diagnostic tool in immunodepressed children, in those lacking a response after a large spectrum antibiotic treatment or after impairment of radiological pictures and last, in children suspected having atypical pneumonia [15-17].

Bronchial biopsy with a flexible bronchoscope is a safe method used to diagnose endobronchial tuberculosis or other granulomatous bronchial lesions [18]. Moreover, bronchial biopsy, allowing a sample of ciliated cells, can be useful to diagnose primary ciliary dyskinesia [5, 9, 12, 18].

A rigid bronchoscope is required during interventional approaches allowing the use of laser technique or positioning tracheal or bronchial stents although tracheal or bronchial stenosis in children are less frequent than in adults and generally those are congenital. Tracheal stenosis that have not cleared up after surgical treatment or severe bronchomalacia in newborns have been successfully treated by positioning tracheal and bronchial stents [19-21].

Conclusions

Paediatric bronchoscopy requires professional expertise with the use of technical devices. Rigid and flexible bronchoscopes are complementary instruments allowing exploration of airways in children. The new ultra-thin flexible instruments and the interventional approaches have increased the application field of paediatric bronchoscopy. Bronchoscopy in adult patients is especially indicated for cancer diagnosis while in children that is particularly addressed to diagnose congenital diseases or persistent pulmonary infections.

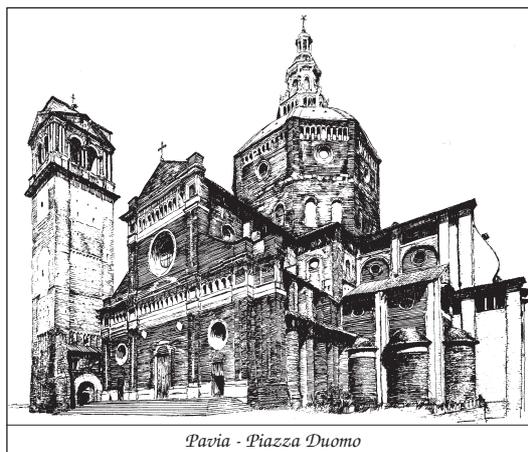
Recommendations

- **There are no absolute contraindications to bronchoscopy except if the informed consent by the patient or by parents of children is lacking (Grade C).**
- **An efficient instrumental approach needs a professional expertise with the use of technical devices and also an anaesthesiological support to monitor vital functions before and after bronchoscopy (Grade C).**
- **The bronchoscopy with a rigid instrument is mandatory if inhalation of foreign bodies is suspected in children (Grade A).**

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