Interventional Bronchology

The Role of Endobronchial Ultrasound and Self-expanding Metallic Airway Stents

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Endobronchial Ultrasound

The view of the endoscopist is restricted to the inner surface of the airways. Even new radiological procedures such as cat-scan and MRI are unreliable in diagnosis of the hilar and mediastinal structures. We therefore investigated the application of endobronchial ultrasound as an additional tool in bronchoscopy.

Two of six systems tested, 12 and 20 MHz probes of Olympus and CVIS proved to be applicable under the conditions. They were tested in a phantom for the imaging quality and in animal organs and human resection specimens to establish the normal sonographic anatomy. But only the Olympus probe could be modified for clinical routine use up to now. Since 1994 it has been applied in almost 2000 endoscopic procedures.

In macroscopic alterations of the mucosa due to malignant diseases also alterations of the sonographic architecture were always found. In early cancer depth of penetration into bronchial wall could be diagnosed. In advanced lung cancer infiltration of the deeper layers of the bronchial wall and parabronchial structures such as the pulmonary artery could be assessed.

Lymph nodes could be detected down to a size 3 mm. But not even by in vitro examination of 84 resected lymph nodes reliable signs for malignant infiltration could be established. Nevertheless ultrasound proved to be helpful in guiding transbronchial needle biopsy (TBNA).

Infiltration of the bronchial wall and involvement of large vessels by mediastinal masses could frequently by diagnosed. And pathological processes compromising the airways such as vascular anomalies, pleural effusion or solid mediastinal masses could be clearly differentiated.

In many instances the results of endosonography influenced decisions for interventional procedures such as stenting of the airways.

In conclusion endobronchial sonography proved to be a valuable additional tool in bronchoscopic diagnosis. By reusing the probes for more than 100 times the costs of the appr. 20 US$ per procedure (processor not included) seem feasible. We are currently investigating the results compared to conventional techniques in a prospective multicenter study.

Stenting with the Tracheobronchial Ultraflex® Stent

As many physicians using only the flexible bronchoscope are no longer trained in rigid bronchoscopy for interventional procedures alternative techniques have been introduced to compensate for the drawbacks of flexible bronchoscope. This is the reason why also stenting of the central airways should be possible by use of the flexible bronchoscope. For safe placement and fixation of the prosthesis, prior to insertion of a stent desobliteration and if necessary dilatation of the stenotic airway has to be accomplished. The resulting lumen should be as close to the physiological diameter as possible.

Meshworks of various materials can be compressed down to a small diameter and fixed onto a dilatation balloon or inside an introducing catheter. Once placed inside the airways they become expanded by balloon inflation or by their

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inherent elastic force after release. Ventilation throughout the procedure is either spontaneous or can be assisted by additional endotracheal intubation under local anaesthesia. Exact placement of these devices and deployment is fairly easy. But expandable stents proved to be unstable inside the airways. Secondly reocclusion by ingrowth of granulation tissue or tumor occurred frequently. By then extraction may be difficult or even impossible. In contrast the first self-expanding models were strong enough to withstand the pressures but due to their high expanding focus and their sharp edges tended to penetrate the wall.

This is why from 1992 we investigated selfexpanding devices made of Nitinol (Ultraflex®, Boston Scientific) that are more flexible and resemble the physical properties of the cartilages. For easy insertion we developed a new crochet knotting device. For prevention of tissue ingrowth and internal reocclusion a device covered by polyethylene is now available. These devices combine the advantages of the metallic stents, e.g. a thin wall leaving a large inner diameter for ventilation, flexibility and ease of insertion with impermeability to granulation or malignant tissue. Fixation is achieved by flares or by a few uncoated loops at the end. Extraction of these prostheses is comparatively easier.

Our experience refers to more than 400 implantations in about 250 patients, the longest observation time now extending over four years. Treatment of different kinds of central airway stenosis, even if complicated by fistulas, has been very successful and the complication rate is not higher than using the Dumon stent. Especially the migration rate is extremely low and placement at crucial locations such as the subglottic region is fairly safe. To our experience apart from some cases of bifurcation stenosis all other patients could be treated effectively by the Ultraflex stent.