Editorial

Diagnostic methods to localize pulmonary nodules and management of pleural infection after lobectomy

Duilio Divisi, Gino Zaccagna, Andrea De Vico, Stefania De Sanctis, Antonio Marella, Roberto Crisci

Department of Life, Health and Environmental Sciences, Thoracic Surgery Unit, University of L'Aquila, L'Aquila, Italy

Correspondence to: Duilio Divisi, Prof, MD, PhD. Department of Life, Health and Environmental Sciences, Thoracic Surgery Unit, University of L'Aquila, L'Aquila, Italy. Email: duilio.divisi@aslteramo.it; duilio.divisi@univaq.it.

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Scientific progress allowed to optimize the diagnostic-therapeutic path of bronchogenic carcinoma, increasing the rate of an early correct diagnosis and the personalized treatments. The main interest are the pulmonary nodules (PNs), defined as lesions <3 cm and surrounded by well-ventilated lung parenchyma (1). The first step in the diagnostic path of PNs, often identified incidentally during chest X-ray, is represented by computed tomography (CT) and/or 18-Fluorine-Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography (18F-FDG-PET/CT), which allow the morphological and topographical study even of very small lesions, defining their radiological characteristics with extreme precision (2). The second step is to define the histological nature of nodules. Preoperative CT-Guided biopsy is advisable in peripheral lesions but is contraindicated in small size nodules or in unfavorable position due to the proximity to the great vessels (3). Electromagnetic navigation has allowed us to overcome the limits of percutaneous biopsy (4). In fact, through a bronchoscope equipped with a radial probe at the end, it is possible to identify even central nodules and carry out a sampling of lesions with a fine needle, avoiding surgical biopsy. This last approach shows a double advantage: (I) a fast intraoperative histological diagnosis; (II) the possibility of proceeding with the most oncologically correct pulmonary resection. To date, the video-assisted thoracic surgery (VATS) is the safest and correct choice in early stage of lung cancer. Unfortunately, one of the main limitations of this method is represented by the impossibility, sometimes, to visually identify the nodule, making it necessary to widen the utility incision to palpate the pulmonary parenchyma but which is ineffective in case of ground glass opacity with a low solid component (5,6). A simple and relatively inexpensive method for intraoperative localization of PNs involves the use of a "hook wire" (7), connected to a suture or a semi-rigid metal thread, which allows the lesion to be anchored and then easily resected in VATS. This technique is easy to apply and, in case of small nodules, the wire can be anchored to the closest landmark to the lesion in order to facilitate resection. The limit of this method is represented by the possible slipping of the wire along the pulmonary parenchyma, preventing the identification and resection of nodule and also exposing patient to the risk of bleeding and pneumothorax. A valid and safe alternative is the CT-Guided percutaneous injection of indocyanine green in correspondence of the nodule (8). The corresponding lung parenchyma will be marked and will be easily identifiable during VATS. The bronchoscopic electromagnetic navigation technique (ENB) has recently been proposed to perform endoscopic injection of indocyanine green, in order to detect deeper nodules intraoperatively with positive results. Currently, the injection near the lesion of glue composed by cyanoacrylate and methylene blue

has been experienced (9,10). This technique allows to highlight nodule more easily, in order to lead the resection of the parenchyma with greater precision. A variant of this method has recently been proposed. The images of lesion are extrapolated by CT and transferred to a system usually used for radiotherapy. A simulator calculates the exact position of the nodule. A mark on the skin of patient in correspondence of nodule is carried out and a needle is inserted at the depth established by simulator in the operating room. This procedure allows to mark the nodule, facilitating VATS resection (11). In some cases, the techniques are borrowed from other application fields. Cornella *et al.* (12) demonstrated that the SAVI SCOUT method, used to more easily identify breast tumors through the preoperative positioning of a landmark subsequently detected in the operating room by a radar, can be also useful and effective in localization and in resection of PNs. This technique is indicated in peripheral nodules, near the surface. Zhou *et al.* (13) have developed, in an animal model, a method that involves a robotic system for identifying non-palpable nodules. This consists to reconstruct a three-dimensional model including all lung structures (parenchyma, vessels and bronchi) by intraoperative CT scan, facilitating the insertion of marker in correspondence of deep nodule. Cui *et al.* (14) demonstrated the effectiveness of this technique. The robotic navigation system with three-dimensional reconstruction successfully identified PNs in 100% of cases, with further advantages in terms of reduction of procedure times and complication rate. This technique introduces the concept of intraoperative identification of lesions with simultaneous resection in a single session. In fact, the use of hybrid operating rooms and a dedicated team with adequate training optimizes time of procedure, hospital stay and exposure of patients to radiation (15). We believe that this method will be the new frontier in thoracic surgery, acquiring an increasingly leading role in the early treatment of lung cancer.

The pleural infection is undoubtedly one of the most fearful complications after surgery for bronchogenic carcinoma; recognizing and promptly treating the infectious pleural effusion can be essential for patient survival. In fact, the exudative fluid collections of the pleural cavity are often associated with involvement of the lung parenchyma. The development of bronchopleural fistula and pleural empyema inevitably leads to an increased risk of postoperative mortality (16). The use of targeted antibiotics chosen on the basis of the antibiogram and the evacuation of infected fluid collections represent the cornerstones of the treatment, in order to avoid a general septic state and the extension of the infection to the chest wall which sometimes requires demolitive re-operations (17). Placement of a pleural drainage tube is the first step. Several studies (18,19) show the effectiveness of antibiotic therapy associated with the infusion of fibrinolytic drugs, such as urokinase and streptokinase, through the drainage tube. In addition, a double chest tube, positioned one at the base and one at the apex, allows the washing of the pleural cavity and the lysis of loculations and septations. This last technique should be avoided in case of bronchial stump dehiscence, to prevent flooding of the tracheo-bronchial tree. Drainage of pleural fluid collection may be improved by the infusion of tissue plasminogen activator (tPA) and deoxyribonuclease (DNase) through the chest tube (20). In conclusion, surgical versus non-surgical management for infected pleural effusion is still debated. We believe that the conservative treatment is the first advisable approach and, if promptly established, it allows the excellent results avoiding invasive procedures.

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Footnote

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