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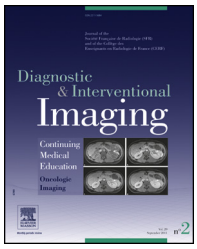

CONTINUING EDUCATION PROGRAM: FOCUS...

Normal postoperative appearances of lung cancer

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KEYWORDS
Lung cancer;
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Abstract The major lung resections are the pneumonectomies and lobectomies. The sublobar resections are segmentectomies and wedge resections. These are performed either through open surgery through a thoracotomy or by video-assisted mini-invasive surgery for lobectomies and sublobar resections. Understanding the procedures involved allows the normal postoperative appearances to be interpreted and these normal anatomical changes to be distinguished from potential postoperative complications. Surgery results in a more or less extensive physiological adaptation of the chest cavity depending on the lung volume, which has been resected. This adaptation evolves during the initial months postoperatively. Chest radiography and computed tomography can show narrowing of the intercostal spaces, a rise of the diaphragm and shift of the mediastinum on the side concerned following major resections.

The main indication for oncological thoracic surgery is currently non-small cell lung cancer (NSCLC). Lobectomies and pneumonectomies are the major scheduled lung resections and follow the principles of radical oncological surgery. These are combined with routine ipsilateral mediastinal lymph node dissection [1,2]. These procedures may be extended to include neighboring structures aiming always to achieve a resection margin passing through

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healthy tissue. Sublobar resections, segmentectomies, or *wedge resection* may be carried out in selected cases [3].

These different resection procedures result in anatomical changes in the chest, which evolve over time. Interpretation of postoperative imaging for lung cancer should therefore make it possible to distinguish normal anatomical changes from those due to complications.

We have examined the postoperative follow-up appearances of major and sublobar lung resections and, to distinguish the early and late radiological findings (chest radiography and computed tomography [CT]).

Specific features of thoracic oncological surgery

Radical surgery remains the reference curative treatment for localized NSCLC (stages 1 and 2), either in isolation or as part of multimodal treatment [1,2]. The extent of the resection depends on T status, the site of the lesion and pulmonaryfunction. Resection is carried out by dividing and suturing arterial and venous components and the bronchial pedicle for scheduled surgery (pneumonectomy, lobectomy and segmentectomy) — or extra-anatomically for unscheduled surgery (wedgeresection).

Since the prospective *Lung Cancer Study Group* study in 1995 which described 3 and 5 times more recurrences after anatomical segmentectomy or wedge resection respectively [4], lobectomy/lymph node dissection has been the standard procedure for localized NSCLC.

Pneumonectomy is indicated for central, bulky or multifocal tumors and is classically intrapleural, removing the lung and its visceral pleura. The extrapleural procedure is reserved for NSCLC with extension to the parietal pleura or for primary pleural tumors. Pneumonectomy, particularly on the right side, is associated with high morbidity and mortality [5], a significant reduction in quality of life, as well as limited treatment options if the tumor recurs.

These pitfalls can be reduced by a number of parenchymal-sparing techniques, which preserve the oncological quality of the procedure provided they are combined with extemporaneous examination of the resection specimens. These involve particularly sleeve lobectomies, which are carried out if the tumor has extended to the bronchial tree or pulmonary arterial system (Fig. 1) [6].

Radical resection may then need extension to the chest wall (ribs, vertebrae, and diaphragm), the major vessels (pulmonary artery trunk, pericardium, superior vena cava) or the atria [7].

Sublobar parenchymal resections can be offered for non-invasive or only minimally-invasive lesions such as atypical adenomatous hyperplasia, *in situ* adenocarcinoma or micro-invasive adenocarcinoma, or in patients with marginal pulmonary function [8,9].

''Mini-invasive'' surgery is tending to take over from conventional surgery with thoracotomy in selected situations, particularly stage T1 NSCLC for which lobectomy is indicated [10]. This technique was first developed in the 1990s and involves the same resection procedure as conventional surgery, although it uses only video-assisted thoracoscopy (Fig. 2). The aim of video-assisted surgery is to reduce postoperative pain due tointercostal spacing, as well as the risk for complications which may arise from this such as atelectasis or pneumonia, in order to shorten hospital stays and enable patients to resume their usual activities more quickly [11,12]. Although pneumonectomy can theoretically be performed using the same approach, mini-invasive surgery is still mostly reserved for atypical resections and lobectomies suitable for this approach on presentation. Robotics have been introduced in recent years and may now be used to assist these procedures [13].

The inherent principle of thoracoscopy precludes manual palpation for nodules. Perioperative identification can therefore be difficult, and preoperative identification is used by CT guided implantation of landmarks (coils or harpoons) to map out the target lesion (Fig. 3) [14].

Normal postoperative appearances

Chest radiography

During the hospital stay

Lobectomies and sublobar resections

A standard chest film is sufficient in the immediate follow-up period after lung resections in patients who have a normal

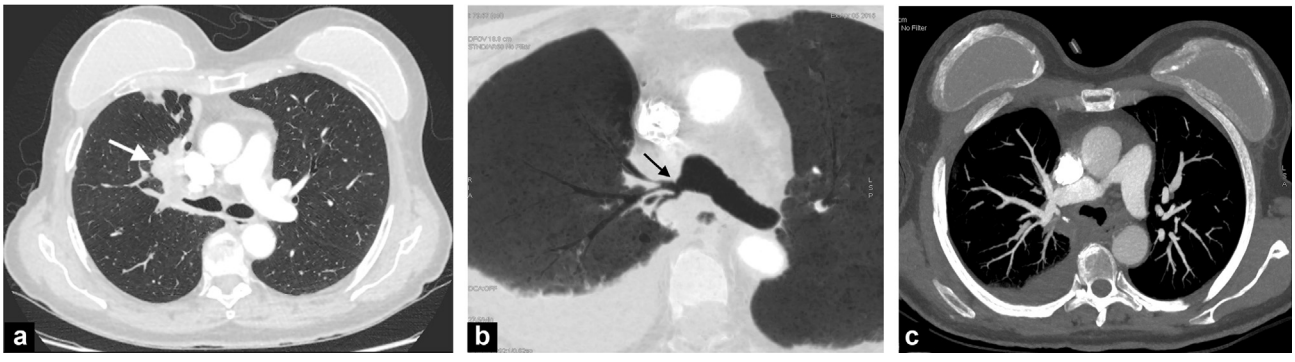

Figure 1. A 58-year-old patient treated for right upper lobe adenocarcinoma with extension to the main bronchus (arrow). Preoperative axial CT image in the parenchymal window after IV contrast enhancement (a). This image shows central tumor infiltration extending to the right main bronchus. Postoperative axial CT image with iodine contrast enhancement. Min IP axial reconstruction shows reinsertion of the right lower lobe bronchus into the main bronchus (b) (arrow). The MIP reconstruction shows the end to end anastomosis and interposition of a vascular graft (c). The tissue density image behind the allograft represents the presence of an intercostal flap.

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