CT-guided fine-needle biopsy of focal lung lesions as the method for reducing the number of invasive diagnostic procedures

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Summary

Background: CT-guided fine-needle biopsy (FNB) of focal lung lesions is one of the possibilities of obtaining histopathological diagnosis in pulmonary diseases. Its place in the algorithm is determined by the invasiveness. In case of no diagnosis after bronchoscopy or endobronchial ultrasonography (EBUS) guided biopsy, CT-guided FNB can become an alternative for more invasive procedures, such as open lung biopsy – thoracotomy.

Material/Methods: Since January 2009 until February 2010, we performed 37 CT-guided FNB in 34 patients aged 31 to 76 (mean age 60.9). Among them, there were 16 women and 18 men. All patients underwent a standard chest CT with contrast medium injection. They were diagnosed with focal lesions and they were rejected from surgery as the primary method of treatment. During biopsy, the patient was positioned prone or supine, depending on the location of lesions. After performing a scout image and initial slices, we marked the level of biopsy, using a metal marker. Next, the biopsy needle was introduced under local anesthesia. When the obtained position of the needle in the lesion was correct, the specimen was taken. After needle removal, the patient was controlled for the presence of complications (i.e. pneumothorax). Biopsy time ranged from 10 to 50 minutes.

Results: In 94.6% of biopsies, the specimens for histopathological and cytological examinations were obtained. In 22 (64.7%) patients, histopathological diagnoses (in 14 cases this was the non-small cell cancer and in 8, inflammatory lesions) were established which allowed us to resign from invasive thoracotomy and to introduce an appropriate treatment. In the remaining 12 patients, no diagnosis was established. Complications in the form of a minor pneumothorax occurred in 2 patients.

Conclusions: Fine-needle biopsy of the focal lung lesions is an affective and a relatively safe method, which can replace the more invasive diagnostic thoracotomy in the majority of patients.

Key words: focal lung lesions • CT • fine-needle biopsy

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Background

Lung cancers constitute a large group of diseases as far as their histopathology is concerned. The method of treatment depends on the lesion type. Nowadays, there are two basic groups of cancers identified on the basis of the treatment method: small cell cancers and non-small cell cancers [1]. The first type is characterised by a rapid dissemination, so that in most of the cases, the cancer is highly advanced at the moment of the diagnosis. The treatment of choice is chemotherapy [2]. Non-small cell cancers constitute a group of tumours with heterogeneous histopathology. However, their treatment methods are similar and depend to a larger degree on the clinical advancement of the cancer.
rather than on its histopathological structure. The treatment of choice in case of relatively unadvanced non-small cell cancers is the surgical procedure extended by chemotherapy or radiotherapy. In case of more advanced non-small cell cancers, the therapeutic process may join the induction chemotherapy with a surgical procedure or apply chemo- or radiotherapy only [1,3]. Taking into consideration all these factors, it is extremely important to obtain the histopathological diagnosis.

There are a few methods with which it is possible to collect the material for histopathological and cytological examination. The least invasive are the ones that examine the sputum for the presence of cancer cells. The next stage is the examination of the material obtained during the bronchoscopic brush biopsy or the bronchial lavage. It is also possible to obtain samples in the course of endobronchial ultrasonography-guided biopsy (EBUS) [4]. Even more invasive procedures include the fluoroscopy- or CT-guided fine needle biopsy (FNB). The most invasive procedures are: mediastinoscopy, videothoracoscopy and thoracotomy [1].

**Material and Methods**

Within 14 months (January 2009 – February 2010), in our diagnostic laboratory, we performed 37 CT-guided BAC procedures in 34 patients (including 18 men and 16 women, aged 31 to 76 years). Their mean age was 60.9 years. We qualified for the biopsy patients with focal lung lesions, histopathologically undiagnosed in the process of previously conducted, less invasive procedures. Those individuals did not qualify for any surgery either, due to the stage of lesion development or their general condition. The inclusion criterion was the location of the lesion not deeper than the length of the available biopsy needles (9 cm), which guaranteed a maximal safety of the procedure. The main risk factor was the distance from large vessels of the chest. The biopsy was not possible either if the lesion was located behind such osseous structures as the scapula or upper ribs. All patients underwent a baseline, standard CT of the chest. During the procedure, the patient was positioned prone or supine, depending on the location of the lesion. Before each biopsy, a scout image and a few scans were performed at the level of the lesion (Figure 1). This level was then localised with a metal marker (Figure 2). Next, the biopsy needle was introduced under local anaesthesia. The location of the needle was monitored with further CT scans (Figure 3). After obtaining an optimal needle location within the lesion, a sample material for cytology and histopathological examination was collected. In case of lesions located in pulmonary parenchyma, after needle removal, the patient was controlled for the presence of a pneumothorax. In case of paramural lesions, the patient was monitored with a standard chest X-ray, 1 hour after the procedure [5]. The biopsy time ranged from 10 to 50 minutes (22 minutes on average). All scans were performed at a constant kV and mA value (120 kV and 80 mA).

**Results**

Thirty-five out of 37 biopsies (94.6%) resulted in the collection of the sample material for cytological examination. Two biopsies (5.4%) failed. In 14 patients (41.1%), a non-small cell lung cancer was diagnosed histopathologically. Thanks to this diagnosis, we could resign from further, more invasive diagnostic procedures and introduce
treatment. In 8 cases (23.5%), inflammatory lesions were found. The presented diagnostic method revealed a diagnostic efficacy of 64.7% in total. The remaining 12 patients (35.3%) required further, more invasive diagnostics. Two biopsies (5.4%) were complicated by the presence of a minor pneumothorax which did not require thoracoscopic intervention (Figure 4). The mean total radiation dose received per patient was comparable to the dose in a single-phase chest CT.

Discussion

Histopathological diagnosis in a suspected lung cancer is essential for further management [1–3]. In case of non-small cell lung cancers in stage I–IIIA, the treatment of choice is the surgical procedure [3]. Patients with more advanced lesions or patients disqualified from surgery due to their general condition, require chemotherapy as a method of choice (induction or neoadjuvant one) [3]. If it is impossible to establish the diagnosis with one of the mentioned, less invasive methods, the CT-guided FNB constitutes an alternative for such invasive procedures as mediastinoscopy, videothoracoscopy or open lung biopsy in the course of thoracotomy [5,6]. CT-guided FNB is an available method, relatively easy to perform and pretty well tolerated by patients [6–9]. The time of the procedure and exposition to radiation are acceptable, taking into consideration the diagnostic value of the procedure. Its effectiveness is typical for fine-needle biopsies, lower than in core-needle or surgical biopsies, and ranging from 42% to 88%, according to the literature [6–9]. However, the chance that some patients may avoid other, more invasive procedures, makes it a method worth applying in pulmonary and thoracoscopic diagnostics. The analysis of our material confirms the effectiveness of the applied method. In almost 2/3 of patients, we received an unequivocal histopathological diagnosis which allowed for an abstention from more invasive diagnostic procedures and a rapid introduction of the proper treatment course. Owing to CT guidance during biopsy, this procedure becomes relatively safe, which was proved by the absence of major complications – in only 2 out of 37 biopsies there was a minor pneumothorax not requiring thoracosurgery.

Conclusions

CT-guided biopsy of pulmonary lesions is an effective and relatively safe method which can replace a more invasive diagnostic thoracotomy in most patients.

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