

Iatrogenic Dissemination Of initially Resectable Lung Cancer After Transthoracic Fine-needle Biopsy : who is to Be Blamed?

Yuan-Yuan Liu

Xuzhou Central Hospital

Longbo Gong

Xuzhou Central Hospital

Wenbin Wu

Xuzhou Central Hospital

Miao Zhang (✉ zhangmiaodr@163.com)

Xuzhou Central Hospital <https://orcid.org/0000-0001-7431-5986>

Case report

Keywords: Lung cancer, Aspiration, Core biopsy, Patient-physician relationship, Medical decision making, Artificial intelligence

Posted Date: June 29th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-37775/v1>

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Abstract

Background: Percutaneous fine-needle biopsy is a well-established procedure for the diagnosis of lung lesions. However, tumor dissemination after transthoracic biopsy is potentially unpreventable. For radiographical malignant localized tumors, the optimal choice (a timely surgery or preoperative biopsy) is debatable.

Case Presentation: A 57-year-old male patient was admitted due to a radiographical malignant but initially resectable lung tumor in the chest images. Although lobectomy, instead of biopsy, was recommended by the multidisciplinary consultation team, the patient declared that he would ask for compensation if the pulmonary lesion was benign. He developed pleural and pericardial effusion about 9 months after the first biopsy, which failed to yield a definite diagnosis. Chest tube drainage revealed malignant tumor cells. Finally, unresectable stage III primary lung adenocarcinoma was confirmed by another biopsy. Therefore, chemotherapy plus targeted agents was administered. The patient was lost to follow up 1 month later.

Conclusions: A timely resection rather than biopsy of the lung lesion suspicious for cancer should be considered when appropriate. In addition, how to avoid the negative effect of patient-physician relationship in medical decision making warrants further ethical and clinical studies.

Background

Fine needle aspiration biopsy is a useful procedure for the diagnosis of lung cancer. However, controversy still remains as to whether it should be employed in patients with undiagnosed and operable lesions suspicious for lung cancer. A potential complication of computed tomography (CT)-guided transthoracic fine-needle biopsy is the dissemination of tumor cells along the needle track, resulting in pleural and chest wall metastasis[1,2]. In theory, a timely operation rather than preoperative biopsy for pathological diagnosis seems reasonable for selected patients.

Physicians could explain what should be done and the patients could freely express their opinions regarding treatment choice. Nevertheless, surgical decision-making is sometimes inevitably hampered by a few absurd reasons including the quality of patient-physician relationship and the personality of the patients. For example, a timely resection of the initially localized tumor would be suspended or cancelled if the patient distrusts the physician. Thus, in addition to identifying reliable and the optimal individualized management options, it is crucial to improve the patient-physician relationship. To the best of our knowledge, the negative effect of patient-physician conflict on medical decision is not uncommon in the real-world settings. Who is to be blamed?

Herein we presented a case of pleural dissemination of initially resectable lung adenocarcinoma after percutaneous fine-needle biopsy, followed by a brief literature review regarding the usefulness and potential risks of transthoracic biopsy.

Case presentation

The clinical data of the patient was presented anonymously for privacy concern. A 57-year-old male patient was admitted on April 4, 2016 because of cough for about 1 month, without fever, hemoptysis, hoarseness, chest distress, thoralgia, dorsalgia, or significant weight loss. The physical examination showed nothing abnormal. The serum carcinoembryonic antigen, neuron-specific enolase, squamous cell carcinoma antigen, and cytokeratin-19 fragment were all in normal range. Further chest CT revealed a pulmonary lesion in the left upper lobe, measuring 43 mm \times 19 mm in size (Fig. 1A). It was suspicious of lung cancer due to the obvious spiculation margin and pleural tag signs. Distal metastasis was excluded by preoperative work-up including abdomen CT, cranial magnetic resonance and bone emission CT. Based on these findings, the case was staged as cT2bN0M0 (IIA) according to the 8th edition of tumor node metastasis staging system for lung cancer[3].

After a multidisciplinary consultation, uniportal thoracoscopic lobectomy and mediastinal lymph node sampling was recommended. The patient was informed that the lung tumor was probably malignancy, and biopsy was correlated with the potential risk of tumor dissemination. Nevertheless, the patient declared that he would ask for reimbursement from the physicians after the operation if the lesion turned out to be benign. Surgery was therefore cancelled. However, a CT-guided percutaneous core biopsy with an 18-gauge cutting needle failed to yield a pathological diagnosis of lung cancer. The alternative management including a second biopsy and intensive follow up were introduced. Then the patient was discharged from the hospital.

During the follow up, his CT on June 13, 2016 showed that the pulmonary lesion was slightly enlarged (Fig. 1B). But the physicians still did not perform surgery because of the fear of patient-physician conflict. The patient was readmitted about 9 months after the first transthoracic biopsy on January 9, 2017 due to gradually aggravated chest tightness. Unfortunately, the pleural and pericardial perfusion was indicated (Fig. 1C), and malignant cells were detected in the pleural effusion after chest tube drainage. The second CT-guided biopsy revealed the pathological diagnosis of lung adenocarcinoma (cT4NxM1a, IA). Systemic chemotherapy plus targeted agents was conducted accordingly. Thereafter, the patient was transferred to another hospital after the first cycle of anti-tumor treatment.

Discussion And Conclusions

The present report aimed to improve both clinicians and patients' understanding of the risk of CT-guided biopsy, as well as the importance role of patient-physician relationship in medical decision making.

The radiographical features of pulmonary nodules including short axis, contour, concavity, texture, location, fissure attachment, lobulation; while spiculation can be used with size-based measures to enhance prediction accuracy and to reduce false-positives[4]. Positron Emission Tomography-CT (PET-CT) plays an important role in the diagnosis, staging, response assessment and follow-up for non-small cell lung cancer (NSCLC) patients [5]. The diagnostic accuracy of contrast-enhanced CT and PET-CT is 0.58 and 0.9 respectively in identifying malignant solitary pulmonary nodules (diameter range 8-30mm)[6].

In addition to the radiological images, percutaneous fine-needle biopsy is widely used for cytological diagnosis of bronchogenic carcinoma. We searched PubMed, Web of Science, Scopus, Embase and Google Scholar for relevant reports up to January 2020. Key words and MeSH terms in title or abstract including "biopsy" or "puncture" or "CT-guided" and "pulmonary" or "lung" were used. No restriction was made regarding the publication language. Finally a total of 15 studies indicating the performance of CT-guided transthoracic needle biopsy were summarized in Table 1. The diagnostic accuracy of CT-guided aspiration biopsy of large nodules (>1.5 cm) and small nodules (\leq 1.5 cm) was 96% and 74%, respectively[7]. In addition, the diagnostic accuracy of CT-guided needle biopsy was significantly improved for large (> 10 mm) lesion size and short (< or = 40 mm) needle path length[9]. Factors such as the acquisition of two or fewer specimens, lesions in the lower lobe, malignant lesions, and lesions measuring \leq 1.0 cm or \geq 3.1 cm significantly increased the rate of diagnostic failure[10]. Core biopsy is a preferred method as it gives a higher percentage of representative samples than fine-needle aspiration biopsy[12]. Furthermore, the major complication rates for core biopsy and fine needle aspiration were 5.7 % and 4.4 %, respectively. Smaller nodule diameter, larger needle diameter and increased traversed lung parenchyma were risk factors for complications[22]. Based on the available evidence, CT-guided percutaneous lung biopsy for pulmonary nodules is a feasible and efficient diagnostic method.

However, dissemination of cancer cells along needle track can make a potentially resectable localized lung cancer to be unresectable. Previous reports of lung tumor dissemination or implantation after biopsy were summarized in Table 2. The largest reported sample from Japan indicated that the incidence of tumor seeding at the site of the puncture route after fine-needle biopsy was about 0.06%[34]; whereas the interval between the initiation of biopsy and the diagnosis of implantation/metastasis was reported to be 4-13 months[26, 30, 36]. Therefore, post-biopsy radiographic examination was necessary. Furthermore, transthoracic fine-needle biopsy should not be performed in patients with sub-pleural pure solid nodules who were suspected of having NSCLC[40]. Other studies showed that CT-guided lung biopsy with a coaxial needle did not seem to cause pleural dissemination or pleural recurrence[35,41]; whereas visceral pleural invasion was responsible for tumor relapse.

On the other hand, chest wall implantation of lung adenocarcinoma at the drainage tube site has also been reported[43]. To prevent such tumor seeding at the time of thoracotomy, the pleural cavity should be washed out routinely with a massive volume of saline prior to closure of the chest wall. Despite the reports of malignant spread along the needle track, preoperative biopsy does not affect the survival in stage I NSCLC patients[44]. In addition, subcutaneous implantation of tumor cells along the needle track has also been reported in bladder, urethra, and prostate, adrenal, pancreatic, thyroid, parathyroid, and hepatocellular carcinoma[28, 45-52]. Therefore, percutaneous fine-needle biopsy of the suspicious malignant lesions as indicated in radiographical images should not be performed indiscriminately but be reserved.

Moreover, the patient-physician trust is the foundation of clinical practice. The incidence of patient-reported regret over the decision to major abdominal and thoracic operations is 37%[53]. The factors most often associated with regret include type of surgery,

disease-specific quality of life[54], decisional conflict and lower satisfaction with the decision, adverse physical health outcomes, and greater anxiety levels[55].

Furthermore, healthcare workplace violence is an underreported problem that has been largely ignored. Deterioration of patient-physician relationship had worsened and the violence against the healthcare workers emerged as a visible risk to reasonable decision-making[56]. One of the most prominent forces driving patient-physician mistrust is a patient perception of injustice within the medical sphere due to knowledge imbalances and conflicts of interest. The mistrust leads to attacks against physicians[57]. A cross-sectional survey indicated that 34.4% of healthcare workers reported verbal or physical violence in the preceding 12 months, along with 13.5% of physical assault[58]. A meta-analysis showed that the prevalence of healthcare workplace violence is especially high in Asian and North American countries[59]. On the contrary, patients are also afraid that an important diagnosis will be missed or delayed through laziness, or incompetence of the physicians[60]. Moral, regulatory and legal responses are needed to restore the patient-physician trust. Generally speaking, surgical decision-making is impaired by time constraints, uncertainty, complexity, decision fatigue, hypothetical-deductive reasoning and bias. Integration of artificial intelligence with surgical decision-making has the potential to diminish overtreatment[61].

For the present case, a timely minimally invasive lobectomy was recommended on his first admission after multidisciplinary evaluation. However, the physicians intentionally gave up the operation to avoid potential patient-physician conflict, as the patient declared that he would demand compensation if the lesion turned out to be benign. In the real-world settings, some doctors do not know how to face the complex relationship with their patients. Meanwhile, the fear of violence impairs the decision-making deliberately. Therefore, the choice of treatment is only partly provided based on the published official guidelines and consensus recommendations.

In summary, tumor implantation or dissemination after fine-needle biopsy is somewhat inevitable and unpreventable. A timely operation should always be considered for radiographical malignant and resectable lung lesions, providing that the potential patient-physician conflict could be avoided efficiently.

List Of Abbreviations

CT, computed tomography; MRI, magnetic resonance imaging; PET-CT, Positron Emission Tomography-Computed Tomography; NSCLC, non-small-cell lung cancer

Declarations

Ethics approval and consent to participate

This report was approved by the Institutional Review Board of Xuzhou Central Hospital, and written informed consent was obtained from the patient.

Consent for publication

Written informed consent was obtained from the patient for publication of this report and any accompanying images.

Availability of data and materials

The data of the present case is available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable.

Authors' contributions

MZ performed the surgery and wrote this paper. YYL contributed to the preparation of the figures and tables. All authors contributed to preparation of the paper and to the perioperative treatment of the patient. All authors approved the final manuscript.

Acknowledgements

Not applicable.

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Tables

Table 1
Previous studies regarding the diagnostic performance of transthoracic fine-needle lung biopsy

Author, year	No. of nodules	Tumor size (cm)	Biopsy methods	Needle size (gauge)	False-negative (%)	Diagnostic failure (%)	Sensitivity (%)	Specificity (%)
Li, 1996 ^[7]	27	≤1.5	Aspiration	NA	NA	26	NA	NA
	70	>1.5				4		
Tsukada, 2000 ^[8]	138	2.3±1.2 (0.6-7.0)	Core biopsy	NA	15.22 (21/138)	17.4	76.9	93.6
Ohno, 2003 ^[9]	162	≤ 2	Aspiration	NA	NA	22.8	NA	NA
Hiraki, 2009 ^[10]	1000	2.3±1.5 (0.4-11.4)	Core biopsy	20	4.10 (41/1000)	4.8	94.2	99.1
Wu, 2012 ^[11]	98	NA	single needle cutting	18	NA	2	96.9	100
	100		coaxial					96.4
Beslic, 2012 ^[12]	147	2.9 (1.2-6.3)	Aspiration	20-22	NA	NA	NA	NA
	95		Core biopsy	14				96
Choi, 2013 ^[13]	305	≤ 1	Core biopsy/ aspiration	20	3.61 (11/305)	5.0	93.1	98.8
Lee, 2014 ^[14]	1153	2.7±1.7	Core biopsy	18	2.86 (33/1153)	3.0	95.7	100
Yang, 2015 ^[15]	311	NA	Core biopsy	18	3.86 (12/311)	7.1	95.3	95.7
Wang, 2016 ^[16]	195 paramediastinal	NA	Core biopsy	18	2.56 (5/195)	4.6	95.6	100
	1289 nonparamediastinal				3.41(44/1289)	5.3	94.2	100
Li, 2017 ^[17]	141	≤ 2	Core biopsy	18	0	3.9	94.4	100
Tian, 2017 ^[18]	560	1.8±0.6 (≤3)	Core biopsy	18	NA	5.4	92.0	98.6
Jeon, 2018 ^[19]	238	NA	NA	NA	3.78 (9/238)	3.8	94.4	100
Ahn, 2019 ^[20]	224	NA	Core biopsy	20	NA	3.1	96.1	100
Tosi, 2019 ^[21]	68	≤1.5	Aspiration	22, 23	NA	27.9	100	100

Abbreviations: NA, not available; NSCLC: non-small cell lung cancer.

Table 2

Previous reports of tumor dissemination/implantation after transthoracic fine-needle lung biopsy

First author, year	Biopsy methods	Needle size (gauge)	Pattern of tumor dissemination	Number of patients	Incidence of tumor dissemination	The interval between biopsy and diagnosis of dissemination
Wolinsky, 1969[23]	NA	NA	Needle track implantation	1	-	NA
Sinner, 1976[24]	Aspiration	NA	needle track implantation	1	0.08% (1/1264)	NA
Woyke, 1982[25]	NA	NA	Chest wall implantation	1	-	NA
Moloo, 1985[26]	NA	NA	chest wall metastasis	1	-	13 months
Seyfer, 1989[27]	aspiration	NA	Chest wall implantation	1	-	NA
Voravud, 1992[28]	aspiration	NA	Chest wall implantation	1	-	NA
Paik, 1994[29]	aspiration	NA	Chest wall implantation	1	-	NA
Sing, 1996[30]	aspiration	NA	chest wall metastasis	1	-	4 months
Raftopoulos, 2000[31]	NA	NA	Tumor implantation	1	-	NA
Yoshikawa, 2000[32]	aspiration	19	Chest wall implantation	1	-	NA
Kara, 2001[2]	aspiration	NA	needle track implantation and metastasis	1	-	NA
Kim, 2003[33]	aspiration	NA	chest wall implantation	9	0.21% (9/4365)	NA
Matsuguma, 2005[1]	Core biopsy	18	9 pleural recurrence; 1 needle track implantation	10	10.75% (10/93)	NA
Tomiyaama, 2006[34]	Core biopsy	18, 20	needle track implantation	6	0.06% (6/9783)	NA
Sano, 2009[35]	Core biopsy	20	5 pleural dissemination	5	2.92% (5/171)	NA
Ibukuro, 2009[36]	NA	NA	needle track implantation	4	0.56% (4/713)	4-7 months (mean, 5.6 months)
Scotti, 2012[37]	aspiration	NA	chest wall implantation	1	-	NA
Schreiner, 2013[38]	aspiration	NA	chest wall metastasis	1	-	NA
Kim, 2014[39]	NA	22	implantation metastasis in the pulmonary parenchyma	1	-	17 months
Kashiwabara, 2016[40]	aspiration	21	Needle tract implantation	1	1.59% (1/63)	NA
Ahn, 2019[41]	NA	NA	Concomitant pleural recurrence in 42 (5.1%); isolated pleural recurrence in 26 (3.1%)	68	12.59% (68/540)	NA
Huang,	NA	NA	Chest wall implantation	1	-	NA

Figures



Figure 1

A The chest CT on April 4, 2016 showed a pulmonary nodule in the left upper lobe; B The lesion was enlarged on June 13, 2016; C Pleural and pericardial effusion was indicated on January 9, 2017 after biopsy.

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