Management for chest wall implantation of non-small cell lung cancer after fine-needle aspiration biopsy

Joo Hyun Kim*, Young Tae Kim, Hong Kook Lim, Yong Hee Kim, Sook Whan Sung

Department of Thoracic and Cardiovascular Surgery, Seoul National University Hospital, Cancer Research Institute, Seoul National University College of Medicine, 28 Yongun-Dong, Chongro-Ku, Seoul, 110-744, South Korea

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Abstract

Objective: The implantation of cancer cells in the chest wall after percutaneous needle biopsy of the lung is rare. We investigated the clinical outcomes of implantation metastasis after percutaneous fine-needle aspiration biopsy of pulmonary mass suggestive of lung cancer.

Methods: Between January 1990 and December 2001, nine patients were treated for implantation metastasis of the chest wall. We retrospectively reviewed the patients’ records and analyzed their clinical outcomes.

Results: During an 11-year period, 4365 patients underwent percutaneous fine-needle aspiration biopsy for indeterminate pulmonary nodule at Seoul National University Hospital. Eight patients developed implantation metastasis related to the procedure. One patient was presented to us after being biopsied in another hospital. A wide, full-thickness excision of the chest wall was performed in eight patients. In one patient, palliative chemotherapy was performed due to the presence of distant metastases in addition to the local recurrence. In six patients, postoperative adjuvant radiation was given. There was no surgical mortality or morbidity. The median survival was 96.5 months (range, 15–128 months) after pulmonary resection and 75 months (range, 8–93 months) after chest-wall resection. Six patients developed recurrence of the primary cancer in a median of 52 months (range 5–93 months). Three patients recurred at the chest-wall excision site and a wide, full-thickness chest-wall re-resection was performed for two patients who recurred only at the previous chest-wall excision site. Four patients are alive, four have died of recurrent disease, and one died of underlying lung disease. None died of implantation metastasis per se.

Conclusions: The incidence of chest-wall implantation metastasis after fine-needle aspiration biopsy is extremely rare. With successful resection, the prognosis for the patient seems to depend on the primary cancer. A radical and wide resection in conjunction with irradiation may provide long-term survival in patients with an initial early stage cancer.

Keywords: Percutaneous needle biopsy; Implantation metastasis; Non-small cell lung cancer

1. Introduction

Percutaneous fine-needle aspiration biopsy is often used for the diagnosis of pulmonary nodules of the lung. Although it is a useful diagnostic procedure, various complications, such as pneumothorax, bleeding, infection, air embolism, and implantation metastasis, have been reported [1–3]. The purpose of this study is to investigate the clinical presentation and outcome in patients who developed implantation metastasis of non-small-cell lung cancer (NSCLC) after percutaneous fine-needle aspiration biopsy (PCNB) for two reasons. The first is to assess the risk of implantation metastasis. The second, and more important, is to identify the best treatment modality for those patients and the factors important for the selection of that modality.

2. Methods

Between January 1, 1990, and December 31, 2001, 4365 patients, because bronchoscopy did not give a diagnosis, underwent percutaneous fine-needle aspiration biopsy (PCNB) of the lung at Seoul National University Hospital. Twenty-two-gauge needles were used for aspiration biopsies and 19.5-gauge needles for gun biopsies. Of these 4365 patients, our records in the Department of Radiology indicate that only eight of those patients returned to our hospital due to implantation metastasis related to the procedure. In addition, one patient was presented to us...
after being biopsied in another hospital. Due to lack of resources, it was impossible to contact each of these 4365 individuals personally to determine if any patients with similar metastasis had gone to other hospital for treatment. Although theoretically such a situation is possible, in Korea it is not probable because every cancer patient in the country desires to be treated at our hospital. Thus, one may easily conclude that any patient treated at our hospital who developed such a metastases would return to our hospital for treatment because he or she would have priority for treatment. The presenting symptom of the nine patients with implantation metastasis was a growing mass on the chest wall. Fig. 1 gives an example of an implantation nodule that developed on the chest wall after PCNB of a lung mass. The nodule is clearly indicated by the arrow in the middle of CT scan at the bottom of the figure. We retrospectively reviewed and analyzed the demographics, perioperative data, treatment modalities, and clinical outcomes of these patients.

3. Results

Of the nine patients with implantation metastasis in the tract of PCNB, three were women and six were men and the median age was 61 years (range, 52–69 years). Bronchoscopic examination was carried out in all patients but pathologic diagnosis could not be acquired. Six of the patients underwent a lobectomy, two received a pneumonectomy, and one a wedge resection. In the two pneumonectomy cases, one patient had two separate lesions, one in the upper lobe and the other in the lower lobe, which were regarded as a double primary cancer, and the other had a transfissural invasion.

The histology of the tumor was squamous cell cancer in four of the patients, an adenocarcinoma in three, and a bronchioloalveolar cell carcinoma in two patients. The tumor was invading the visceral pleura in two of the patients. The pathologic stage was Ib in seven of the patients, IIIa in one, and IV in the other patient. Chest-wall implantation metastasis was detected at a median of seven months (range, 2–16 months) after the needle biopsy. A wide excision of the chest wall was performed in eight patients. In one patient, only palliative chemotherapy was performed due to the concomitant presence of distant metastases resulting from the primary cancer (Fig. 2). The excised chest wall included skin and subcutaneous tissue in four patients; skin, subcutaneous tissue, and muscle in one patient; subcutaneous tissue and muscle in one patient; and the full-thickness chest wall, including skin, subcutaneous tissue, muscle, ribs, and parietal pleura, in two patients. Frozen section examinations of the resection margins were free of malignant cells in all eight patients. The average size of the resected area was $7.1 \times 4.6 \text{ cm}^2$. The resected chest wall was primarily repaired in seven patients and reconstructed with Gore-Tex mesh and rectus abdominis.

Fig. 1. This 69-year-old man developed a 1.4 cm-sized mass on the left anterior chest wall. The location of the lesion coincided with the site of the previous needle biopsy, which had been performed 2 months before. Note the serial chest computed tomographs performed at the time of lung cancer diagnosis, when the implantation metastasis (arrow) was diagnosed, and performed after chest-wall resection.
myocutaneous flap in one patient (Fig. 3). Pathologic examination revealed the same cell type of carcinoma as that of the primary lung cancer.

Six patients received radiation therapy of the chest wall postoperatively, one of whom also received chemotherapy. One patient received adjuvant chemotherapy, and one did not receive radiation as the patient had already been treated with radiation of the implantation cancer site preoperatively. There was no surgical mortality or morbidity.

Among those eight patients who underwent surgery, six developed recurrence of the cancer in a median of 52 months (range 5–93 months). Three patients had a recurrence at the chest-wall excision site 6, 5, and 2 months after the first excision. One of these three patients recurred at both the chest-wall resection sites and in distant organs. Another three patients recurred at distant sites 11, 7, and 5 months after the chest wall excision. A wide, full-thickness chest-wall re-resection was performed for the two patients who recurred only at the previous chest-wall excision site. A large chest-wall defect required reconstruction with Gore-Tex mesh and muscle transposition. One of these two patients died of underlying idiopathic pulmonary fibrosis (IPF) at 6 years after the second resection and one still remains alive at 5 years after the second resection.

All three patients who recurred in distant organs received chemotherapy. Unfortunately, however, they died at 14, 4, and 38 months after recurrence.

The median survival after pulmonary resection was 96.5

![Fig. 3. This 59-year-old man was referred for treatment of an enlarging mass and ulceration on the chest wall after lung cancer resection. The lesion had been irradiated with 8800 cGy before visiting our hospital. A wide, full-thickness chest-wall resection was performed, and the defect was repaired using Gore-Tex mesh and transverse abdominis myocutaneous flap. Note the irradiation burn on the skin.](https://academic.oup.com/ejcts/article-abstract/23/5/828/407355)
months (range, 15–128 months), and the median survival after chest-wall resection was 75 months (range, 8–93 months). Currently, four patients are alive, including a patient who received only chemotherapy without chest-wall resection due to concomitant distant metastasis. Two did not have any recurrence after the chest-wall resection. The remaining one re-occurred at the chest-wall resection site, which was re-resected, and that patient remains alive without any evidence of additional recurrence. Among the five patients who died during the follow-up period, one died of aggravation of IPF, and four died of progressive distant metastasis, despite systemic chemotherapy. The sites of distant metastasis included cervical lymph nodes, the contralateral lung, bone, and the superior vena cava.

4. Discussion

As fine-needle aspiration biopsy is a simple and easy procedure with high sensitivity and low mortality, it is often used to diagnose lung disease. Although the incidence of complication in fine-needle aspiration biopsy is reported to be low, various complications, such as pneumothorax, infection, bleeding, air embolism, and implantation metastasis [1–3], have been reported. Tumor dissemination in the needle tract is a rare complication with an overall reported incidence of less than 1% [4]. Sinner et al. (1976) reported 0.02% among 5300 cases [5]. The incidence of implantation metastasis is relatively high when the cell type is an adenocarcinoma or when a large bore Vim–Silverman cutting needle is used. However, the incidence is lower when fine needles smaller than 22-gauge [6] are used. As a general practice, we use 22-gauge needles for aspiration biopsies and 19.5-gauge needles for gun biopsies. The incidence in our series was similar to those in previous reports. However, as the total number of needle biopsies included patients with benign disease and patients with multiple procedures whose needle biopsies had been non-diagnostic, the exact incidence should be higher. Our work confirms that tumor implantation in the needle tract is, indeed, rare. More importantly, it shows that although this is a cause of concern [6,7], it is not sufficient to contraindicate use of this procedure. We found that these implantation metastases are easily managed, but that early detection is essential. This means that the treating physician must be aware of all aspects of this subject and be suspicious of the existence of such metastases in patients who have undergone the procedure.

Previous case reports have demonstrated that the duration of implantation metastasis after needle aspiration varies from 6 months to 26 months. The implantation metastasis occurred within 2–16 months after the procedure in our cases. It should be stressed that a high index of suspicion is necessary for early diagnosis and that a careful physical examination of the needle biopsy site is mandatory during the follow-up periods.

The mechanism of implantation metastasis is still unclear. Sawabata and associates suggested that tumor cells remaining in the pleural space after fine-needle aspiration biopsy might cause pleural carcinomatosis and could grow [8]. However, in our series the tumor was located mainly in the subcutaneous tissue of the muscle and the resection included the parietal pleura in only two cases. This suggests that the implantation occurs due to tumor cells spilling into the soft tissue during the procedure.

The treatment strategy for implantation metastasis is controversial. Seyfer and associates suggested that a wide en-bloc excision and a muscular or myocutaneous flap be used if there is no evidence of distant metastasis. It was also suggested that, if the tumor is located close to the axilla, axillary lymph node dissection is needed because secondary metastases to axillary nodes had been reported [4,9–11].

There has been no large study regarding the appropriate extent of resection for implantation metastasis. Our study is one of the largest for this rare situation. We did not employ radical resection in some cases. When the lesions were small, a wide excision was performed, including only soft tissue without resection of the underlying rib or parietal pleura. There is, however, no clear evidence that a radical resection would be superior to a less extensive complete resection.

We elected to treat some patients with wide, complete excision, followed by local radiation with a usual palliative dose of 4000–5000 cGy [12]. We did not perform chemotherapy routinely. Postoperative radiation was performed, in all but two patients, one of whom was not treated because the patient had received preoperative radiation. The other patient who did not receive postoperative radiation recurred after chest wall resection, and underwent a re-resection. That patient did not receive radiation after the second operation and still remains free of disease. We were not able to clarify the effect of postoperative radiation in our patients.

The size of the implantation metastasis seems to be the most important factor. The sizes of the implantation metastases that recurred after chest wall resection were larger than 2.5 cm (2.5, 4.7, and 6 cm, respectively) at the time of diagnosis. On the other hand, the sizes were 1.4 and 0.5 cm for those that did not recur. In patients who recurred at distant sites, the sizes were 0.7, 1.0, and 5.0 cm. The patient with the 5.0 cm mass was treated with a radical wide excision including the whole chest wall, followed by hard and soft tissue reconstruction. It is, thus, emphasized that implantation metastasis should be diagnosed as early as possible to achieve cure with chest wall resection. A index of suspicion with a careful physical examination of the needle biopsy site during the early postoperative period is very important for early diagnosis. When the mass size is large, more aggressive wide excision is mandatory because the risk of local recurrence is high. The TNM stage of all patients who underwent chest wall resection was T2N0M0,
and we were unable to tell the influence of the TNM stage of the primary tumor on the implantation metastasis.

Four out of eight patients with implantation metastasis died of distant metastasis that was most likely related to the original tumor. This finding is important for selecting an appropriate treatment modality. Positron emission tomography, would be a good modality to be used before attempting chest wall resection for patients with implantation metastasis, especially high-risk patients. However, given the low morbidity and mortality for chest wall resection for implantation metastasis, it would be reasonable to resect the implantation metastasis whenever possible.

In conclusion, the possibility of implantation metastasis should not be used as an argument against the use of PCNB. Implantation metastasis can be managed by wide excision and postoperative radiation therapy. If such implantation metastasis is found early so that the nodule is small in size, the result of the surgical resection is acceptable. Thus, physicians following up on patients who have undergone PCNB should always be cognizant of the possibility for implantation metastasis.

References


