

Is It Sufficient to Evaluate Bone Metastasis Involvement in Breast Cancer using SPECT/CT? A New Approach of SPECT/CT-Guided Targeted Bone Marrow Biopsy

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Research Article

Keywords: bone metastasis, breast cancer, biopsy, tomography, mission computer, single photon, $^{99\text{Tc}}$ -methyl diphosphonate

Posted Date: February 16th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1295129/v1>

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Abstract

Objective To investigate the feasibility, safety, and clinical application value of single photon emission computed tomography/computed tomography (SPECT/CT)-guided bone marrow biopsy (BMB) in breast cancer (BC) patients with suspected bone metastases (BM) and compare its diagnostic performance for detection of BM with SPECT/CT.

Methods The records of breast cancer patients referred for bone scintigraphy (BS), SPECT/CT and SPECT/CT-guided BMB from January of 2018 to June of 2021 in our hospital were retrospectively reviewed. 49 Patients were consecutively included in this study, all 49 specimens were analyzed by pathological and immunohistochemical studies. The biopsy success rate, total examination time, biopsy operation time, complications, CT radiation dose, and pathological and immunohistochemical results were recorded. The diagnostic performance based on SPECT/CT and SPECT/CT-guided BMB were compared with pathological, immunohistochemical examinations and the results of subsequent follow-up.

Results Bone samples of the sites with high uptake were obtained in all 49 patients under BMB. No severe postoperative complications occurred. Among all 49 cases, 34 specimens were positive for metastatic breast cancer (69%, 34/49), and positive for benign tissue in 15 cases (31%, 15/49). 1 case of 15 cases was subsequently diagnosed as metastatic breast cancer according to the follow-up result. SPECT/CT-guided BMB demonstrated significantly higher negative predictive value (NPV) when compared to SPECT/CT ($p=0.021<0.05$). Patients with differential expression of ER, PR, and HER-2 between primary lesions and metastatic lesions accounted for 12, 17, and 5 cases, respectively, and the inconsistency rates were 35.2% (12/34), 50% (17/34), and 14.7% (5/34), respectively. Molecular subtype changes occurred in 7 patients, accounting for 47% (16/34) of metastatic patients.

Conclusion It is not insufficient to evaluate BM in BC patients using ^{99m}Tc -MDP SPECT/CT imaging. SPECT/CT-guided BMB was safe, accurate, and feasible and provided significantly higher sensitivity and NPV when compared to SPECT/CT for detection of BM in BC patients. In addition, our study initially showed the integrated approach that includes SPECT /CT and SPECT/CT-guided BMB, which can obtain one-stop imaging, pathological and molecular typing diagnosis in nuclear medicine department and offer important opportunities for precision treatment to improve quality of life of BC patients with BM.

Background

Breast cancer (BC) is the most common malignant tumour among women [1]. Bone is the most common location of metastasis for BC. Bone metastases (BM) count approximately 60–70% of all metastatic BC and more than 70% of patients showed bone metastases during autopsy[2]. BM significantly affects both quality of life and survival of the breast cancer patient. Clinically, complications secondary to bone metastasis include pain, pathologic fractures, spinal cord compression, and hypercalcemia of

malignancy [3]. Therefore, early diagnosis and treatment of breast cancer bone metastasis has important significance.

Bone marrow biopsy (BMB) is the “gold standard” of diagnosis of BM in BC. According to relevant practice guidelines of the National Comprehensive Cancer Network (NCCN), European Society for Medical Oncology (ESMO) and China Anti-cancer Association (CACA) [4, 5], re-biopsy for suspected metastatic lesions in patients with late-stage BC is considered to confirm diagnosis.

The evaluation of BM status is of critical importance in BC, as it is re-evaluated to confirm potential molecular subtype changes. The results may directly change the treatment plan [6]. However, conventional imaging cannot be used to confirm the target area, and advanced technology is not readily available; therefore, diagnosis cannot be routinely performed in clinical practice.

Nuclear medicine molecular imaging has unique advantages with respect to target area selection. In previous study, PET/CT-guided targeted BMB was confirmed to be a safe and feasible technique for the appraisal of advanced lung cancer and lymphomas [6, 7]. Zhao et al. applied SPECT/CT for thoracic tumor biopsy and confirmed its safety and reliability [8]. However, there are no studies examining the utility of SPECT/CT-guided targeted BMB.

After mastering PET/CT-guided percutaneous biopsy technology, this technology was introduced into SPECT/CT to perform SPECT/CT-guided BMB to target suspected bone metastatic lesions in breast cancer and test its feasibility and clinical value. The results are reported below.

Methods

Patients

The records of women with biopsy-proven breast cancer referred for routine clinical work-up with ^{99m}Tc -methyl diphosphonate (MDP) bone scintigraphy (BS) and SPECT/CT from January of 2018 to June of 2021 in our hospital were retrospectively reviewed. Patients were consecutively included in this retrospective study if positive lesions were identified on SPECT/CT imaging and SPECT/CT-guided BMB were performed, and patients with a second malignancy were excluded. SPECT/CT scans were performed within 7 days before BMB. The findings from SPECT/CT and SPECT/CT-guided BMB were compared with the results of subsequent imaging follow-up and pathological and immunohistochemical examinations.

^{99m}Tc -MDP SPECT/CT technique and imaging

A GE Discovery NM/CT670 combined with a low energy high resolution collimator, with an energy window of 20% and energy peak of 140 KeV, was used. ^{99m}Tc -MDP 740-1110 MBq was intravenously injected, and anterior and posterior full-body images and SPECT/CT fusion images were collected after 3 h.

Image analysis

BS and SPECT-CT images were independently analyzed by two experienced nuclear medicine physicians on the work station. The readers were blinded to patients' clinical information including previous therapy, previous BS findings, and the findings of other imaging modalities. Only the lesions that were not clearly defined on BS were evaluated. In case of any discrepancy regarding the findings of planar and SPECT images, a consensus was reached after mutual discussion. Malignant lesions were suggested by the presence of lytic, sclerotic, or mixed lytic-sclerotic changes on CT images. The presence of osteophytes, spondyloarthropathy, subchondral sclerosis, or narrowing of the joint space was regarded as a clear sign of the benign nature of the lesion. The site and characters of the lesions were also identified.

SPECT/CT-guided targeted BMB

^{99m}Tc-MDP SPECT/CT fused images were used to determine the appropriate puncture site with high uptake, and the biopsy needle was introduced stepwise under fused SPECT/CT image and CT guidance. After conventional disinfection, draping, and local anaesthesia to the periosteum using 1% lidocaine, a bone puncture needle (BMT-B 2.4×70, Shanghai SA Medical Technology) was pressed, rotated, and inserted in accordance with the plan. Scanning was performed again to confirm that the needle tip was located at the edge of the target area (120 kV, 20 mA, image fusion using VMI software). The needle was connected to a spare casing tube and inserted into the needle core. The needle was forcefully pressed and rotated clockwise. When the fusion image confirmed that the needle tip passed through the target area, tissues were obtained after the needle was rotated counterclockwise and withdrawn. One or two samples were obtained for each patient, and the lengths of samples all were 1.5 or 2.2 cm. The BMB specimens were fixed in 10% formaldehyde solution and analyzed by morphological and immunohistochemical studies. The pathological results of all BMBs were validated by review of the individual pathology reports. After the biopsy procedure was finished, patients were kept for observation for at least 30 min after the in a recovery room and were allowed to leave when there were no adverse reactions.

Molecular subtyping of groups

Based on estrogen receptor (ER), progesterone receptor (PR) and human epidermal growth factor receptor 2 (HER2) status, patients were classified following the recommendations of the 12th International Breast Conference [9]. The five patient groups were: 1) Luminal A: ER(+) and/or PR(+), HER2(-), Ki-67 low (<14%); 2) Luminal B-HER2(-): ER(+) and/or PR(+), HER2(-), and Ki-67 high (>14%); 3) Luminal B-HER2(+): ER(+) and/or PR(+), HER2(+), and any Ki-67 index; 4) HER2(+): ER(-), PR(-), and HER2(+); 5) Basal: ER(-), PR(-), and HER2(-).

Follow-up and reference standard

All the previous clinicopathological data of 49 patients have been followed up as soon as possible and their molecular subtypes have been classified. We derived the final diagnoses from histopathology and clinical/imaging follow-up (CT, MRI, PET -CT, SPECT -CT) over at least 6 months. It was considered

positive for a tumor if there is an increase in size or a change of nature under treatment, whereas benign if lesions had unchanged size and character over 6 months without therapy[10].

Statistical analysis and ethics

The total examination time, biopsy operation time, complications, CT radiation dose, and biopsy success rate were recorded. The total dose-length product (DLP; mGy) of each scan was used as the CT radiation dose that patients received. The effective radiation dose (DLP × weighting factor κ ; 0.019 mSv·mGy⁻¹·cm⁻¹ for the chest and 0.016 mSv·mGy⁻¹·cm⁻¹ for the abdomen and pelvis) was calculated. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were determined on the basis on number of patients, not number of lesions. McNemar test was used to test differences in the sensitivity and specificity between SPECT/CT and SPECT/CT-guided BMB. Chi-square test was used to test differences in the NPV and PPV between SPECT/CT and SPECT/CT-guided BMB. All statistical analysis was performed using SPSS, version 26 software. A p-value < .05 was considered significant. This retrospective evaluation of collected data was approved by the ethics committee of our institution. This study was approved by the Ethics Committee of our hospital (approval number: YXLL-2020-033).

Results

Patient characteristics and tumor characteristics are summarized in Table 1.

SPECT/CT-guided BMB

Bone samples of the sites with high uptake were obtained in all 49 patients under BMB. The average total examination time was (42.3±10.8) min, the average biopsy operation time was (24.5±6.2) min, and the effective radiation dose was (1.9±0.8) mSv. No postoperative complications such as infection, pneumothorax, massive bleeding, or nerve damage occurred.

The sites and characters of biopsy lesions are summarized in Table 2

Pathological diagnosis of bone metastasis

Among all 49 cases, 34 specimens were positive for metastatic breast cancer (69%, 34/49), and positive for benign tissue in 15 cases (31%, 15/49). The 15 benign biopsy specimens contains broken bone and bone marrow tissues (n=10), fibrous tissues (n=2), inflammatory cell infiltration (n=3), myofibroblastoma (n=1). To avoid potentially false negative of the 15 cases, they were further evaluated by clinical and imaging follow-up: 14 cases were confirmed as benign (inflammatory, myofibroblastoma , and lymph node hyperplasia) and 1 cases were subsequently diagnosed as metastatic breast cancer.

Typical images are shown in Figs 1-3.

Diagnostic performance of SPECT/CT vs. SPECT/CT-guided BMB

According to the pathological results and follow-up results, bone metastasis was confirmed in 35 of the 49 patients (71%). SPECT/CT was positive for disease in 27, yielding a sensitivity of 77% (27/35). Because of 1 case was false negative, the sensitivity of SPECT/CT-guided BMB was 97.5% (34/35). SPECT/CT-guided BMB exhibited significantly higher sensitivity when compared to SPECT/CT for determination of bone metastasis ($p=0.016<0.05$). (Table 3). SPECT/CT was true negative for bone metastasis in 10 of 14 patients, yielding a specificity of 71% (10/14), whereas the specificity was of SPECT/CT-guided BMB (14/14,100%). (Table 3). The PPV and NPV of SPECT/CT were 87% (27/31) and 55.5% (10/18) respectively, while PPV and NPV of SPECT/CT-guided BMB were 100% (34/34) and 93.3% (14/15) respectively. SPECT/CT-guided BMB demonstrated significantly higher NPV when compared to SPECT/CT ($p=0.021<0.05$). (Table 3).

Molecular classification & molecular subtyping shifts

Immunohistochemical examinations of ER, PR, and HER-2 were performed for all 34 metastatic tumors. Changes in ER expression in metastatic lesions and primary lesions were discovered in 12 patients (7 patients converted from positive to negative, and 5 patients converted from negative to positive), and the inconsistency rate was 35.2%. Shifts in PR expression were discovered in 17 patients (13 patients converted from positive to negative, and 4 patient converted from negative into positive), and the inconsistency rate was 50%. Conversions in HER-2 expression were discovered in 5 patients (4 patients converted from positive to negative, and 1 patient converted from negative to positive), and the inconsistency rate was 14.7%. According to diverse combinations of ER, PR and HER-2 status, the total molecular subtype rate of molecular subtype shifts was up to 47% (16/35). (Table 4).

Discussion

Breast cancer is an evolutionary heterogeneous tumour, and its molecular subtype can convert between bone metastatic lesions and primary tumors [11, 12]. Therefore, it is significant that early detection of bone metastasis and personalized treatment based on molecular subtypes, which can preserve or improve long-term quality of life and functional independence of BC patients with bone metastasis [13].

Relevant practice guidelines of the National Comprehensive Cancer Network (NCCN), European Society for Medical Oncology (ESMO) and China Anti-cancer Association (CACA) all recommend re-biopsy for suspected metastatic lesions in patients with late-stage breast cancer to confirm diagnosis. After metastasis is confirmed, biological indicators are re-evaluated to confirm potential molecular subtype changes. The results may directly change the treatment plan.

CT guided-BMB is currently the main guidance method for bone biopsy. However, there are some limitations[14]: (1) CT cannot confirm the sampling target for tumors that do not have lesions with abnormal morphology and structure at the early stage. (2) Systemic staging information cannot be obtained, the safest target area cannot be selected, and there is an increase in the incidence of complications (such as pneumothorax, paravertebral hematoma, and nerve damage).

Nuclear medicine molecular imaging, including SPECT/CT and PET/CT, can display anatomic and metabolic information concurrently and has unique advantages with respect to target area selection.

Bone scintigraphy (BS) is different from anatomical imaging. BS, commonly performed with technetium-99m-labeled bisphosphonates such as methylene diphosphonate (99mTc-MDP), is a widely used procedure, provides a whole-body skeletal survey at a relatively low cost, and is the standard initial imaging modality for assessment of bone metastases. It is a kind of imaging examination based on its own function, including blood flow, cell function, cell number, and active level of bone salt metabolism of bone tissue. Metastatic bone tumors are usually detected 3 to 6 months earlier than CT. 99Tcm-MDP BS plays an irreplaceable role in the screening and early diagnosis of bone metastasis.[15]. Numerous reports emphasize the high sensitivity of BS in the diagnosis of osseous metastases.

SPECT/CT has realized the organic combination of metabolic imaging and anatomical imaging, and solved the difficulty of accurate anatomical localization of positive lesions by BS. Meanwhile, CT imaging analysis of lesions can be carried out, which has important clinical value in differentiating benign and malignant bone lesions [16, 17]. For staging of the skeleton, because of the greater contrast resolution of SPECT coupled with the correlation with the morphologic appearance of lesions on CT, further gains in sensitivity and, especially, in specificity and diagnostic confidence were apparent with SPECT/CT [10, 18, 19].

¹⁸F-NaF is a bone-specific tracer first described in 1962, and its uptake by bone is secondary to high blood flow locally and osteoblastic activity thus raising the possibility of false positives as with BS. However, the advent of combined PET/CT has improved specificity by allowing morphological correlation at sites of skeletal uptake with better differentiation between benign and malignant abnormalities[20].

Many studies have used PET/CT for guidance or for guiding biopsy and showed higher success rates and safety. J.J.Cerci et al. evaluated the impact of percutaneous PET/CT-guided biopsies on histological confirmation of PET/CT-positive lesions and confirmed PET/CT-guided biopsy is feasible and may optimize the diagnostic yield of image-guided interventions[21].Wei et al. reported that PET/CT-guided percutaneous FDG-avid target biopsies offers a new integrated precise re-biopsy algorithm for pathologic confirm and surveillance of molecular subtype shifts of the recurrent breast cancer, which can improve precise individual therapy and prolong survival [6].Her previous research involving in¹⁸F-FDG PET/CT in guiding biopsy of bone metastases in patients with advanced lung cancer also confirmed it is an effective and safe method that yields a high diagnostic success rate in the evaluation of hypermetabolic bone lesions in patients with suspected advanced lung cancer [22].Bing et al. investigated whether PET/CT-guided bone marrow biopsy adds complementary information for evaluation of bone marrow involvement (BMI) in newly diagnosed lymphomas, and draw a conclusion that PET/CT-guided targeted BMB may complement the results of possible false-positive PET/CT and false-negative iliac crest biopsy findings [7]. Juliano et al verified that PET/CT-guided biopsy is feasible and may optimize the diagnostic yield of image-guided interventions, and PET/CT-positive lesions with no morphological correlation may now be accessible to percutaneous interventions[23].

However, there are fewer PET/CT apparatuses, thus their application is restricted. Furthermore, SPECT/CT is more common. Owing to that SPECT/CT is organic fusion of metabolic imaging and anatomical imaging, using SPECT/CT-guided biopsy can theoretically increase the accuracy and success rates and can be extensively promoted. There are fewer reports of SPECT/CT-guided biopsy. Zhao et al. applied SPECT/CT for thoracic tumour biopsy and confirmed its safety and reliability[8].

This study applied SPECT/CT to guide biopsy for suspected bone metastatic lesions in breast cancer. In our study, the relatively safer puncture site that is suspicious on SPECT/CT images was preferred consideration. Thus, the biopsy success rate was 100%, there were no serious complications, and an adequate amount of tissue was obtained in all 49 patients. 5 of 49 patients had no morphological changes on CT and were thus not suitable for CT-guided biopsy, while SPECT/CT identified an accurate biopsy site. Statistical analysis demonstrated that SPECT/CT-guided BMB showed significantly higher sensitivity and NPV when compared to SPECT/CT for determination of bone metastasis.

The possible reasons lie in the principle of ^{99m}Tc -MDP and the limitations of SPECT/CT. Abnormal accumulation of ^{99m}Tc -MDP is related to changes in local blood flow and osteoblastic activity, but does not reflect the true tumor burden in the bone marrow. The mechanism of accumulation means that the uptake of ^{99m}Tc -labeled diphosphonates is not specific for metastatic disease [24]. BS and SPECT/CT sometimes fail to distinguish bone metastases from benign disease, including trauma, inflammation and primary tumor of bone [10].

The additional radiation dose in this study was from positioning CT. Because of the advantage of fusion images, the tube current and tube voltage were only 20 mA and 120 mV, respectively, and the effective radiation dose was approximately (1.9 ± 0.8) mSv, which was lower than the dose for one-time chest CT scans and doses in literature reports[25].

In our study, the inconsistency rates between metastatic lesions and primary lesions for ER, PR, and HER-2 expression in 34 metastatic tumors were 32.3% (11/34), 47% (16/34), and 14.7% (5/39) respectively, and the rate of change in the molecular subtype was 54.3% (19/39), a finding that was basically consistent with that in literature reports[6, 26].

In summary, this study suggested that SPECT/CT-guided bone biopsy was safe and feasible and did not significantly increase the radiation dose. It provides breast cancer patients with an opportunity for accurate pathological and heterogeneous diagnosis of suspicious bone metastases. It has high clinical value and is worthy of extensive clinical application.

The limitations of our study were inherent to its retrospective design and small sample population. In addition, pathological benign pathological lesions should be followed up or other examinations should be conducted to exclude the possibility of false negative results. The next step is to conduct a study with a larger sample and continue long-term follow-up verification. Lastly, conventional decalcification in bone biopsy histopathology might influence immunohistochemical results, therefore, the ER, PR, and HER-2 expression results might not be accurate.

Conclusion

It is not insufficient to evaluate BM in BC using ^{99m}Tc-MDP SPECT/CT imaging. It is recommended that SPECT/CT-guided BMB be performed if positive lesions were identified on SPECT/CT imaging, which could offer significantly higher sensitivity and NPV when compared to SPECT/CT for detection of bone metastasis in BC patients. In addition, our study initially showed that SPECT/CT guidance provided a new integrated approach for bone metastatic BC patients, which include diagnosis of bone lesions, as well as a new SPECT/CT-guided BMB method to achieve tissue samples for monitoring potential molecular subtyping shifts of BC.

The integrated approach that includes SPECT/CT and SPECT/CT-guided BMB, which can be performed in one stop in nuclear medicine department, can offer important opportunities for precision treatment and improved quality of life of breast cancer patients with bone metastases.

Abbreviations

Abbreviations	Full name
BC	Breast cancer
BM	Bone metastases
BMB	Bone marrow biopsy
NCCN	National Comprehensive Cancer Network
ESMO	European Society for Medical Oncology
CACA	China Anti-cancer Association
MDP	⁹⁹ Tcm-methyl diphosphonate
BS	Bone scintigraphy
ER	Based on estrogen receptor
PR	Progesterone receptor
HER2	Human epidermal growth factor receptor 2
DLP	Dose-length product
PPV	Positive predictive value
NPV	Negative predictive value

Declarations

Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the principles of the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The study was approved by the Human Research Ethics Committee of Shanxi Bethune Hospital, Taiyuan, China (YXLL-2020-033). Written informed consent was obtained from each participant.

Consent to publish

Not applicable .

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Funding

This work was supported by the Shanxi Province key research and development project (grant no. 201903D321202).

Author Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Xiaomin Li, Caixia An and Wanchun Zhang. The first draft of the manuscript was written by Xiaomin Li and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Acknowledgements

We are indebted to Nuclear department of Shanxi Bethune Hospital for providing technical assistance. We also thank all the patients for allowing us to analyze their data.

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Tables

Table 1 Patient characters and tumor characteristics of the 49 patients

Vriable	n	%
Total patients	49	
Age(years)	53.37±11.36	
Histology		
Invasive ductal carcinoma	42	85
Invasive lobular carcinoma	4	8
lobular carcinoma in situ	2	4
mucinous adenocarcinoma	1	2
Estrogen receptor status		
+	41	83
-	8	17
Progesterone receptor status		
+	30	61
-	19	39
HER2 status		
+	27	56
-	22	44

Table 2 Sites and CT characters of evaluated lesions

Vriable	n	%
Sites	49	100
Vertebrae	13	26
Pelvis	12	24
Scapula	3	6
Sternum	11	22
Ribs	6	12
Clavicle	4	8
Characters		
Lytic	26	53
Sclerotic	18	36
Unchanged	5	11

Table 3 Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of SPECT/CT, and SPECT/CT-guided BMB in diagnosing metastasis

Parameter	SPECT/CT	SPECT/CT-guided BMB
Sensitivity	77	97.5
Specificity	71	100
PPV	87	100
NPV	55.5	93.3
Accuracy	79	98

CT, computed tomography; NPV, negative predictive value; PPV, positive predictive value; SPECT, single-photon emission computed tomography

Table 4 Molecular subtyping shifts of 34 breast cancer patients.

Molecular subtype shifts	datum	%
Unchanged	19	55.8
Changed	16	47.0
Total	34	100

Figures

Figure 1

Anterior bone scintigraphy, SPECT/CT fusion tomography image, biopsy image, and biopsy pathology image of a patient with invasive ductal carcinoma of the left breast (female, 44 years old). 1A. The anterior bone scintigraphy suggested increased punctate abnormal metabolism in the sternal body (black arrow). 1B, 1C. SPECT/CT fusion tomography showed bone destruction in a location of increased metabolism in the sternal body. 1D. SPECT/CT-guided percutaneous biopsy of the biological target in the sternal body. 1E. Pathological examination results suggested metastatic breast invasive ductal carcinoma, and light microscopy results revealed the nested distribution of tumour cells in the space between bones and dead bones, with obvious cell atypia combined with nuclear hyperchromic malformation (HE ×100).

Figure 2

Posterior bone scintigraphy, SPECT/CT fusion tomography image, biopsy image, and biopsy pathology image of a patient with invasive ductal carcinoma of the right breast 3 years after surgery (female, 29-year-old). 2A. The posterior bone scintigraphy suggested multiple abnormal increases in bone metabolism in the whole body and an abnormal increase in metabolism of the right ilium (black arrow). 2B, 2C. SPECT/CT fusion tomography results indicated that the bone density in the right ilium that exhibited increased metabolism had significantly increased. 2D. SPECT/CT-guided percutaneous biopsy of the biological target in the right ilium. 2E. Pathological examination results suggested metastatic breast invasive ductal carcinoma, and light microscopy results revealed metastatic adenocarcinoma cells in blood clots (HE ×100).

Figure 3

Anterior bone scintigraphy, SPECT/CT fusion tomography image, biopsy image, and biopsy pathology image of a patient with invasive ductal carcinoma of the right breast 2 years after surgery (female, 30-year-old). 2A. The anterior bone scintigraphy suggested abnormally increased bone metabolism on the right side of the manubrium of the sternum (black arrow). 2B, 2C. SPECT/CT fusion tomography results showed bone destruction in the location of increased metabolism on the right side of the manubrium of the sternum. 2D. SPECT/CT-guided percutaneous biopsy of the biological target in the right ilium. 2E. Pathology and immunohistochemistry results suggested myofibroblastoma. Light microscopy results

revealed a small amount of bone and dead bone tissues, polygonal cells between bone trabeculae, and nucleoli (HE ×100).