

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Breast manifestation of extramedullary myeloid sarcoma: A case report [☆]

Saba Naamo, MD^{a,*}, Samar Naamo, MD^b, Srawasti Sarker, MS^c, Megan Vasconez, DO^d,
Monica Froicu, MD, PhD^a

^a Department of Radiology, Geisinger Medical Center, 100 N Academy Ave, Danville, PA 17821, USA

^b Department of Radiology, Stony Brook Medicine, 101 Nicolls Rd level 4, Stony Brook, NY 11794, USA

^c Philadelphia College of Osteopathic Medicine, 4170 City Ave, Philadelphia, PA 19131, USA

^d Department of Pathology, Geisinger Medical Center, 100 N Academy Ave, Danville, PA 17821, USA

ARTICLE INFO

Article history:

Received 8 July 2022

Revised 29 August 2022

Accepted 4 September 2022

Keywords:

Extramedullary

Myeloid Sarcoma

Acute Myeloid Leukemia

Breast Mass

Breast Cancer

Breast Biopsy SET KEYWORDS

ABSTRACT

Extramedullary myeloid sarcoma (MS) of the breast is a rare disease, representing 0.12% of all diagnoses of acute myeloid leukemia. We review a case of a 27-year-old female who presented with a palpable right breast mass. She subsequently underwent a biopsy, which showed breast tissue with diffuse infiltrate of blasts compatible with MS. A bone marrow biopsy was performed with no evidence of leukemia or lymphoma. Therefore, a second breast biopsy was obtained for additional testing and cytogenetics which demonstrated positive (t8;21)(q22;q22) translocation associated with acute myeloid leukemia. Patient was admitted for induction of chemotherapy, but she subsequently developed neutropenic colitis and C. diff colitis. Unfortunately, her condition quickly deteriorated, and she passed away shortly after. This report aims to describe the clinical, radiographic, and pathological features of a case of extramedullary MS involving the breast.

Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Introduction

Extramedullary myeloid sarcoma (MS), also known as granulocytic sarcoma or chloroma, is a rare subtype of acute myeloid leukemia that involves the extra-medullary proliferation of myeloid blasts with subsequent disruption of the normal tissue architecture. In a study focusing on 94,185 cases

of acute myeloid leukemia (AML), only 746 patients were diagnosed with extramedullary MS (1%) [1]. The most commonly involved organs were connective/soft tissues (31.3%), followed by skin/breast (12.3%) and the gastrointestinal system (10.3%) [1]. While MS can predate AML by months or years, few cases describe primary MS of the breast without medullary involvement [2].

[☆] Competing Interests: None for all contributing authors.

* Corresponding author.

<https://doi.org/10.1016/j.radcr.2022.09.003>

1930-0433/Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

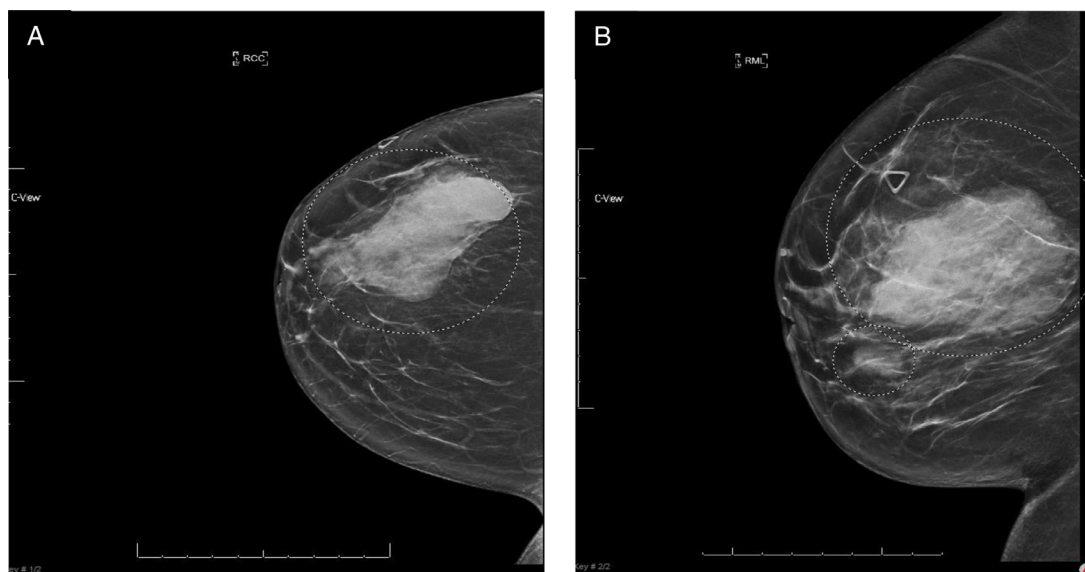


Fig. 1 – Right sided mammogram of a 27-year-old female presenting with a palpable breast mass with final diagnosis of myeloid sarcoma. (A) Craniocaudal and (B) mediolateral views show a high density, irregularly shaped mass in the upper outer quadrant. Image B demonstrates a second irregular mass at the anterior depth of the lower breast.

Case

A 27-year-old female presented to her primary care doctor for a right sided, tender breast lump.

She subsequently underwent a diagnostic mammogram and ultrasound. Mammogram showed a high density, irregularly shaped mass with indistinct margins in the upper outer quadrant of the right breast (Fig. 1). Targeted ultrasound demonstrated a corresponding 65 mm × 34 mm × 64 mm irregularly shaped, heterogeneously hypoechoic mass with indistinct margins, posterior shadowing and internal vascular flow at 10 o'clock, 5 cm from the nipple (Fig. 2). A second mass was seen at the anterior depth of the lower outer quadrant (Fig. 1B). Targeted ultrasound demonstrated a corresponding 14 mm × 9 mm × 21 mm irregularly shaped heterogeneous mass with indistinct margins, posterior shadowing, and internal vascular flow at 9 o'clock, 2 cm from the nipple (Fig. 3). Additionally, 2 right axillary lymph nodes were seen with normal cortical thickness measuring 3 mm. Patient was given BI-RADS 4 (suspicious), and an ultrasound guided biopsy was recommended.

Pathology showed breast tissue with diffuse infiltrate of blasts, consistent with MS. The neoplastic cells were strongly positive for CD117 and MPO; however, a subset was weakly positive for CD19 and therefore suspicious for translocation (t8;21) leukemia (Fig. 4). Patient went on to have a bone marrow biopsy that did not show evidence of acute leukemia or lymphoma. CBC with differential also showed no evidence of leukemia. She then underwent a repeat breast biopsy for further testing. At this time, pathology showed blasts weakly positive for CD33 and cytogenetics positive for (t8;21)(q22;q22).

PET-CT further showed a metabolically active right breast mass with suspicious metabolic activity within the right axillary lymph nodes (Fig. 5). Patient was referred to medical oncology where she was started on Cytarabine (Cytosar -

U), Daunorubicin (Cerubidine), and Gemtuzumab Ozogamicin (Mylotarg). Patient was admitted for induction of chemotherapy, but she subsequently developed neutropenic colitis and *C. diff* colitis. Unfortunately, her condition quickly deteriorated, and she passed away shortly after.

Discussion

Hematologic malignancies can rarely manifest as extramedullary soft tissue masses. The rarity of it provides a diagnostic and therapeutic challenge. MS is a unique presentation of acute myeloid leukemia characterized by the development of tumor masses, consisting of immature myeloid cells, at an extramedullary site. Common sites include soft tissues, skin, lymph nodes, and the gastrointestinal system [1]. While MS typically presents as a systemic manifestation of AML, it can rarely present as an isolated entity without medullary involvement. Many of these individuals with isolated MS will develop AML in the absence of chemotherapy [3].

Primary MS of the breast without medullary involvement at the time of diagnosis is very rare. Several literature reviews were performed to determine the number of cases, clinical presentation and radiographic characteristics of such lesions. Our PubMed search for “extramedullary MS AND breast” revealed a report by Cunningham in 2006 describing 27 cases of breast MS diagnosed prior to bone marrow involvement [5]. Since then, there have been 7 additional cases described in the literature, one of which was in a male patient [4–10]. Of these patients only 9 cases were reported to be between the ages of 20 and 29 [4–10].

Similar to our patient's presentation, MS of the breast typically presents as a palpable mass for which patients subsequently get diagnostic imaging. Mammogram findings previ-

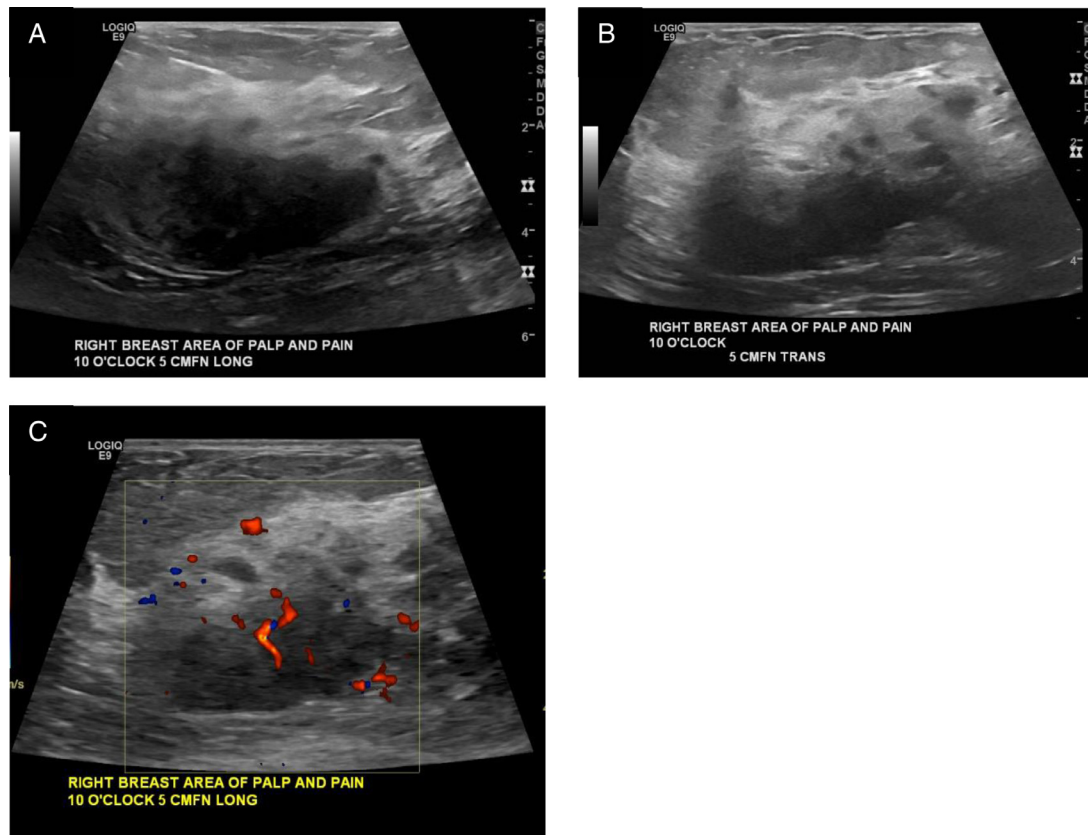


Fig. 2 – (A, B) Targeted ultrasound of the upper outer quadrant demonstrates an irregularly shaped, heterogeneously hypoechoic mass with internal vascularity on doppler ultrasound (C) at 10 o'clock, 5 cm from the nipple.

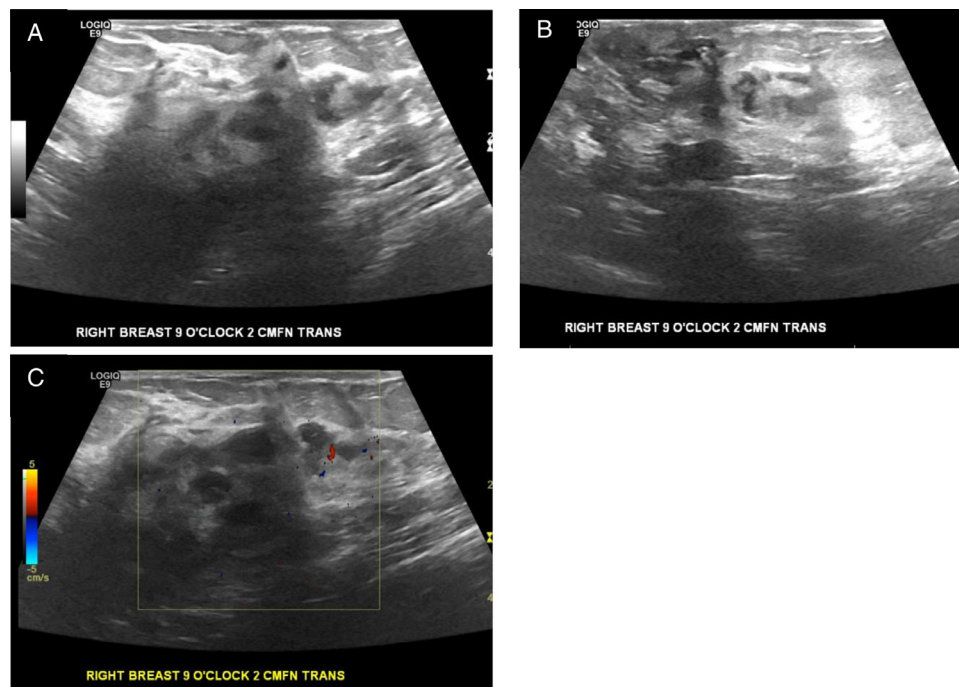


Fig. 3 – (A, B) Targeted ultrasound of the lower outer quadrant shows an additional, smaller, irregular, heterogeneous mass with posterior enhancement at 9 o'clock, 2 cm from the nipple. The mass further demonstrates internal vascularity on color doppler (C).

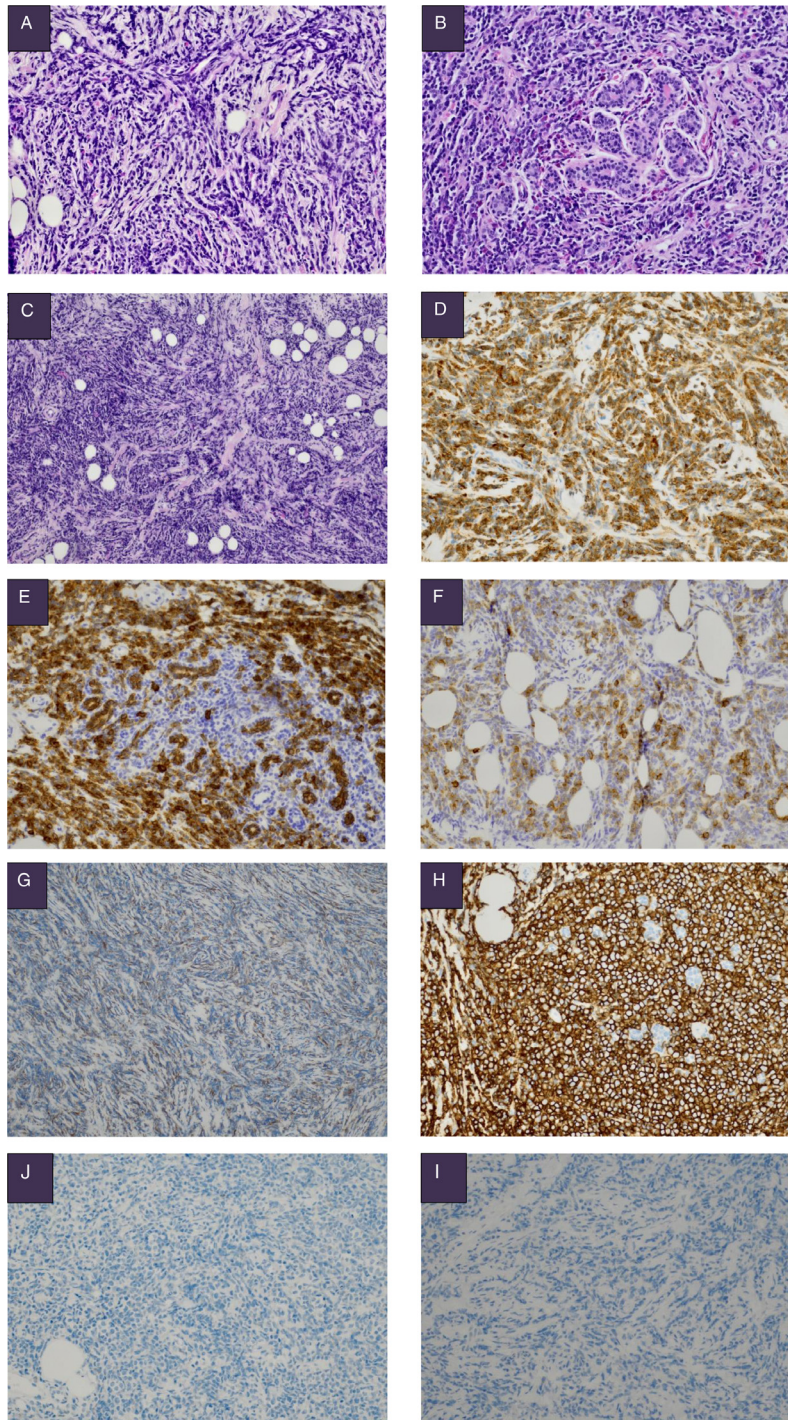


Fig. 4 - (A) Hematoxylin and eosin (H&E)-stained core biopsy showing atypical, intermediate-sized mononuclear cells with ovoid to irregular nuclear contours (200x). **(B)** H&E-stained core biopsy showing diffuse, sheet-like growth of atypical, intermediate-sized mononuclear cells with ovoid to irregular nuclear contours. The pattern of growth displaces but does not infiltrate the breast ductal epithelium (200x). **(C)** H&E-stained core biopsy showing diffuse, sheet-like growth with effacement of ductal structures (100x). **(D)** Tumor cells highlighted by Myeloperoxidase immunohistochemical stain demonstrating myeloid differentiation (200x). **(E)** Breast ductal epithelium surrounded by tumor cells positive for CD117 immunohistochemical stain indicating myeloid origin (200x). **(F)** Tumor cells weakly highlighted by CD19 immunohistochemical stain favoring aberrant expression of B-cell markers (200x). **(G)** Tumor cells are weakly positive for CD34 immunohistochemical staining representing hematopoietic progenitor origin (100x). **(H)** Tumor cells positive for CD43 immunohistochemical stain, a helpful diagnostic marker for myeloid sarcoma (20x). **(I)** Tumor cells negative for GATA immunohistochemical staining, a marker used to identify epithelial neoplasms (200x). **(J)** Tumor cells negative for Mammaglobin immunohistochemical stain, a marker used to identify breast carcinoma (200x).

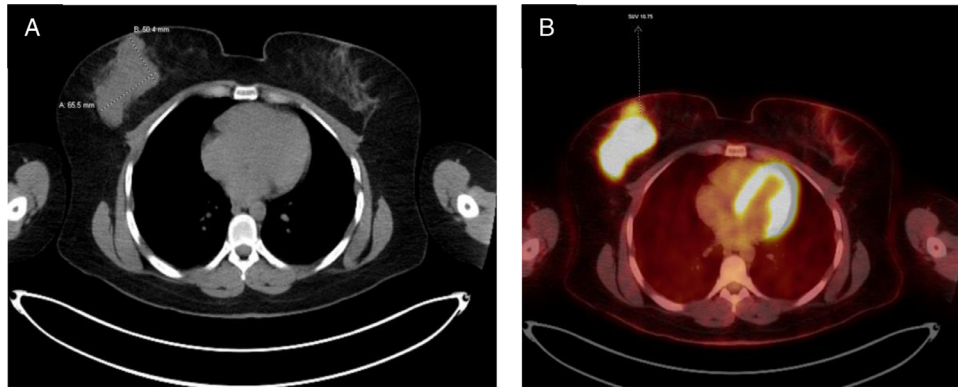


Fig. 5 – (A) Noncontrast axial CT scan demonstrates a large irregular right breast mass, (B) FDG PET-CT demonstrates metabolically active right breast mass.

ously described include large, noncalcified irregular masses with poorly defined margins [11–14]. US findings are variable and include homogeneous or heterogeneous hypoechoic lesions that are hypervascularized on color Doppler scans and cannot be easily distinguished from benign lesions [15–17]. Additionally, MRI can be a valuable diagnostic tool with breast MS presenting as hypointense lesions on T1-weighted images, hyperintense on T2-weighted images, and with inhomogeneous enhancement [18]. While nonspecific, these findings are suspicious and warrant a biopsy.

Certain genetic abnormalities can predispose to the development of MS and acute myeloid leukemia. In particular, the t(8;21)(q22;q22) translocation has been associated with 5–12% of cases of AML [19]. Patients with t(8;21) may have tumor manifestations such as MSs at presentation. Rarely, these individuals may have isolated extramedullary masses without bone marrow involvement. In such cases, patients should be diagnosed with AML despite a negative bone marrow biopsy. These patients typically have a good response to chemotherapy and high complete remission rate when treated with high dose cytarabine (HiDAC) plus anthracycline/anthracenedione-based induction therapy [19,20]. Most common induction regimen includes “7+3” therapy (7 days of cytarabine (Ara-C) followed by 3 days of idarubicin (4-demethoxydaunorubicin)) [18]. It is recommended to perform a bone marrow aspirate and biopsy 14–21 days after the start of the induction therapy to evaluate the efficacy of the treatment [20]. Recent studies have shown molecular biology analysis in conjunction with cytogenetics can be used to risk stratify patients for a more targeted treatment strategy [21]. For this reason, it is imperative to diagnose isolated MS cases with close attention to the characteristic clinical, radiographic, and pathologic findings.

Patient consent

Written and informed consent was taken from the patient’s next of kin (husband). He was informed that no personal details will be revealed in the publication of this case.

REFERENCES

- [1] Goyal G, Bartley AC, Patnaik MM, Litzow MR, Al-Kali A, Go RS. Clinical features and outcomes of extramedullary myeloid sarcoma in the United States: analysis using a national data set. *Blood Cancer J* 2017;7(8):e592. doi:10.1038/bcj.2017.79.
- [2] Kahn RM, Gordhandas S, Chapman-Davis E, Margolskee E, Matrai C, Chadburn A, et al. Acute myeloid leukemia presenting as myeloid sarcoma with a predisposition to the gynecologic tract. *Case Rep Oncol Med* 2019 Article ID 41892755 pages, 2019. doi:10.1155/2019/4189275.
- [3] Byrd JC, Edenfield WJ, Shields DJ, Dawson NA. Extramedullary myeloid cell tumors in acute nonlymphocytic leukemia: a clinical review. *J Clin Oncol* 1995;13(7):1800–16. doi:10.1200/JCO.1995.13.7.1800.
- [4] D’Costa GF, Hastak MS, Patil YV. Granulocytic sarcoma of breast: an aleukemic presentation. *Indian J Med Sci* 2007;61(3):152–5.
- [5] Cunningham I. A clinical review of breast involvement in acute leukemia. *Leuk Lymphoma* 2006;47(12):2517–26. doi:10.1080/10428190600967022.
- [6] Azim HA, Jr, Gigli F, Pruneri G, Martinelli G, Travaini LL, Petralia G, et al. Extramedullary myeloid sarcoma of the breast. *J Clin Oncol* 2008;26(24):4041–3. doi:10.1200/JCO.2008.17.3997.
- [7] Nalwa A, Nath D, Suri V, Jamaluddin MA, Srivastava A. Myeloid sarcoma of the breast in an aleukemic patient: a rare entity in an uncommon location. *Malays J Pathol* 2015;37(1):63–6.
- [8] Shaikh MS, Kayani N. Aleukemic myeloid sarcoma of the breast. *J Coll Phys Surg-Pak: JCPSP* 2015;25(Suppl 2):S122–3. doi:10.2015/JCPSP.S122S123.
- [9] Li X, Fu J, Xue Y, Yang Y, Wang Y, Zhang C, et al. Allogeneic hematopoietic stem cell transplantation as treatment for primary granulocytic sarcoma of the breast. *Cell Biochem Biophys* 2015;72(3):791–4. doi:10.1007/s12013-015-0534-7.
- [10] Minoia C, de Fazio V, Scognamiglio G, Scattone A, Maggialetti N, Ferrari C, et al. Long-lasting remission in de novo breast myeloid sarcoma treated with decitabine and radiotherapy. *Diagnostics (Basel, Switzerland)* 2019;9(3):84. doi:10.3390/diagnostics9030084.
- [11] Yang WT, Muttarak M, Ho LWC. Nonmammary malignancies of the breast: ultrasound, CT, and MRI. *Semin Ultrasound CT MRI* 2000;21(5):375–94. doi:10.1016/s0887-2171(00)90031-3.
- [12] Barloon TJ, Young DC, Bass SH. Multicentric granulocytic sarcoma (chloroma) of the breast: mammographic findings.

- AJR Am J Roentgenol 1993;161(5):963–4. doi:[10.2214/ajr.161.5.8273636](https://doi.org/10.2214/ajr.161.5.8273636).
- [13] Luca N, Antuono L, Mariagiorgia F, Carla BA, Paola B, Enrica GV, et al. Myeloid sarcoma of the breast: a pathology that should not be forgotten. *Ecancermedicalsecience* 2020;14:1160. doi:[10.3332/ecancer.2020.1160](https://doi.org/10.3332/ecancer.2020.1160).
- [14] Ozsoy A, Akdal Dolek B, Barca N, Aktas H, Araz L, Kulacoglu S. Ultrasound findings in a case of myeloid sarcoma of the breast. *J Belgian Soc Radiol* 2016;100(1):15. doi:[10.5334/jbr-btr.986](https://doi.org/10.5334/jbr-btr.986).
- [15] Guermazi A, Quoc SN, Socie G, Briere J, de Kerviler E, Solal-Celigny P, et al. Myeloblastoma (chloroma) in leukemia: case 1. Granulocytic sarcoma (chloroma) of the breast. *J Clin Oncol* 2000;18(23):3993–6. doi:[10.1200/JCO.2000.18.23.3993](https://doi.org/10.1200/JCO.2000.18.23.3993).
- [16] Thachil J, Richards RM, Copeland G. Granulocytic sarcoma—a rare presentation of a breast lump. *Ann R Coll Surg Engl* 2007;89:7–9. doi:[10.1308/147870807x227827](https://doi.org/10.1308/147870807x227827).
- [17] Kim SJ, Kim WG. Sonographic features of a myeloid sarcoma of the breast as a relapse of acute myeloid leukemia after stem-cell transplantation: a case report. *Am J Case Rep* 2019;20:612–19. doi:[10.12659/AJCR.915453](https://doi.org/10.12659/AJCR.915453).
- [18] Huang C, Fei S, Yao J, Chen P, Luo J, Wang Y, et al. Breast myeloid sarcoma presenting as a palpable breast lump after allogeneic stem cell transplantation for acute myelomonocytic leukemia: a rare case report. *World J Surg Onc* 2021;19:289. doi:[10.1186/s12957-021-02399-9](https://doi.org/10.1186/s12957-021-02399-9).
- [19] Jaffe ES. *Pathology and genetics of tumours of haematopoietic and lymphoid tissues*. IARC Press; 2001.
- [20] Tallman MS, Wang ES, Altman JK, Appelbaum FR, Bhatt VR, Bixby D, et al. Acute myeloid leukemia, version 3.2019, NCCN clinical practice guidelines in oncology. *J Natl Compr Canc Netw* 2019;17(6):721–49. doi:[10.6004/jnccn.2019.0028](https://doi.org/10.6004/jnccn.2019.0028).
- [21] Herold T, Rothenberg-Thurley M, Grunwald VV, Janke H, Goerlich D, Sauerland MC, et al. Validation and refinement of the revised 2017 European LeukemiaNet genetic risk stratification of acute myeloid leukemia. *Leukemia* 2020;34:3161–72. doi:[10.1038/s41375-020-0806-0](https://doi.org/10.1038/s41375-020-0806-0).