Chronic myeloid leukemia (CML) is a myeloproliferative neoplasm characterized by BCR-ABL1 translocation. It often presents with leukocytosis without morphologic dysplasia. The diagnosis is established by the demonstration of BCR-ABL1 using cytogenetic or molecular studies. There are three main BCR-ABL1 fusion transcripts, p190, p210, and p230. Monocytosis is an uncommon feature of CML at presentation, and if present, it is often associated with p190.
transcript. Here, we report a rare case of p210 BCR-ABL1 CML that presents with monocytosis and dysplasia.

A 39-year-old woman was admitted with cough and fever for 1 month. She had no splenomegaly. A complete blood count showed leukocytosis (white blood cell 30.8 × 10^9/L), anemia (hemoglobin 87 g/L), and thrombocytosis (platelet 728 × 10^9/L). Review of the peripheral blood smears showed monocytosis (21%) with 3% circulating blasts and left-shifted granulocytes (Figure 1, left: blue arrows for monocytes that were increased in numbers with some atypical and immature forms). Bone marrow core biopsy and smears (Figure 1, right) showed a hypercellular marrow with 14% myeloblasts (red arrows) and 12% monocytes (blue arrows). Early myeloid cells showed some atypical morphology, including hy- pergranulation (black arrows) and cytoplasmic vacuolization (brown arrow). Some mature granulocytes (green arrow) were hypolobated. Many megakaryocytes were small and hypolobated (not shown). The numbers of basophils and eosinophils were within normal ranges in both peripheral blood and bone marrow smears. The concurrent flow cytometric analysis of bone marrow cells demonstrated that blasts were CD34+, CD117+, and HLA-DR + dim with partial CD7 expression. Granulocytes showed an asynchronous CD13/CD16 maturation pattern. Monocytes were increased in numbers, about 14% of total cells, and they were positive for CD14 and CD64 with decreased HLA-DR. Given monocytosis and atypical morphology identified in granulocytes and megakaryocytes, chronic myelomonocytic leukemia (CMML) was considered. However, conventional cytogenetic analysis of bone marrow cells revealed a complex karyotype with t(9;22): 51, X, del(X)(p22.3), t(9;22)(q34;q11), +10, +?10, +19, +20, +der(22)(9;22)(q34;q11). Molecular study confirmed BCR-ABL1 translocation with p210BCR-ABL1 and monocytosis was rendered. Next-generation sequencing (NGS) analysis detected the following mutations: RUNX1-p.R201X, ASXL1-p.E727X, BCOR-p.R1183X, CUX1-p.L264Sfs*17, DIS3-p.D268N, EP300-p.F1374L, and FBXW7-p.P66R. Other mutations commonly seen in CMML such as TET2 and SRSF2 were negative.

Following the diagnosis of CML, the patient received imatinib in combined with decitabine, homoharringtonine, and cytarabine. After three cycles of treatment, minimal residual disease was detected with p210BCR-ABL1 transcript level of 16%. The patient then underwent allogeneic stem cell transplant and is currently under complete remission, 30 days after the transplant.

2 | DISCUSSION

Monocytosis and morphologic dysplasia are common morphological features in CMML. In this study, we present a case of CML with monocytosis and dysplasia as the initial presentation. Monocytosis in CML is rare, and monocytosis accompanied with morphologic dysplasia is even rarer. The differential diagnosis between CML and CMML in this scenario can be challenging. Karyotyping and/or molecular studies for BCR-ABL1 are essentially required for the correct diagnosis. p190BCR-ABL1 in CML is often associated with monocytosis. In the case described here, monocytosis is associated with p210BCR-ABL1. The association between monocytosis and p210BCR-ABL1 is rarely reported previously. Mutation analysis using next-generation sequence (NGS) in our case showed RUNX1 and ASXL1 mutations. RUNX1 mutation has been reported as a key genomic event during CML disease progression, and ASXL1 mutations were associated with a poor prognosis. ASXL1 is also a common mutated gene in CMML. Whether ASXL1 mutation is associated with monocytosis in our CML case is uncertain but worth further investigation.

3 | CONCLUSION

Rare cases of CML harbored p210BCR-ABL1 presented with monocytosis and dysplasia at initial diagnosis. It is important
to perform karyotyping and/or molecular studies to confirm the diagnosis for further TKIs targeted therapy. Stem cell transplantation will be considered if patients cannot get remission after conventional therapy.

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CONFLICT OF INTEREST
All authors declare no conflict of interest.

AUTHOR CONTRIBUTION
HW: designed and performed the study. XW and FW: organized the material and wrote the paper. ZW: completed the cytometry detection, and YL: helped on morphological observation. DW: gave language review, and BZ: provided some financial support on this article. All authors approved the final version of this manuscript.

ORCID
Zie Wang https://orcid.org/0000-0001-8739-0440
Huanling Wu https://orcid.org/0000-0002-9046-9982

REFERENCES
1. Dunphy CH. Bone marrow evaluation of monocytosis. Diagn Histopathol. 2009;15:116-124.
2. Ravandi F, Cortes J, Albitar M, et al. Chronic myelogenous leukemia with p185 BCR-ABL expression: characteristics and clinical significance. Br J Haematol. 1999;107:581-586.
3. Verma D, Kantarijan HM, Jones D, et al. Chronic myeloid leukemia (CML) with P190BCR-ABL1: analysis of characteristics, outcomes, and prognostic significance. Blood. 2009;114:2232-2235.
4. Chen X, Wang F, Zhang Y, et al. Panoramic view of common fusion genes in a large cohort of Chinese de novo acute myeloid leukemia patients. Leuk Lymphoma. 2019;60:1071-1078.
5. Dass J, Jain S, Tyagi S, Sazawal S. Chronic myeloid leukemia with p210 BCR-ABL and monocytosis. Leukemia and Lymphoma. 2011;52(7):1380-1381.
6. Giustacchini A, Thongjuea S, Barkas N, et al. Single-cell transcriptomics uncovers distinct molecular signatures of stem cells in chronic myeloid leukemia. Nat Med. 2017;23(6):692-702.
7. Asada S, Fujino T, Goyama S, et al. The role of ASXL1 in hematopoiesis and myeloid malignancies. Cell Mol Life Sci. 2019;76(13):2511-2523.

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