Radiology Case Reports 19 (2024) 5033–5037

Available online at www.sciencedirect.com

ScienceDirect

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

Case Report

Multiple enchondromas in Ollier's disease: A case report☆,☆☆

*Jeremy Hugh Yen-hey Lau, MBBS**, *Koon Kiu Ng, MBBS, FHKCR, Wai Chung Wong, MBBS, FHKCR, Boom Ting Kung, MBChB, FHKCR*

Nulcear Medicine Unit, Department of Diagnostic and Interventional Radiology, Queen Elizabeth Hospital, Hong Kong SAR, China

ARTICLE INFO

Article history:
Received 1 April 2024
Revised 13 July 2024
Accepted 15 July 2024

Keywords:
Multiple enchondromas
Ollier's disease
Maffucci syndrome

ABSTRACT

Ollier's disease is a rare sporadic nonhereditary condition associated with mutations in the IDH1 and IDH2 genes, that manifests in early age of life. It is characterized by widespread enchondromas, predominantly affecting one side of the body. Diagnosis is based on clinical and radiological evaluations, and interval assessment for Ollier's disease is important as enchondromas are at risk of malignant transformation into chondrosarcomas. This case report aims to discuss the role of bone scan and plain X-ray in managing multiple enchondromas of a 25-year-old male patient with swellings over the left chest wall and left acromial regions.

Case presentation

A 25-year-old male patient presented with swellings over the left chest wall and left acromial region that have been present for the recent few years. There was no history of similar conditions in his family.

Upon physical examination, firm swellings were observed in both hands, left chest wall, and left shoulder region. The overlying skin appeared normal. Plain X-rays were taken, including the hands, legs, elbows, forearms, and knees. The X-rays revealed multiple lytic lesions over bilateral tibias and left fibula with narrow zone of transition. Some of these lesions demonstrated associated medullary expansion and internal chondroid matrix. There was no associated periosteal reaction, soft tissue component and pathological fracture. No associated soft tissue calcifications were present to suggest phleboliths. The X-ray of both hands showed multiple enchondromas affecting the bilateral metacarpal bones and phalanges. Similar features were also observed in the X-ray of both feet, involving the metatarsal bones and phalanges (Figs. 1 and 2).

Bone scan was performed with patchy and multifocal increased bony tracer uptake with appendicular skeleton predominance. There were multiple tracer uptake foci in hands and feet and patchy increased tracer in acromia, proximal

☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.
☆☆ Acknowledgments: None.
* Corresponding author.
E-mail address: hugh.lau@ha.org.hk (J.H.Y.-h. Lau).
https://doi.org/10.1016/j.radcr.2024.07.080

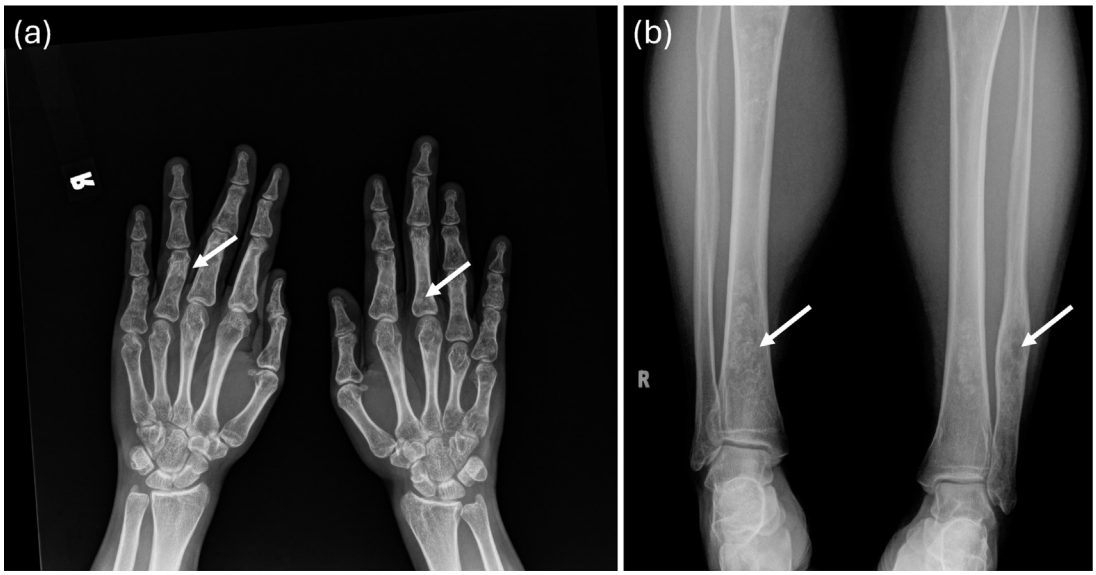

Fig. 1 – Multiple lytic lesions over (A) bilateral hands, (B) tibias and left fibula with narrow zone of transition. Some of them demonstrate associated medullary expansion and internal chondroid matrix (arrows). There is no associated periosteal reaction, soft tissue component and pathological fracture.

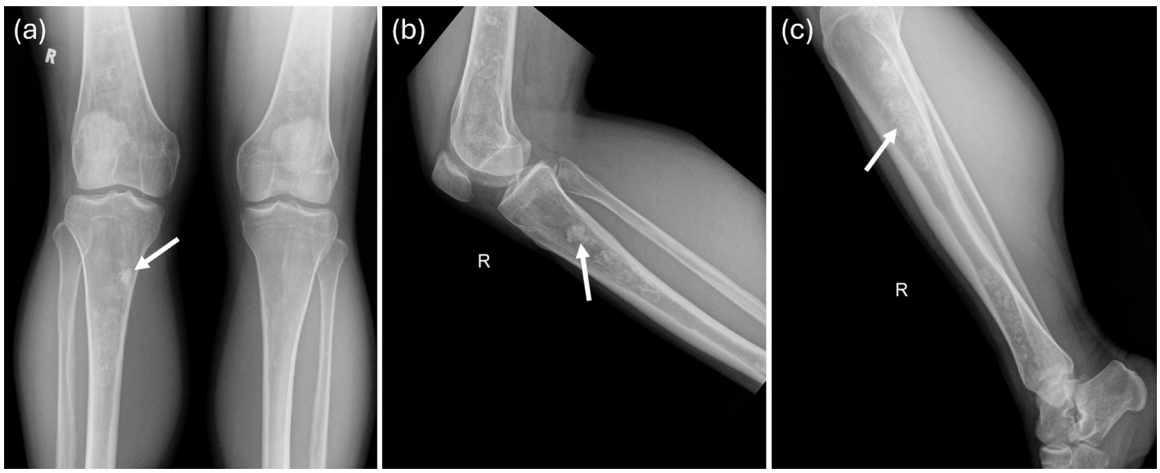

Fig. 2 – Multiple lytic lesions over (A) tibias with (B and C) lateral view of right tibia with narrow zone of transition. Some of them demonstrate internal chondroid matrix (arrows). There is no associated periosteal reaction, soft tissue component and pathological fracture.

humeri, manubrium, sternum, rib cage, right acetabulum, femur, tibias, and left fibula (Fig. 3).

Based on the morphology and location of the bone lesions observed on the plain radiographs, a diagnosis of multiple enchondromatosis (Ollier's disease) was made [1]. Bone scan revealed additional osteoblastic lesions in the axial skeletons. However, it is important to rule out hereditary exostosis as a differential diagnosis. Patient refused invasive investigations such as bone biopsy for histological confirmation. Magnetic resonance imaging (MRI) was not done due to limited availability and financial concern. Moreover, the patient has multiple enchondromas involving extensive region of skeletons, making comprehensive assessment of complication and malignant transformation by MRI difficult.

Discussion

One of the diagnostic criteria of Ollier's disease is the presence of 3 or more enchondromas [2]. The pathogenesis of the disease remains unclear, some literature proposed the involvement of abnormalities in signaling pathways that regulate the proliferation and differentiation of chondrocytes,

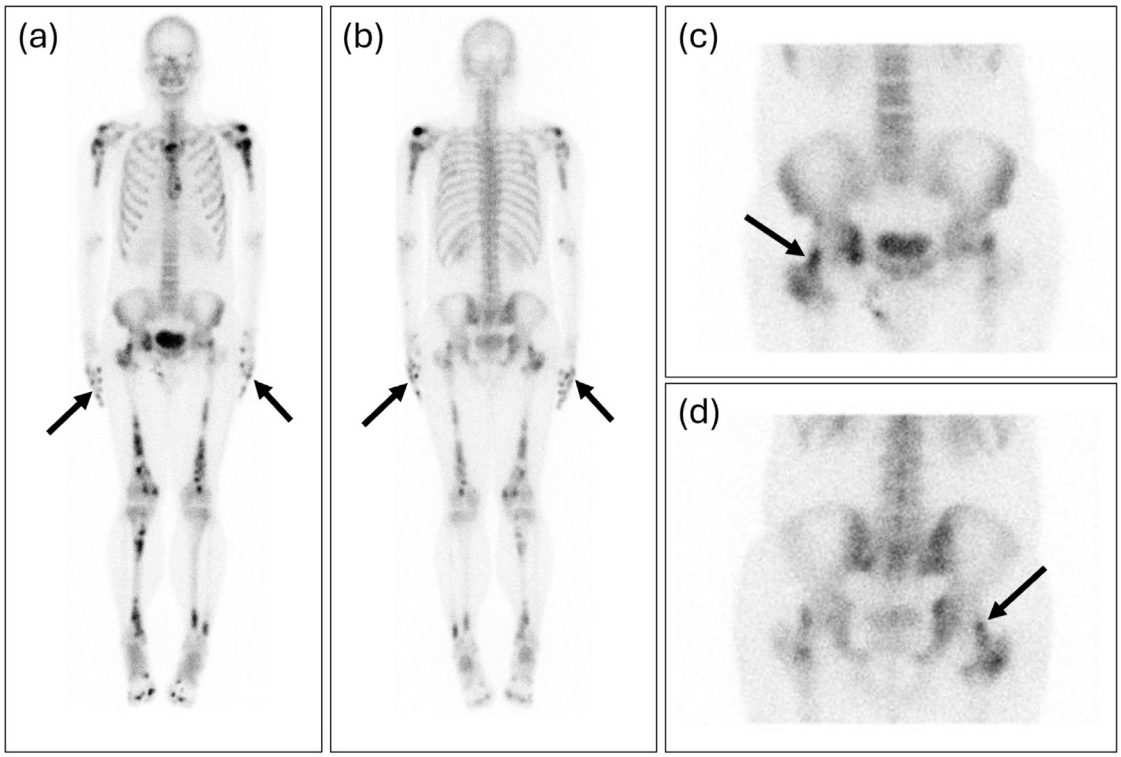

Fig. 3 – (A) Anterior whole body planar image of bone scan. (B) Posterior whole body planar image of bone scan. Patchy and multifocal increased bony tracer uptake with appendicular skeleton predominance. Multifocal tracer uptake in hands (arrows) and feet and patchy increased tracer in acromia, proximal humeri, manubrium, sternum, rib cage, right acetabulum, femurs, tibias and left fibula. Involvement of the right proximal femur (arrows) is also seen, (C) anterior regional planar image of hip and (D) posterior region planar image of hip.

leading to the development of intraosseous cartilaginous foci [3]. Both Ollier's disease and Maffucci syndrome are nonfamilial disorders, they usually present with asymmetrical distribution of lesions which suggests somatic mosaic mutation. Research showed that potential associations between certain mutations (i.e. IDH1, IDH2, and PTHR1 mutations [4,5]) and the disease in some cases, but they are not considered causative. Genetic evaluation is not routinely performed for the diagnosis of Ollier's disease as it is primarily diagnosed based on clinical and radiological findings. However, it may be helpful in differentiating Ollier's disease from other genetic conditions with similar presentation such as hereditary multiple exostoses and metachondromatosis. The presence of hemangiomas and occasionally lymphangiomas are features of Maffucci syndrome, which were not seen in this patient. Currently, there are no specific markers for the progression of the disease towards malignancy and clinical and radiological criteria remain the primary means of deciding on genetic evaluation.

Enchondromas predominantly affect the long tubular bones, such as the tibia, femur, and fibula, but can also occur in flat bones, including the pelvis. Patients typically experience symptoms in the first decade of life, with initial signs including palpable bony masses, limb length discrepancy leading to limping, and osseous deformities, sometimes accompanied by pathological fractures. The lesions are usually asymmetrical, with unilateral localization, and a dominant side may be present.

Characteristic X-ray findings of Ollier's disease include multiple radiolucent lesions with narrow zone of transition, medullary expansion, internal chondroid matrix without associated periosteal reaction. MRI can also reveal lobulated lesions with intermediate signal intensity on T2-weighted images [6]. However, routine use of MRI is not recommended due to high cost and limited availability for assessment of multiple regions while plain radiographs provide sufficient diagnostic information [7].

Bone scan is a sensitive whole body imaging technique. The bone uptake by the radiopharmaceutical technetium ^{99}m-methyl diphosphonate (Tc^{99}m-MDP) is governed by the blood flow and osteoblastic activity of the bone [8]. Uptake pattern with patchy marked increased uptake in bone scan can be seen in patients with bone metastases or metabolic bone disease with reduced soft tissue uptake. Some of the metabolic bone diseases also show expansile increased bone uptake (i.e. fibrous dysplasia). The bone scan in this case report showed multiple increased uptake foci in hand and feet, patchy increased uptake in appendicular skeletons and some of the axial skeletons, with no reduced soft tissue uptake nor expansile increased bone uptake. Given the young age of the patient and no history of malignancy, together with plain X-ray and bone scan findings, overall impression is in favor of multiple

enchondromatosis rather than bone metastases or metabolic bone disease [9].

Malignant transformation is a significant complication of enchondromatosis. Signs of malignancy include cortical erosion, extension of the tumor into soft tissues, and irregular or indistinct borders. In contrast, enchondromas tend to be well-circumscribed and show a uniform pattern of mineralization. The presence of unmineralized parts within the lesion raises suspicion of malignancy. Malignant transformation into chondrosarcoma in Ollier's disease is more common in shoulder and pelvis [10]. Delayed diagnosis and treatment of malignant transformation in Ollier's disease is often caused by lack of histological diagnosis while whole-body MRI assessment is not a common practice for guiding biopsy site. Newer imaging modalities such as ^{18}F-FDG PET/CT may be helpful in the management of Ollier's disease. There are case reports suggesting the use of whole-body ^{18}F-FDG PET/CT as a complementary role in evaluating the metabolic activity of potential malignant transformation and subsequently for guiding histological evaluation of target lesion [11].

As mentioned above, bone scan is sensitive for whole body assessment, which is useful for the assessment of unknown sites of involvement. Apart from that, interval assessment with bone scan can be used as disease monitoring tool by the change in extent and intensity of tracer uptake, which can be earlier than anatomical change in plain X-ray for guiding biopsy site for the assessment of malignant transformation. On the other hand, plain X-ray is useful for further characterization of specific suspected site of malignant transformation, or assessment of complications such as limb length discrepancy, osseous deformities, and pathological fractures.

There is currently no medical treatment available for Ollier's disease. Surgical intervention is required in cases of pathological fractures, growth deformities, and if there is a risk of malignant transformation [12]. It is important for individuals with Ollier's disease to have lifelong monitoring due to the potential malignant risk [13]. Radiological follow-up is typically by CT with intervals of 6-12 months to monitor for complications such as pathological fracture or malignant transformation. In our case, the patient has an upcoming CT appointment at 12-month interval for reassessment. The treatments of chondrosarcoma include surgery, radiation therapy and chemotherapy while some research suggested the use of target molecular therapy was helpful [14].

Research showed variable malignant transformation rate (5%-50%) in individuals diagnosed with Ollier's disease [15]. A recent study found that patients with Ollier's disease and Maffucci syndrome who developed one or more chondrosarcomas can be up to 46% [16]. When malignancy is suspected, histopathology investigations are used to determine the grade of the cancer, as prompt and appropriate management is required [17].

Conclusions

Enchondromas are common intraosseous lesions with proximity to growth plate cartilage. They are commonly benign, and their diagnosis can be made through plain radiographs and uptake pattern in bone scan. Patients with multiple enchondromas have a higher risk of malignant transformation, hence they require careful lifelong follow-up and radiographic assessments.

Ethical standards

This study was performed in line with the principles of the Declaration of Helsinki.

Author contributions

Lau Jeremy Hugh Yen-hey designed the study, acquired, and analyzed the data and drafted the manuscript. Ng Koon Kiu, Wong Wai Chung and Kung Boom Ting critically revised the manuscript for important intellectual content. Lau Jeremy Hugh Yen-hey, Ng Koon Kiu, Wong Wai Chung and Kung Boom Ting had full access to the data, contributed to the study, approved the final version for publication and take responsibility for its accuracy and integrity.

Patient consent

Informed consent of the patient was obtained.

IRB approval

The case report was approved by the Central Institutional Review Board of Hospital Authority, Hong Kong(Ref No.: CIRB-2024-180-2).

REFERENCES

[1] Sadiqi J, Rasouly N, Hamidi H, Siraj S. Radiographic features of Ollier's disease - two case reports. BMC Med Imaging 2017;17(1):58. doi:10.1186/s12880-017-0230-8.
[2] Pansuriya TC, Kroon HM, Bovée JV. Enchondromatosis: insights on the different subtypes. Int J Clin Exp Pathol 2010;3(6):557–69.
[3] Silve C, disease Jüppner HOllier. Orphanet J Rare Dis 2006;1:37. doi:10.1186/1750-1172-1-37.
[4] Zhang J, Hua R, Ma L, Liu C, Zhang Y, Lü X, et al. Ovarian juvenile granulosa cell tumors with Ollier's disease in children with IDH1 gene somatic mutation. Front Endocrinol (Lausanne) 2023;14:1093273. doi:10.3389/fendo.2023.1093273.
[5] Hopyan S, Gokgoz N, Poon R, Gensure RC, Yu C, Cole WG, et al. A mutant PTH/PTHrP type I receptor in enchondromatosis. Nat Genet 2002;30(3):306–10. doi:10.1038/ng844.
[6] Ardakani AG, Morgan R, Matheron G, Havard H, Khoo M, Saifuddin A, et al. Magnetic resonance imaging features and prognostic indicators of local recurrence after curettage and cementation of atypical cartilaginous tumour in the appendicular skeleton. J Clin Med 2023;12(21):6905. doi:10.3390/jcm12216905.

[7] Akoh CC, Craig E, Troester AM, Miller BJ. Radiographic enchondroma surveillance: assessing clinical outcomes and costs effectiveness. Iowa Orthop J 2019;39(1):185–93.
[8] Van den Wyngaert T, Strobel K, Kampen WU, Kuwert T, van der Bruggen W, Mohan HK, et al., EANM Bone & Joint Committee and the Oncology Committee The EANM practice guidelines for bone scintigraphy. Eur J Nucl Med Mol Imaging 2016;43(9):1723–38. doi:10.1007/s00259-016-3415-4.
[9] Khan SH, Rather TA, Koul PA, Makhdoomi R, Bhat AR, Malik D, et al. Bone scintigraphy in Ollier's disease: a rare case report. Indian J Nucl Med 2013;28(4):226–9. doi:10.4103/0972-3919.121968.
[10] Liu J, Hudkins PG, Swee RG, Unni KK. Bone sarcomas associated with Ollier's disease. Cancer 1987;59(7):1376–85. doi:10.1002/1097-0142(19870401)59:7⟨1376::aid-cncr2820590725⟩3.0.co;2-f.
[11] Zhang Q, Xi Y, Li D, Yuan Z, Dong J. The utility of ^{18}F-FDG PET and PET/CT in the diagnosis and staging of chondrosarcoma: a meta-analysis. J Orthop Surg Res 2020;15(1):229. doi:10.1186/s13018-020-01748-w.
[12] Kramer HD, Valentine MJ, Pettinelli N, Kim J, Kramer RC. Ollier disease: a case report and review of treatment options. Cureus 2023;15(8):e43815. doi:10.7759/cureus.43815.
[13] Coşkun HS, Erdoğan F, Büyükceran İ, Dabak N. Evaluation of prognostic factors affecting survival in chondrosarcoma treatment and comparison with literature. Jt Dis Relat Surg 2022;33(2):440–8. doi:10.52312/jdrs.2022.526.
[14] Miwa S, Yamamoto N, Hayashi K, Takeuchi A, Igarashi K, Tsuchiya H. Therapeutic targets and emerging treatments in advanced chondrosarcoma. Int J Mol Sci 2022;23(3):1096. doi:10.3390/ijms23031096.
[15] LaPrade CM, Andryk LM, Christensen JL, Neilson JC, Wooldridge AN, Hackbarth DA, et al. Natural history of intraosseous low-grade chondroid lesions of the proximal humerus. Front Oncol 2023;13:1200286. doi:10.3389/fonc.2023.1200286.
[16] Verdegaal SH, Bovée JV, Pansuriya TC, Grimer RJ, Ozger H, Jutte PC, et al. Incidence, predictive factors, and prognosis of chondrosarcoma in patients with Ollier disease and Maffucci syndrome: an international multicenter study of 161 patients. Oncologist 2011;16(12):1771–9. doi:10.1634/theoncologist.2011-0200.
[17] Mirra JM, Gold R, Downs J, Eckardt JJ. A new histologic approach to the differentiation of enchondroma and chondrosarcoma of the bones. A clinicopathologic analysis of 51 cases. Clin Orthop Relat Res 1985(201):214–37 PMID: 4064409.