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Seeing the Invisible

The Value of Bone Scan to Distinguish Chondroblastic Osteosarcoma From Prosthesis Loosening

Tzyy-Ling Chuang, MD,† Yu-Ruei Chen, MD,‡ and Yuh-Feng Wang, MD, PhD*†§*

Abstract: A 76-year-old woman with uterine cervical cancer 20 years ago received right total hip replacement 3 months ago for right hip avascular necrosis without specific intraoperative finding. She reported persistent right hip pain after falling from bed. Pelvic x-ray showed right pubic ramus fracture. To evaluate prosthesis loosening, ^{99m}Tc-MDP 3-phase bone scan was arranged, showing diffusely and heterogeneously increased vascularity and tracer perfusion over the right hip, with intensely and heterogeneously increased metabolism in the right iliac bone and hip. SPECT/CT showed nearby swelling of calcified muscles. After debridement and synovectomy, the pathologic report showed chondroblastic osteosarcoma.

Key Words: 3-Phase, bone scan, chondroblastic osteosarcoma

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From the *Department of Nuclear Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi; †School of Medicine, Tzu Chi University, Hualien; and ‡Department of Medical Imaging and §Center of Preventive Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Chiayi, Taiwan, Republic of China.

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Correspondence to: Yuh-Feng Wang, MD, PhD, Department of Nuclear Medicine, Dalin Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, No. 2, Minsheng Rd., Dalin Township, Chiayi 622, Taiwan, Republic of China. E-mail: yuhfeng@gmail.com.

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REFERENCES

1. Bakhtiari S, Noormohammadi R. A 62-year-old man with chondroblastic osteosarcoma of maxilla: a rare case. *J Dent Mater Tech*. 2018;7:185–189.
2. Nanci Neto F, Marchiori E, Vianna A, et al. Parosteal osteosarcoma: findings on conventional radiology. *Radiol Bras*. 2007;40:81–86.
3. Tossato Pdos S, Pereira AC, Cavalcanti MG. Osteosarcoma and chondrosarcoma — radiographic differentiation with computerized tomography [in Portuguese]. *Pesqui Odontol Bras*. 2002;16:69–76.
4. Almeida E, Mascarenhas BA, Cerqueira A, et al. Chondroblastic osteosarcoma. *J Oral Maxillofac Pathol*. 2014;18:464–468.
5. Bojan A, Christy W, Chanmougananda S, et al. Osteosarcoma of mandible: a case report and review of literature. *J Clin Diagn Res*. 2012;6:753–757.
6. Neville BW, Damm DD, Allen CM, et al. *Oral and Maxillofacial Pathology*. 4th ed. Philadelphia, PA: Saunders; 2016.
7. Sayin B, Yildirim N, Vural M, et al. Osteosarcoma of the maxilla. *Radiol Oncol*. 2005;39:95–99.
8. Ludhani PM, Anathakrishnan R, Chandrasekar P, et al. Unusual case of chondroblastic osteosarcoma of the rib in an adult. *Asian Cardiovasc Thorac Ann*. 2014;22:745–747.
9. Soares RC, Soares AF, Souza LB, et al. Osteosarcoma of mandible initially resembling lesion of dental periapex: a case report. *Rev Bras Otorrinolaringol*. 2005;71:242–245.
10. Baghaie F, Motahhary P. Osteosarcoma of the jaws: a retrospective study. *Acta Med Iran*. 2003;4:113–121.
11. Borba MA, Farias TP, Sá RM, et al. Osteosarcoma of the jaw: prognosis factors. *Rev Bras Cir Cabeç Pescoço*. 2004;33:15–19.
12. Sun HH, Chen XY, Cui JQ, et al. Prognostic factors to survival of patients with chondroblastic osteosarcoma. *Medicine (Baltimore)*. 2018;97:e12636.
13. Mirabello L, Troisi RJ, Savage SA. Osteosarcoma incidence and survival rates from 1973 to 2004: data from the surveillance, epidemiology, and end results program. *Cancer*. 2009;115:1531–1543.
14. Castro HCd, Ribeiro KdCB, Bruniera P. Osteosarcoma: experience of the Pediatric Oncology Clinic of the Santa Casa de Misericórdia Hospital in São Paulo. *Rev Bras Ortop (Sao Paulo)*. 2008;43:108–115.
15. Tsagozis P, Laitinen MK, Stevenson JD, et al. Treatment outcome of patients with chondroblastic osteosarcoma of the limbs and pelvis. *Bone Joint J*. 2019;101-B:739–744.
16. Zheng YF, Lin J, Yang HL. Chondroblastic osteosarcoma secondary to fibrosarcoma: a case report and literature review. *Oncol Lett*. 2015;10:3573–3576.
17. Schulte M, Brecht-Krauss D, Werner M, et al. Evaluation of neoadjuvant therapy response of osteogenic sarcoma using FDG PET. *J Nucl Med*. 1999;40:1637–1643.
18. Hoch M, Ali S, Agrawal S, et al. Extraskeletal osteosarcoma: a case report and review of the literature. *J Radiol Case Rep*. 2013;7:15–23.

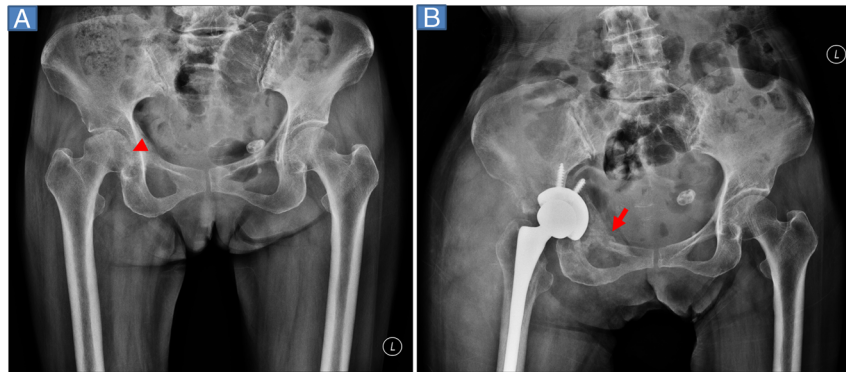

FIGURE 1. A 76-year-old woman with cervical cancer post radiotherapy 20 years ago received right total hip replacement for right hip avascular necrosis (**A**, arrowhead) with no specific intraoperative finding 3 months ago. She complained of right lower limb pain and swelling 2 months postsurgery and persistent right hip pain after falling from bed. Painful disability and loss of function were noted over the right hip. Pelvic x-rays revealed right total hip replacement with cup inner migration, right pubic ramus fracture (**B**, arrow), and large lateral hip and thigh soft tissue mass.

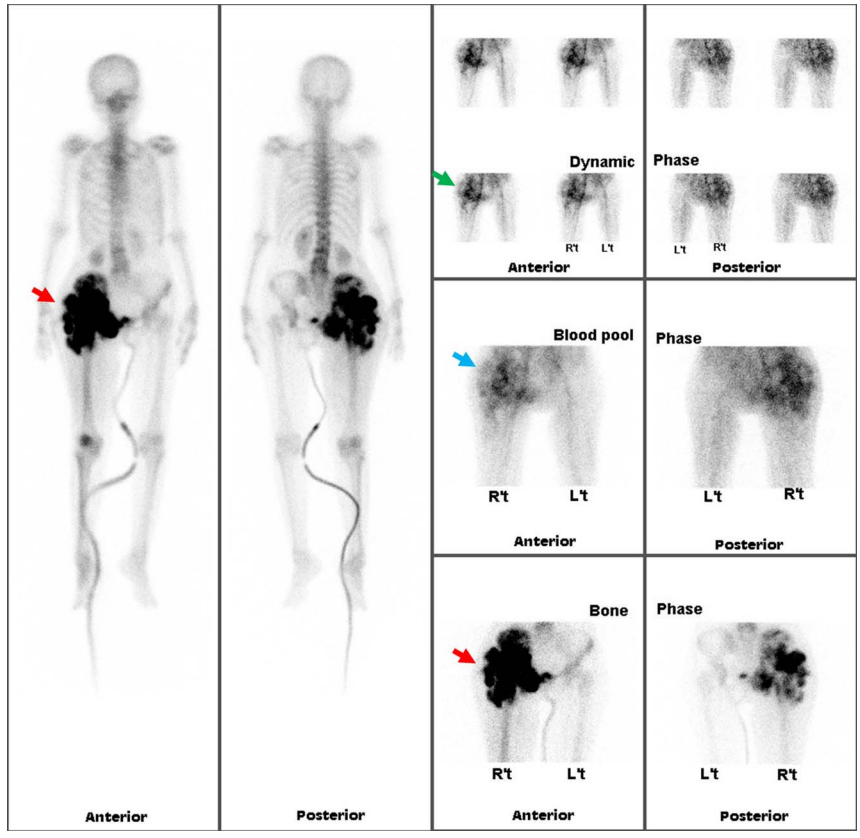

FIGURE 2. Three-phase ^{99m}Tc-MDP study and whole-body bone scan to evaluate prosthesis loosening showed diffusely and heterogeneously increased vascularity (green arrow) and perfusion (blue arrow) of tracer over the right hip, with intensely and heterogeneously increased metabolism (red arrows) in the right iliac bone and hip.

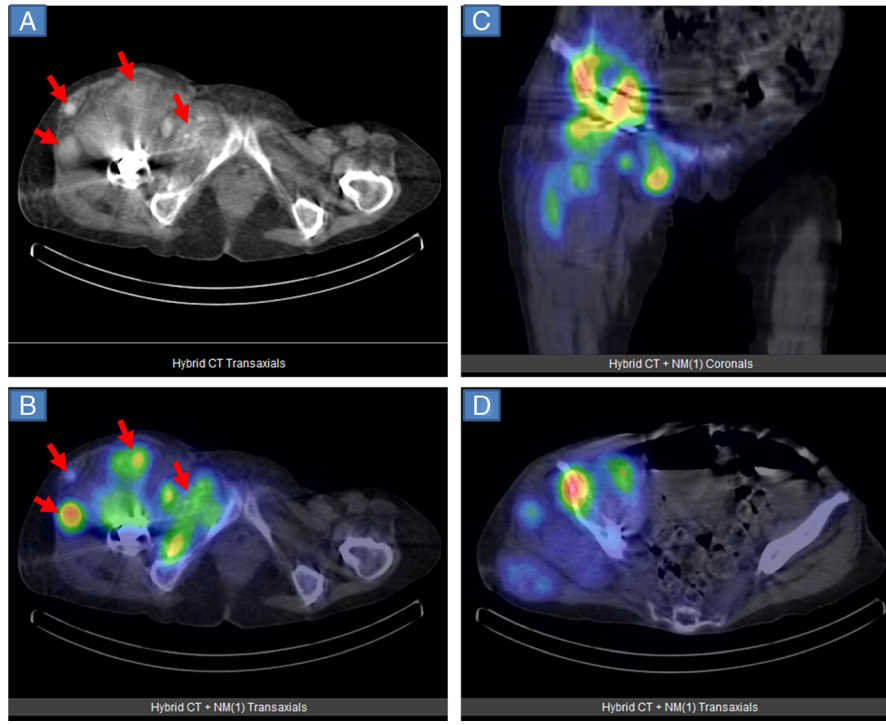

FIGURE 3. SPECT/CT showed uptake to nearby swollen, calcified muscles (**A**, **B**, arrows). Other views showed intensely and heterogeneously increased uptake in the right iliac bone and hip soft tissue (**C**, **D**). After debridement and synovectomy, massive bleeding necessitated emergent transarterial embolization. The pathology showed chondroblastic osteosarcoma (OS). Soft tissue component in the image may be the chondroblastic component of the OS. Osteosarcomas, inducing formation of osteoid or immature bone,[1] are the most common malignant bone tumors in children and young adults, constituting ~15% of all primary bone tumors.[2] Risk factors associated with their development include fibrous dysplasia, retinoblastoma, Paget disease, previous exposure to ionizing radiation or alkylating agent, and chronic osteomyelitis.[3–7] Osteosarcoma principally arises in the metaphysis of long bones, particularly at the lower femur, upper tibia, and humerus.[8] Its symptoms and radiographic features are nonspecific.[5] Depending on the relative amounts of osteoid, cartilage, or collagen fibers produced, OS histological types are fibroblastic, chondroblastic, osteoblastic, telangiectasic, and mixed.[4,7,9,10] The World Health Organization classification defines chondroblastic OS as a histological entity characterized by a predominantly chondroid matrix, with a high degree of hyaline cartilage, and as intimately associated with the nonchondroid element (osteoid or bone matrix).[4,11] Chondroblastic OS is a common subtype of OS (11%–50%) with peak diagnosis at approximately 20 years.[12,13] Important prognostic parameters include tumor localization, size, response to chemotherapy, surgical remission, and metastasis.[4,14] Chondroblastic OS responds poorly to chemotherapy, with a high incidence of metastasis.[15] Limb localization and wide surgical margins can lower the risk of local recurrence. Primary OS usually occurs in youth 10 to 20 years old, with secondary OS more common in the elderly.[16] Secondary OS is associated with osteofibrous dysplasia, bone infarction, chondrosarcoma, or osteogenesis imperfecta.[16] CT is excellent for diagnosing OS, providing visualization of tumoral calcifications, and detailing the involvement of cortical bone, soft tissues, and the medullary extension, which is also the added value of SPECT/CT.[3] Low ^{99m}Tc-MDP uptake tends to be associated with good prognosis. Furthermore, fast tumor growth implies neoangiogenesis with increased perfusion, which may also lead to higher ^{99m}Tc-MDP uptake in highly aggressive tumors.[17] Increased uptake in the primary lesion and metastatic foci on ^{99m}Tc-MDP radionuclide scans is consistent with osteoblastic activity within the tumor.[18]