

Child Thoracic Osteoid Osteoma; Case Presentation, Review of Radiology and Management

Zahra Chakeri¹; Seyedmorteza bagheri²; Alireza Salmanipur³; Nazanin Maleki^{4*}

¹Iran University of Medical Science, Tehran, Iran.

²Iran University of Medical Science, hasheminezhad kidney center, Iran.

³Department of Diagnostic Radiology, Iran University of Medical Science, Tehran, Iran.

⁴Iran University of Medical Science, Tehran, Iran.

Received Date : Apr 12, 2022
Accepted Date : May 25, 2022
Published Date : Jun 08, 2022
Archived : www.jcmimagescasereports.org
Copyright : © Nazanin Maleki 2022

***Corresponding Author:** Nazanin Maleki, Iran University of Medical Science, Tehran, Iran.
Email: Nazanin.maleki.md@gmail.com

Abstract

OO accounts for 10% of all benign bone tumors but only 1% of all spinal tumors. Only 4–13 percent of spinal injuries are caused by benign tumors [1]. osteoid osteoma accounts for just 0.3 percent of all primary bone tumors [2]. Osteoid osteomas are bone cell growth lesions that commonly affect lengthy bones. Only 20% of osteoid osteomas are seen in the spine. 9 Osteoid osteomas are composed of osteoblasts, which create juvenile bone tissue. They are typically tiny, benign, and self-limiting, with local prostaglandin PGE2 synthesis in the nidus (to which its main symptom, local pain, is attributed) [3]. An axial pain or nocturnal pain, as well as warning signs and nonspecific radiological findings, are some of the common symptoms of benign lesions in the spine. Osteoid osteoma is one of them. Osteoid osteoma is a benign bone-forming tumor affecting adolescents and young adults [4]. The typical presentation is painful nocturnal pain which alleviates by NSAIDs. Common locations are cortical diaphysis and spine; they are usually located in posterior elements and may cause painful scoliosis when affecting the spine. Imaging appearance on CT are oval lytic lesions known as nidus located within the dense cortical bone; on MR, reactive soft tissue and bone marrow edema is evident [5, 6].

Case presentation

In this paper we present a real case, a 10-year-old female with back pain, on CT images, a well-defined lytic lesion surrounded by dense reactive sclerosis is seen in the right lamina and posterior aspect of the 11th vertebral body, on MRI high T2 signal nidus with thick low T2 rim due to surrounding sclerosis and extensive bone marrow edema is present, which are characteristic features of osteoid osteoma. Treatment options are pain control by NSAIDs, surgical removal of the lesion, and percutaneous radiofrequency ablation of the nidus under CT guidance [5, 7]. Aside from the traditional uses of radiofrequency ablation (RFA) in pain management, various new and emerging therapeutic targets for RF have lately been investigated. To reduce pain, RF can ablate or modulate several pain-producing components [8].

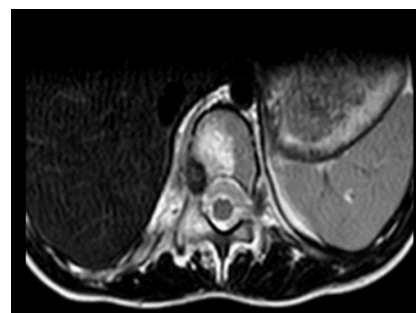


Figure 1A



Figure 1B

Citation: Nazanin Maleki. Child Thoracic Osteoid Osteoma; Case Presentation, Review of Radiology and Management. J Clin Med Img Case Rep. 2022; 2(3): 1165.

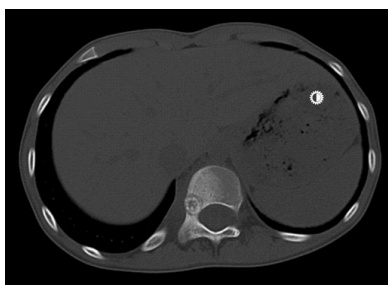


Figure 1C

Caption for Figure: A 10-year-old female with back pain, on CT images, a well-defined lytic lesion surrounded by dense reactive sclerosis is seen in the right lamina and posterior aspect of the 11th vertebral body on MRI high T2 signal nidus with thick low T2 rim due to surrounding sclerosis and extensive bone marrow edema is present, which are characteristic features of osteoid osteoma.

Discussion

Overall, The benign osteoblastic tumor osteoid osteoma is rather rare in the spine. It mostly affects the lumbar spine, with a 75 percent propensity for posterior components [9]. The most prevalent site of involvement in the pars interarticularis. Patients under the age of 30 with a male preponderance (sex ratio – 2–4:1) are more likely to have OOs [10]. Nonsteroidal anti-inflammatory medications (NSAIDs) are efficient pain relievers because they reduce inflammation. The most sensitive technique for localization is radionuclide bone scanning. The “Double density” indication shows a localized increase in uptake surrounded by a reduction in uptake owing to sclerotic bone [10].

Radiological Manifestation: Several imaging modalities have been used to diagnose osteoid osteoma [11]. The categorized list, included.

Plain x-ray: Plain radiography and the characteristic clinical presentation are usually necessary to diagnose osteoid osteoma. Plain radiography should be used to evaluate patients with bone discomfort. Two orthogonal views focused on the lesion are required [12]. The tumor’s radiological appearance relies on its position within the bone. Radiographs have difficulty evaluating certain skeletal lesions. The spine, femoral neck, and tiny bones of the hands and feet [13]. A radiolucent round or oval lesion measuring 1.5-2 cm is usual. This area has variable degrees of fusiform sclerosis [14]. The radiolucent nidus often has central calcification (35). Nidus can be obscured by sclerosis and cortical thickening [15]. Due to ossification, the nidus can appear as a bone island or regular cortical bone [16]. Subperiosteal lesions are soft tissue lesions close to damaged bone. Long-lived tumors promote sclerosis. Kids have more sclerosis than adults [17].

CT scan (CT): CT is used over plain radiography for diagnosing osteoid osteoma [18]. An osteoid osteoma is a round or oval region of soft-tissue attenuation. The reactive sclerosis surrounding the lesion varies in density and response. The nidus expands following intravenous contrast agent delivery [19]. The “bull’s-eye” appearance of the nidus on CT is seen in roughly 50% of cases. Nidus calcification can be punctate, amorphous, or ring-like [19]. The “vascular groove” indication

is found in roughly 80% of instances [20].

MRI (MRI): MRI fails to detect and characterize osteoid osteoma (6). The principal imaging modality has a 35% chance of misdiagnosis [20, 43, 48]. However, MRI can show cortical involvement, intramedullary and soft tissue dissemination. It also shows the nidus in intra-articular lesions [6]. T1-weighted pictures of the nidus show low to moderate signal intensity, while T2-weighted and STIR images show high signal intensity heterogeneity [21]. In perilesional sclerosis and calcifications, T1-weighted and T2-weighted sequences show poor signal intensity [14]. Gadolinium improves osteoid osteoma on T1-weighted imaging.

Nuclear MRI: Scintigraphy examines metabolic activity and finds new bone lesions in one exam [22]. ^{99m}Tc scintigraphy detects osteoid osteoma by increased activity at the tumor location with approximately 100% sensitivity [23]. The “double density” sign consists of a dense focus area surrounding by a less dense uptake area. Central indicates nidus, surrounding by host bone tumor reaction. The spine has less osteosclerosis than the appendicular bones, hence this indication is less common [15]. ¹⁸F-FDG PET/CT may also be used to detect osteoid osteoma, as ¹⁸F-FDG accumulates in these cancers [24].

Also, Hashemi et al. investigated 44 individuals with osteoid osteoma retrospectively. In the plain film, 35 patients had cortical type, six had medullary type, and three had subperiosteal osteoid osteoma. The nidus was seen in all CT scans. In 15 instances, nidus calcification and ossification were modest or nonexistent. In two cases, scoliosis was evident, and the lesion was seen as an increase in density in the pedicle (one thoracic and one lumbar vertebra). In the L1 lesion, the body and the vertebral pedicle had increased density. The nidus was evident in four out of five MRI subjects. The fifth patient had a nidus exclusively on CT. MRI revealed bone marrow and soft tissue edema signal alterations in all five patients. Radionuclide Bone Scan employed this sign together with a pathology report to confirm osteoid osteoma in all cases [25]. Neurologic radiologic symptoms might occur in any order or intensity. It can also help clinicians start medication sooner by minimizing the complication burden [26].

Osteoid osteoma versus osteoblastoma: The most prevalent benign osteogenic bone neoplasms are osteoid osteoma and osteoblastoma. Both tumors are most common in the second decade of life, with a male predisposition. These tumors are histologically similar, with typically enhanced osteoid tissue development surrounded by vascular fibrous stroma and perilesional sclerosis. On the other hand, osteoblastoma is larger than osteoid osteomas and has more osteoid production and vascularity. Osteoid osteoma is most typically found in the long bones (eg, femur, tibia). The lesions produce nighttime pain, which is alleviated by nonsteroidal anti-inflammatory medicines (NSAIDs). Osteoblastoma is most commonly found in the axial skeleton, and the pain is not usually severe at night and is less likely to be eased by NSAIDs. Osteoblastoma can be aggressive locally, but osteoid osteoma has no growth potential. NSAIDs can be used to treat osteoid osteoma without surgery [27].

Osteoid osteoma as scoliosis: Osteoid osteoma of the thoracic spine may present as non-painful scoliosis. Tumor resection is effective. During recommended CT examination before scoliosis surgery, clinicians should bear this uncommon lesion in mind. Uehara reported on a 12-year-old child with scoliosis caused by thoracic osteoid osteoma with no obvious pain [28].

Atypical Osteoid Osteoma: Valuuzi reported an atypical osteoid osteoma of the atlas coupled with aberrant soft tissue reactivity is reported for the first time. A 6-year-old kid with suboccipital discomfort and torticollis had an osteoid osteoma affecting the atlas. Initial radiological results revealed edema of upper cervical soft tissues on magnetic resonance imaging. The computed CT revealed a C1 left lamina lesion. Surgical resection was performed when non-conservative therapy failed [29].

Management of osteoid osteoma: The therapy of choice for osteoid osteoma of the appendicular skeleton is percutaneous radiofrequency ablation. However, because of the difficulty in locating the lesion in the spine and its closeness to neural components, it has not yet become a widely used therapy for the spine [30]. Radiofrequency ablation is still the gold standard for percutaneous osteoid osteoma therapy and can be combined with biopsy. It is easier to use and less expensive than interstitial laser ablation, while cryoablation offers real-time imaging of the ablated zone, boosting treatment safety. The most revolutionary non-invasive approach, magnetic resonance-guided focused ultrasound surgery, is radiation-free [31].

The nidus has traditionally been surgically resected. CT-guided radiofrequency ablation (RFA) has recently gained appeal as a more precise alternative therapy. There are two main ways RF works: ablation and making the electromagnetic field. A circuit comprises an RF electrode, pads, and a patient's tissue. RF-induced interactions cause heat to be released, which causes coagulation necrosis and tissue damage, which relieves pain or burns the painful nerve [32]. Yang presented an osteoid osteoma of the C1 lateral mass was effectively treated with CT-guided RFA. A 30-year-old lady with occipital and suboccipital discomfort was treated with CT-guided RFA. The VAS measured pain before and after RFA. Pain alleviation and regular activities were noted. This dropped the VAS score from 8/7 to 1/0. Percutaneous RFA of C1 osteoid osteoma with CT guidance is safe and effective. Contraindications include nidus placement within 2 mm of brain structures [33].

Bergamasch described a 6-year-old female patient who presented with nonspecific thoraco-lumbar pain that responded well to acetylsalicylic acid treatment (AAS). The right T11 pedicle was missing on CT scans of the thoracolumbar spine, and its space was filled with material with a cell attenuation coefficient. The right pedicle of T11 showed a strong signal on T1- and T2-weighted magnetic resonance, indicating a fracture line (spondylolysis) without listesis. Spondylolysis was also detected by bone scintigraphy on the right margin of the T11 vertebra [34].

Treatment: When surgery is essential, minimally invasive techniques (such as CT-guided excision and radiofrequency ablation) are favored. The recurrence rate of osteoblastoma is higher than that of osteoid osteoma, and patients must be treated surgically with intralesional curettage or en bloc

resection [27]. Although several therapeutic techniques for osteoid osteomas and other benign neoplastic lesions of the spine have been described and shown to be effective in specific cases, full-endoscopic resection appears to be a novel and potentially promising option for diagnosis and treatment, especially because it is a safe, effective, and low-morbid intervention [35].

Conclusion

Osteoid osteoma is the third most frequent benign bone malignancy. It has a radiolucent nidus with reactive osteosclerosis. The common clinical manifestation is nocturnal pain relieved by salicylates or NSAIDs. It can take a long time to diagnose. Osteoid osteoma is commonly diagnosed using plain radiography or CT. Because the tumor generally regresses naturally over 2-6 years, salicylates and NSAIDs are used initially. Minimally invasive procedures have superseded open surgery as the gold standard in surgery. While cryoablation appears to be preferable in terms of nerve damage and immunotherapy, radiofrequency ablation is recommended.

References

1. Kelley SP, Ashford RU, Rao AS, Dickson RA. Primary bone tumours of the spine: a 42-year survey from the Leeds Regional Bone Tumour Registry. *European spine journal: official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society.* 2007; 16(3): 405-9.
2. Barlow E, Davies A, Cool W, Barlow D, Mangham D. Osteoid osteoma and osteoblastoma: novel histological and immunohistochemical observations as evidence for a single entity. *Journal of Clinical Pathology.* 2013; 66(9): 768-74.
3. Pourfeizi HH, Tabrizi A, Bazavar M, Sales JG. Clinical findings and results of surgical resection of thoracolumbar osteoid osteoma. *Asian spine journal.* 2014; 8(2): 150.
4. Lee EH, Shafi M, Hui JH. Osteoid osteoma: a current review. *Journal of pediatric orthopedics.* 2006; 26(5): 695-700.
5. Carneiro BC, Da Cruz IAN, Ormond Filho AG, Silva IP, Guimarães JB, Silva FD, et al. Osteoid osteoma: the great mimicker. *Insights into Imaging.* 2021; 12(1): 32.
6. Gamba JL, Martinez S, Apple J, Harrelson JM, Nunley JA. Computed tomography of axial skeletal osteoid osteomas. *AJR American journal of roentgenology.* 1984; 142(4): 769-72.
7. Aiba H, Hayashi K, Inatani H, Satoshi Y, Watanabe N, Sakurai H, et al. Conservative treatment for patients with osteoid osteoma: a case series. *Anticancer research.* 2014; 34(7): 3721-5.
8. Chakravarthy K, Golovac S, Vahedifard F. Future Indications. In: Deer TR, Azeem N, editors. *Essentials of Radiofrequency Ablation of the Spine and Joints.* Cham: Springer International Publishing. 2021; 241-81.
9. Faddoul J, Faddoul Y, Kobaiter-Maarrawi S, Moussa R, Rizk T, Nohra G, et al. Radiofrequency ablation of spinal osteoid osteoma: a prospective study. *Journal of neurosurgery Spine.* 2017; 26(3): 313-8.
10. Gasbarrini A, Cappuccio M, Bandiera S, Amendola L, van Urk P, Boriani S. Osteoid osteoma of the mobile spine: surgical

outcomes in 81 patients. *Spine*. 2011; 36(24): 2089-93.

11. TEPELENIS K, SKANDALAKIS GP, PAPATHANAKOS G, KEFALA MA, KITSOULI A, BARBOUTI A, et al. Osteoid Osteoma: An Updated Review of Epidemiology, Pathogenesis, Clinical Presentation, Radiological Features, and Treatment Option. *In Vivo*. 2021; 35(4): 1929-38.

12. Kitsoulis P, Mantellos G, Vlychou M. Osteoid osteoma. *Acta orthopaedica Belgica*. 2006; 72(2): 119-25.

13. Harish S, Saifuddin A. Imaging features of spinal osteoid osteoma with emphasis on MRI findings. *European radiology*. 2005; 15(12): 2396-403.

14. Chai JW, Hong SH, Choi JY, Koh YH, Lee JW, Choi JA, et al. Radiologic diagnosis of osteoid osteoma: from simple to challenging findings. *Radiographics: a review publication of the Radiological Society of North America, Inc*. 2010; 30(3): 737-49.

15. Allen SD, Saifuddin A. Imaging of intra-articular osteoid osteoma. *Clinical radiology*. 2003; 58(11): 845-52.

16. Jamshidi K, Shafipour R, Qomashi I. Osteoid osteoma with an atypical nidus: A case report. *Foot and ankle surgery: official journal of the European Society of Foot and Ankle Surgeons*. 2012; 18(1): e9-11.

17. Trotta B, Fox MG. Benign osteoid-producing bone lesions: update on imaging and treatment. *Seminars in musculoskeletal radiology*. 2013; 17(2): 116-22.

18. Papathanassiou ZG, Megas P, Petsas T, Papachristou DJ, Nilas J, Siablis D. Osteoid osteoma: diagnosis and treatment. *Orthopedics*. 2008; 31(11): 1118.

19. Bhure U, Roos JE, Strobel K. Osteoid osteoma: multimodality imaging with focus on hybrid imaging. *European journal of nuclear medicine and molecular imaging*. 2019; 46(4): 1019-36.

20. Pottecher P, Sibilleau E, Aho S, Hamze B, Parlier C, Laredo JD, et al. Dynamic contrast-enhanced MR imaging in osteoid osteoma: relationships with clinical and CT characteristics. *Skeletal radiology*. 2017; 46(7): 935-48.

21. Davies M, Cassar-Pullicino VN, Davies AM, McCall IW, Tyrrell PN. The diagnostic accuracy of MR imaging in osteoid osteoma. *Skeletal radiology*. 2002; 31(10): 559-69.

22. TEPELENIS K, PAPATHANAKOS G, KITSOULI A, TROUPIS T, BARBOUTI A, VLACHOS K, et al. Osteochondromas: An Updated Review of Epidemiology, Pathogenesis, Clinical Presentation, Radiological Features and Treatment Options. *In Vivo*. 2021; 35(2): 681-91.

23. Park JH, Pakh K, Kim S, Lee SH, Song SH, Choe JG. Radionuclide imaging in the diagnosis of osteoid osteoma. *Oncology letters*. 2015; 10 (2):1131-4.

24. Lim CH, Park YH, Lee SY, Chung SK. F-18 FDG uptake in the nidus of an osteoid osteoma. *Clinical nuclear medicine*. 2007; 32(8): 628-30.

25. Hashemi J, Gharahdaghi M, Ansari-pour E, Jedi F, Hashemi S. Radiological Features of Osteoid Osteoma: Pictorial Review. 2011; 8(3): 182-9.

26. Morteza-zadeh M, Vahedifard F, Ahmadi-Renani S, Salimzadeh A. A woman with a bamboo spine in the thoracic vertebra and normal sacroiliac joint; a 5-years undiagnosed ankylosing spondylitis: Case report and literature review. *Rheumatology Research*. 2020; 5(1): 33-8.

27. Atesok KI, Alman BA, Schemitsch EH, Peyser A, Mankin H. Osteoid osteoma and osteoblastoma. *J Am Acad Orthop Surg*. 2011; 19(11): 678-89.

28. Uehara M, Takahashi J, Kuraishi S, Shimizu M, Ikegami S, Futatsugi T, et al. Osteoid osteoma presenting as thoracic scoliosis. *The spine journal: official journal of the North American Spine Society*. 2015; 15(12): e77-81.

29. Valluzzi A, Donatiello S, Gallo G, Cellini M, Maiorana A, Spina V, et al. Osteoid Osteoma of the Atlas in a Boy: Clinical and Imaging Features-A Case Report and Review of the Literature. *Neuropediatrics*. 2021; 52(2): 105-8.

30. Hadjipavlou AG, Tzermiadianos MN, Kakavelakis KN, Lander P. Percutaneous core excision and radiofrequency thermo-coagulation for the ablation of osteoid osteoma of the spine. *European spine journal: official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*. 2009; 18(3): 345-51.

31. Parmeggiani A, Martella C, Ceccarelli L, Miceli M, Spinnato P, Facchini G. Osteoid osteoma: which is the best minimally-invasive treatment option? *European journal of orthopaedic surgery & traumatology: orthopedie traumatologie*. 2021; 31(8): 1611-24.

32. Vahedifard F, Malinowski M, Chakravarthy K. Mechanism of Action of Radiofrequency Ablation. In: Deer TR, Azeem N, editors. *Essentials of Radiofrequency Ablation of the Spine and Joints*. Cham: Springer International Publishing; 2021; 7-29.

33. Yang J, Li W, Yin Y, Li Z, Ni C. Radiofrequency ablation of osteoid osteoma in the atlas: A case report. *Interventional neuroradiology: journal of peritherapeutic neuroradiology, surgical procedures and related neurosciences*. 2018; 24(1): 88-92.

34. Bergamaschi JPM, Costa CAM, Sandon LH. Full-Endoscopic Resection of Osteoid Osteoma in the Thoracic Spine: A Case Report. *International Journal of Spine Surgery*. 2021; 14(s4): S78-S86.

35. Bergamaschi JPM, Costa CAM, Sandon LH. Full-Endoscopic Resection of Osteoid Osteoma in the Thoracic Spine: A Case Report. *Int J Spine Surg*. 2021; 14(s4): S78-s86.