JSM Clinical Cytology and Pathology

Case Report

Secondary Chondrosarcoma Arising from Osteochondroma: Case Report and Literature Review

Michelle Arsenault*, Warda Alam, Travis Lambert, Shuo Li, Desiree Nieves Adorno, Ashley kopec and Mohamad Aziz

Department of Pathology, American University of the Caribbean, USA

Abstract

Osteochondroma is the most common form of benign bone tumors. Chondrosarcoma is a rare malignant bone tumor that may be primary or secondary to a malignant transformation of a benign cartilage tumor. We report the case of a 41-year-old man with chondrosarcoma secondary to malignant transformation of osteochondroma of the left third rib. We discuss osteochondromas, chances of malignancy secondary to osteochondromas, assessment of the tumor in our case, as well as treatment options that have shown significant benefits in patient's outcomes.

Keywords: Secondary; Chondrosarcoma; Osteochondroma; Transformation; Metastatic; Hereditary

Abbreviations

HMO: Hereditary Multiple Osteochondromas

Introduction

Osteochondromas are an overgrowth of both bone and cartilage that arise from the metaphysis of bones and commonly present in the second and third decade of life [1]. The cartilage overgrowth is thick in children, then starts to thin out in adolescence, and by adulthood it usually measures less than 1 cm [2]. Osteochondromas most often affect the long bones of the leg, scapula, and the pelvis. They are the most common primary tumors of the axial skeleton and make up 35% of benign bone tumors overall [3].

Most observed cases of osteochondromas are painless, asymptomatic, and discovered as an incidental finding. If symptoms do present they present as limitation of motion, blood vessel or nerve impingement. Treatment of choice for osteochondromas is partial excision of the outgrowth or surgical removal of the solitary lesion [2]. The most serious complication of osteochondromas is transformation to malignant chondrosarcomas, these accounts for less than 1% of reported cases. Furthermore, 3%-5% of these patients are found to have hereditary multiple osteochondroma (HMO) which is an autosomal dominant disorder characterized by two or more osteochondroma lesions [4]. This case report examines the differences between benign recurrences of osteochondromas and malignant transformation to chondrosarcoma.

Submitted: 13 December 2019 | **Accepted:** 26 December 2019 | **Published:** 28 December 2019

***Corresponding author:** Michelle Arsenault, Department of Pathology, American University of the Caribbean, 1 University Drive at Jordan Road, Cupecoy, St. Maarten, 8867 Sarah Ln, Grosse Ile, Mi, USA, Tel: 1313-5104-858; Email: michellearsenault@students.aucmed.edu

Citation: Arsenault M, Alam W, Lambert T, Li S, Adorno DN, et al. (2019) Secondary Chondrosarcoma Arising from Osteochondroma: Case Report and Literature Review. JSM Clin Cytol Pathol 4: 3.

Case Presentation

A 41-year-old male presented with a painful left chest wall mass arising from the third rib. The mass has been present over the last 10 years and has been recently increasing in size, which was firm and extremely painful. Physical examination showed an irregular rubbery firm mass projecting from the chest wall at the level of the left third rib measuring 7.3. cm. A helical CT of the thorax was obtained, with 1.25 mm collimation from the lung apices down to the level of the adrenal glands during the administration of intravenous contrast material. There were no prior studies available for comparison. The CT showed a chest mass with heterogeneous calcification measuring 7.3 x 6.2 cm, which appeared to arise from the anterior aspect of the third rib with soft tissue component. Although the mass was noted to push into pectoralis muscle, there was no evidence of extension into the lung parenchyma (Figure 1A).

The mass extended through intercostal space, but the intercostal vessels were patent, and there were no pleural, pericardial effusions, or cardiomegaly. There was a mildly enlarged benign appearing subaortic arch lymph node, and the remaining mediastinal, hilar, and aortic lymph nodes were unremarkable.

Based on the characteristic radiographic findings, the mass was suggestive of chondrosarcoma of the rib. Given the history of osteochondroma at the same site for 10 years, a diagnosis of chondrosarcoma secondary to osteochondroma was considered. Excision of the mass confirmed the diagnosis of chondrosarcoma in a background of predominantly calcified osteochondroma. Patient underwent surgical resection of the mass with safe margins of the third rib at both ends of the mass. All bony and soft tissue surgical margins were free of tumor. The resected mass showed irregular 7.5 x 6.0 x 4.5 cm cartilaginous excrescence,

heavily calcified, that projected from the surface of the third rib and extending into surrounding soft tissue. The mass was partially covered by a bluish cartilaginous cap (Figure 1B).

Microscopic examination revealed evidence of heavily calcified Osteochondroma with a cartilaginous cap (Figure 1C). In background and merging with the Osteochondroma, there was a dense cartilaginous cellular mass with considerable hyperchromatism, nuclear atypia, and scattered mitoses consistent with chondrosarcoma. The tumor was considered to be a low-grade chondrosarcoma, grade I of III (Figure 1D).

Patient received no post-operative chemotherapy or radiation. He was followed up for seven years with no evidence of recurrence or metastasis, and then he was lost to follow up.

Discussion

In this report, we describe a case for secondary chondrosarcoma arising from an osteochondroma on the neck of the third rib. This unusual painful presentation of osteochondroma can be observed in <1% of patients [4]. The exact incidence of malignant transformation of osteochondroma is not known. Most solitary osteochondromas are found in children and adolescents with symptomatic lesions occurring in younger patients. They are typically asymptomatic and are discovered incidentally [5]. Clinical features of osteochondroma include a non-tender, painless, slowly growing mass [5]. Two types of osteochondromas include sessile type with a broad-based attachment to the cortex as the case in our patient, and pedunculated one with a long and thin stalk and bulbous tip [5].

The risk of malignancy in osteochondromas is generally low. With a follow up of osteochondroma, any alterations in radiological appearance, especially with ill-defined margin evolution and thickening of the cartilage greater than 15 mm, is highly suggestive of malignant transformation of osteochondroma to chondrosarcoma [5-7]. A major consideration in determining the malignant potential of an osteochondroma is the thickness of its cartilage cap; malignant transformation occurs with cartilage cap thicknesses greater than 1–3 cm [8-11]. Many investigators have reported the incidence to be 0.5%-2% in osteochondroma and 5%-25% in patients who have hereditary multiple exostoses [4]. The frequency of malignant transformation is approximately 1% for solitary type and 5-25% for HMO [5]. In the case of our patient, it was a solitary osteochondroma.

Hereditary multiple osteochondromas (HMO) is an autosomal dominant disorder that is characterized by two or more exostoses in the axial and appendicular skeleton. It is diagnosed by presence of two osteochondromas that are detected by radiograph in the metaphyseal ends of the long bones [12]. It presents similarly to those with solitary osteochondromas during the second decade. Males are more commonly affected than females. Most individuals with HMO have a parent with the condition, however spontaneous mutations can be found in 10-20% of individuals with HMO [13].

Secondary chondrosarcomas are rare and often difficult to diagnose due to the slow growth and late recurrence. Long-term

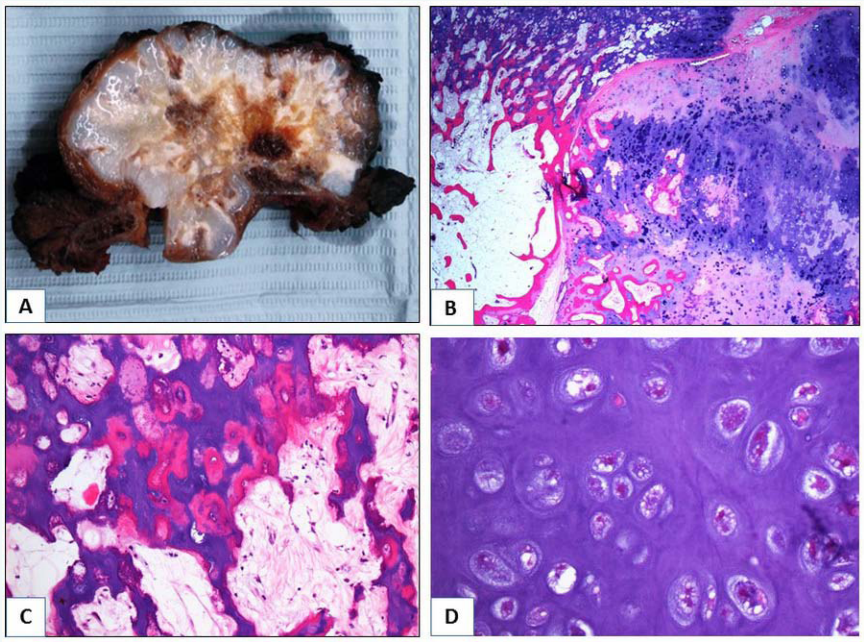

Figure 1 Gross and microscopic examination of the mass.
Figure 1A: Gross examination of the specimen showing a calcified cartilaginous mass arising from the anterior aspect of the third rib with soft tissue component.
Figure 1B: Cartilaginous excrescence, heavily calcified, partially covered by a bluish cartilaginous cap. H&E stain X20.
Figure 1C: Heavily calcified osteochondroma. H&E stain X40
Figure 1D: Cellular mass with considerable hyperchromatism, nuclear atypia, and scattered mitoses consistent with chondrosarcoma. The tumor was considered to be a low-grade chondrosarcoma, grade I of III.

follow up care is standard. One study found that most patients who died of chondrosarcoma, died due to local recurrence of the tumor [14]. Less than 5% of the patients in the study developed metastases, majority of which were found in the lung [14]. Other organ systems affected include nerve or vascular injury, bursa formation and configuration of a pseudoaneurysm [15].

Chondrosarcoma is a heterogeneous type of primary bone cartilage malignancies with highly contrasting clinical outcomes. Although recurrent mutations in the IDH genes and other genetic alterations including inactivation of CDKN2A and COL2A1 are commonly found in these tumors [16], molecular testing of chondrosarcoma is usually not indicated due to lack of significant clinical value. An interesting recent study by Rémy Nicolle et al., used multi-omics molecular profiles from a series of 102 cartilage tumors and found an mRNA classification that identifies two subtypes of chondrosarcomas defined by a balance in tumor differentiation and cell cycle activation. The microRNA classification revealed the importance of the loss of expression of the 14q32 locus in defining the level of malignancy. They also found that DNA methylation is associated with IDH mutations, and the use the multi-omics classifications may be able to predict outcome. Based on their findings, they proposed an mRNA-only classifier to reproduce the integrated multi-omics classification, and its application to relapsed tumor samples showed the progressive nature of the classification. Thus, it may be possible to use mRNA-based signatures to detect patients with high-risk chondrosarcomas [16]. Can this classification be used to predict possible malignant transformation of osteochondroma? This is to be left for future investigation. Heinritz W et al., reported new mutations of EXT1 and EXT2 genes in German patients with Multiple Osteochondromas [17]. No molecular studies on transformed cases were published yet.

The most effective current treatment option reported for osteochondromas and chondrosarcoma is surgical removal of the exocytosed mass, with minimal involvement of the musculature. In surgical case study of a rare scapular osteochondroma arising from the ventro-medial aspect of the right scapula, a muscle sparing technique provided quick post-op recovery, full range of motion, and increased self-esteem in patients [18]. As reported by Ngogang et al., procedures involving no muscle detachment resulted in reduced blood loss and decreased recovery time, which could be decreased further with the use of endoscopy techniques. In our patient, there was no evidence of recurrence or metastasis in seven years follow up period. We believe that the low- grade chondrosarcoma and the complete excision of the mass with safe margins contributed to the favorable outcome.

It is our hope that this report raises awareness of clinicians and pathologists to this possible transformation of osteochondroma to chondosarcoma, and that continued investigation drives further development of efficacious diagnosis and safe treatments for improving patient outcomes.

Acknowledgements

Special thanks to Hana Soueidan, and Georgette Nader, MD candidates, American University of the Caribbean (AUC), for their assistance in final review of this manuscript.

References

1. Vikram V Kadu, K A Saindane, Ninad Goghate, Neha Goghate. Osteochondroma of the Rib: a rare radiological appearance. J Orthop Case Rep. 2015; 5: 62–64.
2. Tessa AH Wilpshaar, Judith VMG Bovee. Atlas Genet Cytogenet Oncol Haematol. 23(5):133-136. Biermann J. Sybil Section Editor(s): Stanitski, Carl L. Editor Journal of pediatric orthopaedics: 2002; 22: 268-273.
3. Tianjun Lan, Xin Liu, Pei-Sheng Liang, Qian Tao. Osteochondroma of the coronoid process: A case report and review of the literature. Oncol Lett. 2019; 18: 2270-2277.
4. Cho HS, Han I, Kim HS. Secondary Chondrosarcoma from an Osteochondroma of the Proximal Tibia Involving the Fibula. Clin Orthop Surg. 2017; 9: 249-254.
5. Javdan M, Hekmatnia A, Ghazavi A, Basiratnia R, Mehrzad M, Hekmatnia F, et al. Case report of osteochondroma with unusual clinical and imaging presentation. Adv Biomed Res. 2015; 4: 2.
6. Murphey MD, Choi JJ, Kransdorf MJ, Flemming DJ, Gannon FH. Imaging of osteochondroma: Variants and complications with radiologic-pathologic correlation. Radiographics. 2000; 20: 1407-1434.
7. Shah ZK, Peh WC, Wong Y, Shek TW, Davies AM. Sarcomatous transformation in diaphyseal aclasis. Australas Radiol. 2007; 51: 110-119.
8. Gordon SL, Buchanan JR, Ladda RL. Hereditary multiple exostoses: report of a kindred. J Med Genet 1981; 18: 428–430.
9. Lichtenstein L, Jaffe HL. Chondrosarcoma of bone. Am J Pathol 1943; 19: 553–589.
10. Spjut HJ. Tumors of bone and cartilage. In: Spjut HJ, Dorfman HD, Fechner FE, Ackerman LV, eds. Atlas of tumor pathology. 2nd series, fascicle 5. Washington, DC: Armed Forces Institute of Pathology, 1971; 84–110.
11. Bredella MA, Stoller DW, Johnston JO. Bone and soft-tissue tumors. In: Stoller DW, ed. Magnetic resonance imaging in orthopaedics and sports medicine. 3rd ed. Philadelphia, Pa: Lippincott Williams & Wilkins, 2006; 2065–2070.
12. Vlok SCS, Wagener GWW, Zaharie D. Secondary chondrosarcoma: Malignant transformation of pre-existing hereditary and non-hereditary cartilaginous lesions. S Afr J Rad. 2014; 18.
13. Schmale GA, Conrad EU, Raskind WH. The natural history of hereditary multiple exostoses. J Bone Joint Surg Am. 1994; 76: 986-992.
14. Ahmed AR, Tan TS, Unni KK, Collins MS, Wenger DE, Sim FH. Secondary chondrosarcoma in osteochondroma:report of 107 patients. Clin Orthop Relat Res. 2003; 411: 193-206.
15. Recht MP, Sachs PB, LiPuma J, Clampitt M. Popliteal artery pseudoaneurysm in a patient with hereditary multiple exostoses: MRI and MRA diagnosis. J Comput Assist Tomogr. 1993; 17: 300-302.
16. Nicolle R, Ayadi M, Gomez-Brouchet A, Armenoult L, Banneau G, Elarouci N, et al. Integrated molecular characterization of chondrosarcoma reveals critical determinants of disease progression. Nat Commun. 2019; 10: 4622.
17. Heinritz W, Hüffmeier U, Strenge S, Miterski B, Zweier C, Leinung S, et al. New mutations of EXT1 and EXT2 genes in German patients with Multiple Osteochondromas. Ann Hum Genet. 2009; 73: 283-291.
18. Ngongang FO, Fodjeu G, Fon AC, Fonkoue L, Guifo ML, Bitang A Mafok LJ, et al. Surgical treatment of rare case of scapula osteochondroma in a resource limited setting: A case report. Int J Surg Case Rep. 2019; 61: 130–134.