CASE REPORT

Cytological diagnosis of chondroblastoma: diagnostic challenge for the cytopathologist

Kafil Akhtar, Shagufta Qadri, Prasenjit Sen Ray, Rana K Sherwani

Department of Pathology,
Jawaharlal Nehru Medical
College, Aligarh,
Uttar Pradesh, India

Correspondence to
Dr Shagufta Qadri,
qadridrshagufta@gmail.com

Accepted 3 May 2014

SUMMARY

Chondroblastoma is an uncommon osseous neoplasm that accounts for less than 1% of all bone tumours. It characteristically arises in the epiphysis or epimetaphyseal region of long bones and has been reported to affect people of all ages with slight male predilection. WHO has defined chondroblastoma as 'a benign, cartilage-producing neoplasm usually arising in the epiphyses of skeletally immature patients'. The authors document the cytological features on fine-needle aspiration cytology of a chondroblastoma which appeared as a lytic lesion in the upper end of the right fibula, an uncommon site, in an 18-year-old male patient. X-ray feature combined with fine-needle aspiration cytology favoured the diagnosis of chondroblastoma, which was further confirmed by histopathological examination.

BACKGROUND

Chondroblastoma is a benign cartilaginous neoplasm usually arising in the epiphyses of long bones in young participants. The histogenesis of chondroblastomas is controversial, although cartilage stem cells or epiphyseal cartilage cells are presumed to be the cells of origin. The most common anatomical site involved by this tumour is the proximal humerus followed by the distal femur, proximal femur, proximal tibia, talus and innominate bone, in descending order.¹ The typical radiological finding is an eccentric osteolytic lesion, frequently accompanied by a thin sclerotic rim. Fine-needle aspirates of chondroblastoma are usually cellular populations of mononuclear chondroblasts admixed with scattered multinucleated giant cells. Dispersed mononuclear chondroblasts demonstrate well-defined, deeply eosinophilic cytoplasm with centrally or eccentrically placed oval or round nuclei, with longitudinal grooves. Larger, more active chondroblasts show characteristic clearing of cytoplasm near the nucleus due to the presence of Golgi apparatus. The multinucleated giant cells are a constant cytological feature of smears from chondroblastoma. The overall cytological features of chondroblastoma are very much characteristic which helps in diagnosing this tumour with a high degree of precision on fine-needle aspiration (FNA). Chondroblastomas are usually treated by simple curettage with bone grafting. Chondroblastoma can affect people of all ages. It is, however, most common in children and young adults between the ages of 10 and 20 years.² Patients usually present with pain and swelling, particularly if a pathological fracture is present.²

The authors document the cytological features on fine-needle aspiration cytology (FNAC) of a chondroblastoma which appeared as a lytic lesion in the upper end of the right fibula, an uncommon site, in an 18-year-old male patient. Through this report, we also intend to discuss the approach to the diagnosis of this condition on cytology—a challenge that can often be faced by the pathologist. A brief review of literature is also undertaken.

CASE PRESENTATION

A 18-year-old male patient presented at the orthopedic outpatient department with progressively increasing swelling around the right knee since 1.5 months. There was no history of local trauma, fever, bone pain or weight loss. On examination, a swelling of around 3×4 cm was seen on the lateral side of the right knee. The lesion was non-tender, hard and appeared to arise from the underlying bone. Ipsilateral inguinal lymphadenopathy was not demonstrable.

INVESTIGATIONS

Plain X-ray showed a well-defined osteolytic lesion involving the right upper fibular epiphysis with a sclerotic rim (figure 1). Concurrently, FNAC from the swelling revealed good cellularity smears with fragments of chondroid matrix admixed with multinucleated osteoclast-like giant cells and mononuclear cells with distinct cell borders, round-to-oval nuclei and dense eosinophilic

Figure 1 Plain X-ray showing a well-defined osteolytic lesion involving the right upper fibular epiphysis with a sclerotic rim.

CrossMark

To cite: Akhtar K, Qadri S, Sen Ray P, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2014-204178

Figure 2 Fine-needle aspiration cytology (FNAC) showing good cellularity smears with fragments of chondroid matrix admixed with multinucleated osteoclast-like giant cells and mononuclear cells (Papanicolaou stain, $\times 100$).

cytoplasm (figures 2 and 3). Chicken-wire pattern of calcification was not seen in the smear. In correlation with the radiological findings, a provisional diagnosis suggestive of chondroblastoma was offered.

An open biopsy followed by curettage and bone grafting was performed. Curettings comprised of friable, red-brown soft tissue masses with a gritty feeling on cutting. Microscopically, the tumour was cellular and consisted of sheets of uniform round-to-polygonal mononuclear cells admixed with scattered osteoclast-like giant cells. The mononuclear cells had well-defined cytoplasmic borders, clear to slightly eosinophilic cytoplasm and occasional nuclear grooves. These cellular elements were separated by a scanty interstitial chondroid matrix with fine calcification arranged in a characteristic ‘chicken-wire’ pattern (figure 4). Thus, cytological diagnosis of chondroblastoma was confirmed on histopathological examination (HPE) of the curetted specimen.

DIFFERENTIAL DIAGNOSIS

Chondromyxoid fibroma closely mimics chondroblastoma due to the presence of myxoid background substance, chondroid fragments and osteoclastic giant cells; however, its spindle-shaped or stellate, fibroblast-like tumour cells in contrast to the mononuclear cells of chondroblastoma with distinct cell borders,

Figure 3 Multinucleated osteoclast-like giant cells and mononuclear cells with distinct cell borders, round-to-oval nuclei and dense eosinophilic cytoplasm in a chondroid matrix (Papanicolaou stain, $\times 400$).

round-to-oval nuclei and dense eosinophilic cytoplasm help in differentiating these two entities. Also ‘chicken-wire’ pattern of calcification on HPE is characteristic of chondroblastoma. Other giant cell containing lesions that comes under differential diagnosis includes osteoclastoma that involves epiphyses of long bones, but the chondroid differentiation and chicken-wire pattern of calcification on HPE, the osteoclastic giant cells are large, more numerous than chondroblastoma and attached to the periphery of the clustered spindle cells, and the nuclei of mononuclear and multinucleated giant cells present identical morphological features; however, in contrast, the nuclei of chondroblasts differ morphologically from the smaller nuclei of osteoclast-like giant cells.³ Giant cell rich osteosarcoma seen in metaphyses and FNA shows pleomorphic round-to-polygonal cells with eccentrically located nuclei, prominent nucleoli and abundant cytoplasm, seen singly or in small clusters with background osteoid material (amorphous eosinophilic material), with osteoclastic giant cells and malignant giant cells. Enchondroma is a solitary, benign intramedullary cartilaginous tumour of the tubular bones of hands and feet, with calcification seen throughout the lesion that ranges from punctuate to rings on X-ray; cytology shows clumps of hyaline cartilage which are often thick; the cells are seen in lacunar spaces with round nucleus without nucleoli and background abundant chondromyxoid materials.

TREATMENT

Curettage and bone grafting was performed.

OUTCOME AND FOLLOW-UP

Currently the patient is doing well; follow-ups performed over the past 12 months showed no signs of recurrence.

DISCUSSION

Although the disease was first described in 1928 by Dr James Ewing, an American pathologist, chondroblastomas were initially named ‘epiphyseal chondroblastomatous giant cell tumours of the proximal humerus’ in 1931 by Ernest Amory Codman, an American orthopaedic surgeon, and are often still termed Codman tumours.² WHO has defined chondroblastoma as ‘a benign, cartilage-producing neoplasm usually arising in the epiphyses of skeletally immature patients’.⁴ This rare tumour accounts for less than 1% of all bone tumours.⁴

Figure 4 Sheets of uniform round-to-polygonal mononuclear cells with well-defined cytoplasmic borders, clear to slightly eosinophilic cytoplasm and occasional nuclear grooves admixed with scattered osteoclast-like giant cells, separated by a scanty interstitial chondroid matrix (H&E, $\times 100$).

Chondroblastomas occur mostly in the second decade of life, and are more common in men.^{4–6} They usually arise from the epiphyseal plate or the epimetaphyseal region of long bones, although few primary metaphyseal or diaphyseal chondroblastomas have been reported.^{7–8} Bones that are most frequently involved are the proximal humerus, distal femur, proximal tibia and the iliac bones.⁷ Cases in literature state that they can also appear in the talus, ribs and digits.⁹ Less common locations of the tumour include bones of the foot, the scapula, patella, radius and fibula.⁹

Typically on a radiograph a chondroblastoma presents with an eccentrically or centrally located osteolytic lesion with either smooth or lobulated margins with a thin sclerotic rim that involves the epiphysis or other secondary ossification centres.¹⁰ In 20% to 25% of the cases metaphyseal involvement is also seen.¹¹ Cortical expansion with erosion and periosteal reaction may be present and occasionally unusual radiological changes are also seen.¹²

FNA is fast gaining acceptance as an accurate and rapid technique for diagnosing osseous neoplasms. Diagnostic cytological features of chondroblastoma are sheet-like clusters of mononuclear cells, scattered osteoclast-like giant cells and focal chondroid matrix formation. The individually lying chondroblasts are typically round mononuclear cells with distinct cell borders and rounded, lobulated or reniform nuclei with longitudinal nuclear grooves, delicate nuclear chromatin and dense glassy cytoplasm. Chondroid matrix and chicken-wire pattern of calcification is often not seen on FNA and rarely described as a cytology feature of this tumour.¹³ The cytological features of chondroblasts are the diagnostic hallmark of chondroblastoma and may allow FNA to become a valuable preoperative technique in the management of these patients.^{14–15}

Treatment of chondroblastoma depends on the anatomic location of the lesion and the extent of bone and/or joint involvement. It is usually treated by curettage and bone graft.^{4–16–17} This procedure is curative in 90% of the cases. Other methods such as curettage alone, endoscopic curettage, endoscopic curettage with cementation, curettage with fat implantation, resection with allograft replacement, marginal resection radiofrequency ablation and osteochondral autograft transfer have also been used with some success.¹⁷

Curettings are characteristically soft, friable, red to grey or brown and resemble granulation tissue. Flecks of gritty, calcific material may be observed. H&E-stained sections show numerous chondroblastic cells embedded in a highly mesenchymal cartilaginous matrix. In general, two cell types will be observed: chondroblasts and osteoclast-like giant cells. The most important feature to observe is areas of chondroid with or without calcific deposits in the stroma. The nuclei of the chondroblasts are round-to-ovoid, sometimes bean-shaped, and nuclear folding often causes nuclear grooves to be identified. Mitotic features can be present but are sparse among the generally well-defined nuclei. Chicken-wire calcification in a lattice-like pattern surrounding the tumour cells is present in 30% of chondroblastomas. Chondroid differentiation of the matrix or the 'chicken-wire pattern of calcification' when present, is helpful in making a firm diagnosis; however, it is not present in the majority of lesions, making it a secondary morphological criterion.^{16–18} Immunohistochemistry for S100 is positive in chondroblastomas.¹⁰

The recurrence rate of this tumour is reported to be 10–15%.¹⁰ Open growth plates have also been considered as a risk factor for recurrence.¹⁷ Complications associated with chondroblastomas include pathological fractures and rarely, malignant transformation and pulmonary metastasis.^{17–18}

Learning points

- Fine-needle aspiration (FNA) is an accurate and rapid technique in establishing the correct diagnosis of osseous neoplasms and it is becoming a valuable preoperative technique in the management of these patients.
- Individually lying chondroblasts with a distinct cell boundary, nuclear grooves, chondroid matrix and chicken-wire calcification are diagnostic cytological features of chondroblastoma and make FNA a prudent preoperative technique in the management of these patients.
- Radiological findings should always be taken into consideration while confirming the diagnosis of chondroblastoma or any other bone and cartilaginous tumours.
- Long-term clinical follow-up is mandated because of high risk of recurrence and rare occurrence of malignant transformation.

Contributors SQ and KA diagnosed the patient, PSR searched the relevant literature, RKS and SQ prepared the manuscript.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Dahlin DC, Ivins JC. Benign chondroblastoma: a study of 125 cases. *Cancer* 1972;30:401–13.
- 2 Jaffe HL, Lichtenstein L. Benign chondroblastoma of bone. A reinterpretation of the so-called calcifying or chondromatous giant cell tumor. *Am J Pathol* 1942;18:969–91.
- 3 Orell SR, Sterrett GF, Whitaker D. Fine needle aspiration cytology. 4th edn. New Delhi: Churchill Livingstone Elsevier, 2005: Chap 16, Bone; 438–40.
- 4 Kilpatrick SE, Parisien M, Bridge JA. Chondroblastoma. In: Fletcher CDM, Unni KK, Mertens F, eds. *World health organization classification of tumours: pathology and genetics of tumours of soft tissues and bone*. Lyon: IARC press, 2002:241–2.
- 5 Kudo T, Okada K, Hirano Y, et al. Chondroblastoma of a metacarpal bone mimicking an aneurysmal bone cyst: a case report and a review of the literature. *Tohoku J Exp Med* 2001;194:251–7.
- 6 Moorthy RK, Daniel RT, Rajskhekar V, et al. Skull base chondroblastoma: a case report. *Neurol India* 2002;50:534–6.
- 7 Ozkoc G, Gonlusen G, Ozalay M, et al. Giant chondroblastoma of the scapula with pulmonary metastases. *Skeletal Radiol* 2006;35:42–8.
- 8 Suneja R, Grimer RJ, Belthur M, et al. Chondroblastoma of bone: long-term results and functional outcome after intralesional curettage. *J Bone Joint Surg* 2005;87:974–8.
- 9 Moore TM, Roe JB, Harvey JP Jr. Chondroblastoma of the talus: a case report. *J Bone Joint Surg* 1977;59:830–1.
- 10 Monda LWMR. S-100 protein immunostaining in the differential diagnosis of chondroblastoma. *Hum Pathol* 1985;16:287–93.
- 11 Ramappa AJ LFYI, Tang P, Carlson JR, et al. Chondroblastoma of Bone. *J Bone Joint Surg Am* 2000;82:1140–5.
- 12 Schajowicz F, Gallardo H. Epiphyseal chondroblastoma of bone. A clinico-pathological study of sixty-nine cases. *J Bone Joint Surg Br* 1970;52:205–26.
- 13 Koss LG, Melamed MR. *Koss's diagnostic cytology and its histologic bases*. 5th edn. Lippincott Williams & Wilkins. 2006: Chap 36, Bone tumors; 1350–51.
- 14 Kilgore WB, Parrish WM. Calcaneal tumors and tumor-like conditions. *Foot Ankle Clin* 2005;10:541–65.
- 15 Cabay RJ, Reddy V, David O, et al. Cytologic features of primary chondroid tumors of bone in crush preparations. *Diagn Cytopathol* 2008;36:758–61.
- 16 de Silva MV, Reid R. Chondroblastoma: varied histologic appearance, potential diagnostic pitfalls, and clinicopathologic features associated with local recurrence. *Ann Diagn Pathol* 2003;7:205–13.
- 17 Abellar R, Robbins SG, Kalisher L, et al. Pathology quiz case: right knee pain in a 29-year-old man. Chondroblastoma with aneurysmal bone cyst formation. *Arch Pathol Lab Med* 2005;129:e16–18.
- 18 Springfield DS, Campagna R, Gherlinzoni F, et al. Chondroblastoma. A review of seventy cases. *J Bone Joint Surg Am* 1985;67:748–55.

Copyright 2014 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow