CASE REPORT

A case of benign periosteal chondroma seeding into humeral medullary bone via percutaneous needle biopsy tract

J P LEARMONT, MBBS, BMedSci, G POWELL, FAOrthA, MRACMA, SLAVIN, MBBS, FRCPA, FACEY, MBBS and PIANTA, MBBS, FRANZCR

Peninsula Health, Frankston, VIC, Australia
St Vincent’s Hospital Melbourne, Fitzroy, VIC, Australia

Address correspondence to: Dr Jonathon Paul Learmont
E-mail: j.learmont1987@gmail.com

ABSTRACT

We report an occurrence of periosteal chondroma seeding into the medulla of humerus via percutaneous needle biopsy tract. To our knowledge, this is the first described case of benign cartilage tumour biopsy tract seeding in the literature. We discuss the clinical, radiological and histological features of periosteal chondroma, as well as the diagnostic challenges associated with distinguishing this entity from periosteal chondrosarcoma. Finally, we briefly discuss the safety of imaging-guided percutaneous needle biopsy and methods to minimize the risk of iatrogenic tumour seeding.

CLINICAL PRESENTATION AND INVESTIGATION FINDINGS

An 18-year-old previously well male presented to his local practitioner with a several-month history of mild left proximal arm pain. There was no preceding trauma. Shoulder ultrasound was normal, including the rotator cuff. Plain radiograph demonstrated saucerization of the humerus cortex at the proximal metaphysis (Figure 1). CT scan demonstrated an intracortical lesion with saucerization but no associated soft tissue mass or cortical breach. MR imaging showed a well-circumscribed, homogeneous juxtacortical lesion measuring 6.5 × 4.5 × 13 mm (anteroposterior × mediolateral × craniocaudal) with scalloping of the adjacent cortex. T1 weighted sequences showed the lesion to be isointense relative to adjacent muscle. There was low-grade peripheral contrast enhancement (Figure 2a). T2 weighted sequences showed central hyperintensity, compatible with cartilage (Figure 2b,c). All sequences demonstrated a focus of signal hypointensity within the lesion, likely representing calcification. There was no bone marrow or adjacent soft tissue oedema. Thallium scan was negative for metabolic activity. Periosteal chondroma was considered the most likely diagnosis given the absence of medullary invasion and small lesion size; however, periosteal chondrosarcoma could not be excluded owing to the presence of pain, necessitating biopsy.

CT-guided core needle biopsy of the superficial cortical portion of the lesion was performed using a coaxial technique with Bard TruGuide 17 G × 7 cm and Bard Magnum 18 G × 10 cm biopsy needle (Bard Biopsy Systems, Tempe, AZ) (Figure 3a). The tissue sample was non-diagnostic, yielding skeletal muscle only. After discussion with the referring Sarcoma Multidisciplinary team, a second pass biopsy was performed using AprioMed Bonopdy 14 G × 9.5 cm penetration set and AprioMed Bonopty 15 G × 16 cm biopsy set (Apriomed AB, Uppsala, Sweden). The biopsy needle was bored through the humeral cortex to obtain an adequate tissue sample and ensure there was no subcortical involvement of the lesion (Figure 3b). Histological analysis with haematoxylin and eosin stain revealed chondroid tissue with loose myxoid stroma and evenly scattered chondrocytes with no atypia. Immunohistochemistry was not necessary for diagnosis in this case. Consensus agreement for periosteal chondroma was made at a soft tissue tumour multidisciplinary meeting. Conservative management was advised.

FOLLOW-UP

The patient re-presented 10 months later owing to worsening pain. MRI showed the original lesion had developed a cartilaginous, multilobulated component, invading through
tential deficit into the underlying medulla (Figure 5a,b). The med-

eral margin surgical resection was performed, confirming the

surrounding abnormal bone. Histology demonstrated bone that

was partially replaced by low grade, bland chondroid material,

with a hyaline matrix, sparse chondrocytes and no atypia.

TREATMENT

Wide-margin surgical resection was performed, confirming the

presence of periosteal chondroma with extension through a cor-
tical deficit into the underlying medulla (Figure 5a,b). The med-

ullary component was treated with phenol and filled with bone

cement. This approach was favoured over en block resection

with auto- or allograft reconstruction, as the patient had a his-
tory of heavy smoking, which could potentially complicate

wound healing.

OUTCOME

Postoperative recovery was uncomplicated. The patient was

reviewed 3 months postoperatively and had no further left pro-

ximal arm pain.

DISCUSSION

We present a unique case of intramedullary seeding of periosteal

chondroma following iatrogenic trauma from percutaneous core

needle biopsy. Invasion of a cartilaginous mass, such as periosteal

chondrosarcoma, into an extra-anatomical compartment is a

characteristic previously believed to be exclusive to malignant

lesions.1,2 Differentiation of periosteal chondroma from low-grade

periosteal chondrosarcoma is challenging, as there is considerable

overlap of patient age, symptomatology, radiological and histolog-

ical features between these entities.1–3 However, the prognosis and

hence management of these lesions differs. Periosteal chondromas

are benign and usually curable with local excision; recurrence is

rare.1,2 Recurrence of periosteal chondrosarcoma following local

excision with complications, including pulmonary metastasis and
death, has been reported by multiple authors, thus wide excision

or amputation is advised.2,4

Periosteal chondromas are benign cartilaginous growths origin-

ating from the deep surface of long bone periosteum. Together

with periosteal chondrosarcoma, these lesions represent approx-
imately 1% of all bone neoplasms.1,2 Periosteal chondromas

arise from the metaphyseal region of long bones, with the most

common sites being humerus, femur, tibia and phalanges.3,5

Macroscopically, these lesions appear as a lobulated cartilagi-

nous mass localized to the bone cortex invested by intact perios-
teurum.1

Periosteal chondroma commonly presents with pain; however, it

typically has a gradual onset of several years and is usually asso-

ciated with a mass or previous traumatic episode.1,2 Pain in the

absence of other symptoms accounts for only 25% of presenta-
tions.1,2 Onset of pain of less than 1-year duration as seen in this

case is a common feature of periosteal chondrosarcoma, present

in almost 50% of patients.4 Regarding the assessment of cartilage

tumours, Bauer et al1 suggest that isolated pain in the

absence of preceding trauma may be owing to the aggressive bio-

logical behaviour of a lesion such as periosteal chondrosarcoma.

On T1 weighted MR sequences, periosteal chondromas demon-

strate hypointense to isointense signal relative to muscle.2 T2 and

T2* weighted sequences characteristically demonstrate the lesion

to be hyperintense relative to fat, attributable to the high water

content of hyaline cartilage; a peripherally based hypointense

lining correlating to intact periosteum is also usually seen.1 Bone

marrow or surrounding soft tissue oedema are rare features.7

Focal areas of signal hypointensity on all image acquisition

sequences likely reflect internal tissue matrix calcification, notable

in approximately 50% of lesions.5 Following the administration of
gadolinium-diethylenetriamine pentaacetic acid (Gd DTPA) con-

trast, Woertler et al described enhancement of the lesion periph-
ery in 100% of cases.

It is recognized that the histological characteristics of periosteal

chondroma can vary from bland cartilage to low-grade cancer,

whereas chondrosarcomas have been shown to always meet the

histological criteria of a malignant diagnosis.7 Histological anal-

ysis of periosteal chondromas demonstrates lobules of immature

hyaline cartilage with small chondrocytes present. Additionally,

these lesions may feature cellular atypia, hypercellularity, multi-

nucleation, hyperchromatic nuclei or myxoid change in the

matrix, making them difficult to distinguish from low-grade

chondrosarcoma.1,2
Discerning periosteal chondroma from periosteal chondrosarcoma can be difficult. Lesion size can be useful in differentiating these entities. The average size of periosteal chondroma has been shown to vary from 2.2 to 2.8 cm, with no lesion greater than 7 cm being reported in the literature. \textsuperscript{1,3,5} Multiple authors have demonstrated the size of periosteal chondrosarcoma to measure greater than 5.5 cm. \textsuperscript{2,3} To date, there has been no reported case of periosteal chondrosarcoma measuring less than 3 cm in size. \textsuperscript{2,3}
Periosteal chondroma was previously thought to be distinguishable from periosteal chondrosarcoma by the absence of medullary invasion. This characteristic was recently challenged by Robinson et al in a study correlating the histological and radiological findings of cartilaginous periosteal lesions, where medullary invasion of periosteal chondroma was reported on CT and MR imaging in 4 out of 22 patients. The reporting osteopathologist was blind to the radiological findings in each case. Given the recommendation from several authors that differentiation of periosteal chondroma from low-grade periosteal chondrosarcoma be

Figure 3. CT-guided core needle biopsy at initial presentation. (a) Axial CT scan, bone algorithm, of the left humerus during first pass biopsy showing location of Bard Trugide 17 G × 7 cm coaxial needle (Bard Biopsy Systems, Tempe, AZ) (arrow). Absence of cortical breech is observed (arrowhead). (b) Axial CT scan, bone algorithm, of the left humerus during second pass biopsy showing AprioMed Bonopty 15 G × 16 cm biopsy needle (Apriomed AB, Uppsala, Sweden) breaching the cortex with needle tip (arrow) located just within the medulla.

Figure 4. MR images obtained 10 months after those seen in Figure 2, to investigate the complaint of worsened pain. (a) Coronal $T_2$ fat-saturated image demonstrating the presence of hyperintense intramedullary lobulated mass (arrows) deep to the low signal, linear needle biopsy tract (arrowhead). (b) Axial $T_1$ fat-saturated post-contrast image demonstrating the original juxtacortical lesion (arrow) as well as cartilage enhancement in the medullary cavity (arrowhead).
made by collaborating clinical, radiological and pathological data rather than based solely on histopathology, it is possible these four cases may have been reported as chondrosarcoma if the osteopathologist had access to the radiological studies.1,2

The lesion identified in our study did have well-defined margins and measured less than 3 cm in maximal dimension, supporting the diagnosis of periosteal chondroma. However, the recent onset of pain in the absence of trauma could have been owing to a low-grade periosteal chondrosarcoma. At our institution, all radiologically detected lesions presenting with characteristics that can be reasonably attributed to a malignant process such as atraumatic pain are further investigated with biopsy. Had the biopsy result demonstrated a malignancy, neoadjuvant chemotherapy and radiation therapy would have been considered with en block resection of the lesion.

To our knowledge, intramedullary seeding of a benign cartilaginous tumour, as seen in this case, has not been reported in the literature, although seeding of sarcoma following core needle biopsy is a rare but recognized complication.6–8 Several authors propose core needle biopsy as the sampling method of choice, as the complication rate has been shown to be 0–10%, compared with 16% for open biopsy.9 Open biopsy carries increased risks of wound breakdown, haematoma and infection, as well as increasing the risk of tumour seeding along biopsy tracts that are not removed during surgical resection.9 To minimize the risks of biopsy tract seeding, biopsy approach should coincide with the planned surgical incision site such that the tract is easily removed during any future surgical intervention.10 Occasionally, it can be difficult for the radiologist to obtain an appropriate tumour sample for diagnosis when limiting the biopsy approach to the surgical incision plane.10 At our institution, such difficult cases are always discussed with the multidisciplinary team.

Despite the first reported case of musculoskeletal tumour biopsy tract seeding in 1993, exact rates of occurrence are not yet clear.7 Recently, UyBico et al11 reviewed 363 cases of percutaneous musculoskeletal tumour biopsies and found no instances of needle tract seeding, suggesting that concern for iatrogenic seeding of musculoskeletal tumours may be more widespread than the evidence base to support it.

In view of the findings of our case and that of other cases of musculoskeletal tumour tract seeding, it may be appropriate that short-term post-biopsy imaging be performed to assess for evidence of biopsy tract seeding prior to definitive therapy, in instances where anatomic compartment breach may have occurred, whether histology yields a malignant or benign proliferative process such as chondroid tumour.6–8

LEARNING POINTS

1. Distinguishing periosteal chondroma from chondrosarcoma is challenging, as there is significant overlap of symptoms, imaging and histological features.
2. Lesion size is a good differentiator between periosteal chondroma and periosteal chondrosarcoma: lesions less than 3 cm in size are likely to be benign, whereas lesions greater than 7 cm are likely to be malignant.
3. Both benign and malignant cartilaginous lesions can breach extra-anatomical compartments following iatrogenic trauma, including biopsy, the approach of which should be confirmed with the treating tumour service.
4. Follow-up imaging after biopsy of cartilaginous lesions may be appropriate to assess for evidence of seeding in instances where anatomic compartment breach may have occurred, whether or not histology demonstrated a benign or malignant proliferative process.

ETHICS APPROVAL

Our institute’s Quality Assurance subcommittee of the Human Research Ethics department has reviewed this case and is agreeable to its publication.
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