Eur J Med Res (2006) 11: 1-7

AGGRESSIVE SCAPULAR CHONDROBLASTOMA WITH SECONDARY METASTASIS – A CASE REPORT AND REVIEW OF LITERATURE

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Abstract
Chondroblastoma is a benign bone tumor, accounting for approximately one percent of all benign bone tumors. It mostly occurs in typical locations such as long bones. Malignant transformation including metastasis has been described in only a few cases. Therefore, we report a unique case of chondroblastoma with tumor manifestation in the 7th decade of life, location of the tumor in the scapula and occurrence of metastasis in the soft tissue of the mandible branch. Due to aggravation of the clinical course, a scapula en bloc resection was performed. The differential diagnosis is discussed and the current literature concerning malignant transformation of chondroblastoma is reviewed.

Key words: Chondroblastoma, malignant transformation, en bloc resection therapy, metastasis

INTRODUCTION

Chondroblastoma is a benign bone tissue tumor, which was first reported by Codman in 1931 in terms of an "epiphyseal chondromatous giant cell tumor". This rare tumor entity accounts for approximately one percent of all benign bone tumors, most frequently found in young male patients with a peak incidence in the second decade of life. Although chromosomal abnormalities have been reported, no specific alteration has been detected so far. Typical tumor locations are the long bones, especially femur, tibia and proximal humerus. Common clinical symptoms are pain and a decreasing range of motion of adjacent joints. In conventional radiographs, signs of asymmetric epiphyseal destruction, often including bone expansion and sclerotic margins, can be seen. In histological staining, the predominant cells are most similar to epiphyseal chondrocytes, expressing distinct morphological features for differentiation. Although most authors assume the tumor being of essentially benign character, 11 cases of malignant transformation including metastasis have been reported in the literature (Table 1). In this context, the present case appears unique due to 1) the scapular location of the tumor, 2) the occurrence of metastasis in the soft tissue of the mandible branch, and 3) a course of disease lasting more than 40 years with tumor manifestation in the 7th decade.

CASE REPORT

A 68-year-old man in good physical condition presented with limitation of left shoulder mobility. Physical examination revealed a tumor along the dorsolateral edge of the left scapula with atrophy of the left shoulder girdle musculature compared to the right side. The patient felt pain in palpation of the lesion and at the lateral shoulder edge. Active adduction/abduction accounted for only 20–0–30, the passive one for 20–0–50 degrees with a restriction of rotational movement. The neurovascular status was inconspicuous except a significant strength loss of the left versus the right hand. No lymphadenopathy, fever, chills, or weight changes were present; the laboratory findings were within normal ranges.

Computed tomography (CT) showed a huge tumor mainly of soft tissue appearance with significant ossification and partial destruction of the left scapula. In a 99mTc bone scintigraphy, a significant enhancement of activity in the tumor surrounding in terms of the proximal left scapula and a large expansion into the suprascapular tissue was detected. In magnetic resonance imaging (MRI), a lesion of 11 x 7 x 9 cm in size, partly lobulated and nodular with expansion starting from the spina scapulae, was visualized with distinct areas in T1- and T2-weighted images before and after applying contrast medium indicating necrotic areas. The tumor itself showed a distinct contrast enhancement with infiltration of the rotator cuff and the origin of the subscapularis muscle. The branches of brachial plexus as well as the subclavian artery appeared without infiltration. The histological examination of a biopsy established the diagnosis of Langerhans' cell histiocytosis. After 15 cycles of fractional radiation up to a maximum of 30 Gy, restaging showed a neither clinical nor radiological regression of the tumor 6 months after primary diagnosis. A second biopsy did not confirm the diagnosis of a Langerhans' cell histiocytosis, but diagnosed a benign chondroblastoma. Since the patient refused to undergo surgery, he was reassigned every 6 months for control examinations. Three years after the patient's first presentation, a significant clinical aggravation of the tumor was observed (Fig. 1). For the mobility of the shoulder, active adduction/abduction now accounted for 20–0–10, the

Table 1. Table of all patients with histologically proven metastases of a chondroblastoma, reported in the literature since 1931

Author (Ref.)	Age, Sex	Site of Primary	Course and Treatment	Interval to metastases	Follow Up
Dahlin D.C. [5]	-	Pelvis	1) Repeated courses of radiation therapy; 2) Multiple pulmonary metastases	58 months	Death due to pulmonary metastases
Gawlik Z. [8]	6 fem	Prox. Humerus	1) Interscapulothoracic amputation; 2) Mediastinal and pulmonary metastases; 3) Thoracotomy	3 months	Death due to widespread pulmonary metastases
Green P. [9]	13 fem	Prox. femur	1) Local recurrence and multiple pulmonary metastases; 2) Thoracotomy	20 months	Stable pulmonary lesions
Huvos A.G. [10]	16 fem	Dist. femur	1) Curettage; 2) Local recurrence with pulmonary nodule 3) Curettage and cryosurgery; 4) Multiple bilateral pulmonary nodules 5) Thoracotomy	11 months	No further metastases
Jambhekar NA. [13]	27 fem	Talus, pulmonary metastases	1) Excision of talus; 2) 2 Yrs. Later thoracotomy 3) Recurrence of pulmonary nodule	3 yrs.	Stable pulmonary lesions
Joshi D.D. [15]	17 fem	Fibula Pulmonary metastases	1) Resection of primary tibial CB, thoracoscopic resection of pulmonary nodules 2)Local recurrence and pulmonary metastasis 3)Resection of bone and soft tissue metastases	-	After three years still in good condition with stable pulmonary metastases
Kahn L.B. [16]	13 male	Pelvis	1) Curettage; 2) Local recurrence and pulmonary metastasis 3) Three times curettage and resection of the primary	9 yrs.	Death due to metastasis 15 yrs after 1st curettage
Khalili K. [17]	43 male	Rib	1) Resection; 2) Diffuse soft tissue metastases (scalp, neck, elbow, buttock)	5 yrs.	No local nor pulmonary metastases
Kunze E. [18]	33 male	Pelvis	1) Hemipelvectomy; 2) Pulmonary metastases	12 yrs.	Stable pulmonary lesions
Kyriakos M. [19]	9 male	Prox. tibia 2 pulmonary nodules	1) Curettage and bone packing. Thoracotomic resection of two nodules 2) Local recurrence, innumerable pulmonary nodules, femoral metastasis 3) Systemic chemotherapy, followed by curettage of the tibial recurrence	-	Five years after 1st surgery death due to metastases
Ramappa A. [22]	29 male	Pelvis	1) Resection; 2) Multiple skeletal, pulmonary metastases 3) Wide resevction	-	Death due to metastases
	49 fem	Rib	1) Resection; 2) Multiple skeletal, soft tissue metastases 3) Resection and radiofrequency ablation		No further recurrence observed
Riddell R.J. [23]	14 fem	Prox. tibia	1) Curettage and insertion of bone graft; 2) Local recurrence with pulmonary metastases; 3) Mid-thigh amputation and thoracotomy	34 months	Stable pulmonary metastases
Schajowicz F. [24]	32 fem	Dist. metatarsus	Local recurrence and metastasis in the gluteal and neck region	5 months	Death 6 years after 1st diagnosis
Sirsat M.V. [25]	15 male	Rt. Prox. tibia	1) Curettage and graft; 2) Well for 2 yrs. 3) Local recurrences; 4) Amputation	unknown	Died due to liver metastases 9yrs. after 1st diagnosis
Sweetnam R. [26]	19 male	Prox. fibula	1) Pulmonary metastases; 2) Lobectomy	-	No further metastases
Van Horn J.R. [29]		Dist. femur	1) Curettage and bone grafting; 2) Pathologic fracture due to local recurrence 3) Resection and arthrodesis; 4) 10 yrs. Later pulmonary metastasis 5) Thoracotomy	2 yrs.	No further metastases
Wellmann K. [30] *	29 male	Scapula	1) Forequarter amputation; 2) pulmonary metastases; 3) Lobectomy	14 yrs	No further metastases
Wirmann J.A. [31] *	38 male	Rt. acromion	1) Resection; 2) Local recurrence with soft tissue invasion 3) Recurrence and pulmonary metastases; 4) Radiation therapy	14yrs./33 yrs.	Death for normal reasons

(Rt: right; Lt: Left; Prox: Proximal; Dist: Distal *Wellmann [30] and Wirman [31]: The only two authors reporting of an chondroblastoma of the scapula with metastases) and of the patients' clinical features.

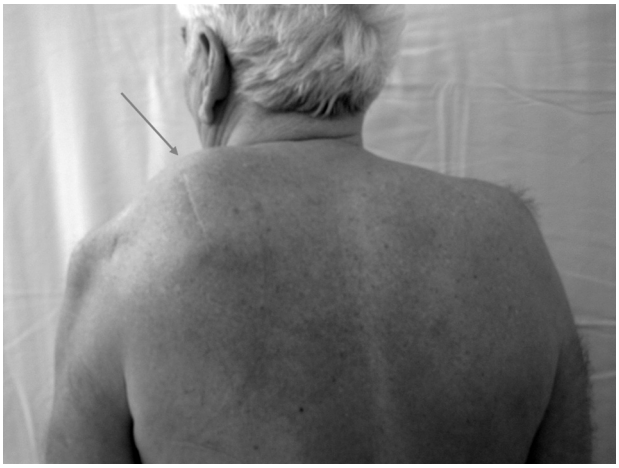

Fig. 1. Photography of the patient's back before surgery. At the upper margin of the left scapula a tumor mass is notable (indicated by the red arrow). The affected shoulder appears to be elevated in level compared to the opposite, right shoulder. Underneath the tumor mass, a mark of approximately 5cm length is visible, most likely due to an ancient surgical procedure. A defect with consecutive loss of mass of the deltoid muscle can be seen on the left compared to the right deltoid area.

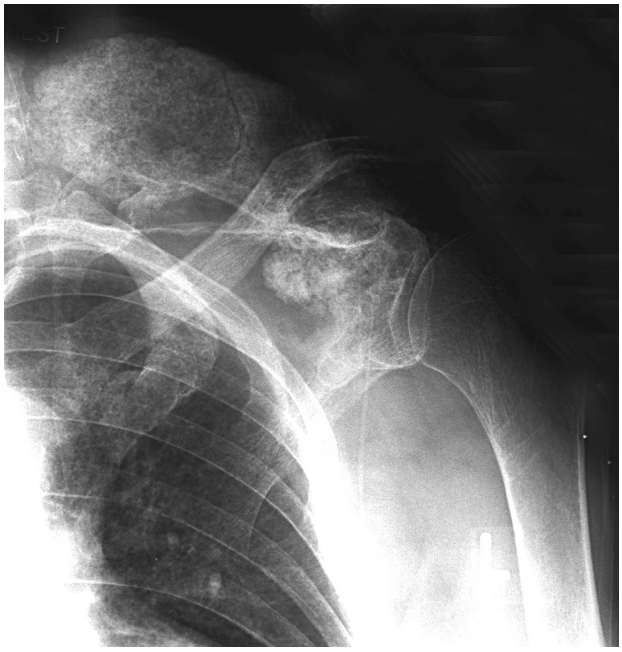

Fig. 2. Radiograph of the left shoulder showing a huge calcified tumor mass above the clavicle. The tumor shows a sclerotic inferior margin and extension into the soft tissue, as well as into the glenoid fossa

passive one for 20–0–20. A weight loss of 2kg during 8 weeks was registered. Additionally, a new 2x2cm sized soft tissue tumor of the right mandible branch, which was first regarded as atheroma or lesion of the salvatory gland, was found. CT showed a maximum primary tumor size of 11 x 5 x 10cm with the main focus at the dorsocranial scapula and massive destruction of the medial scapular third. MRI revealed a progressive and partly neoplastic chondroblastoma with a strong contrast enhancement at the margins (Fig. 2). Another fine needle biopsy proved no alteration of histology. Suspecting a malign transformation to a chondrosarcoma, an en bloc scapulectomia involving resection of surrounding soft tissue was performed, The resected specimen had 1255g in weight and 22 x 17 x 9cm in size. Histological examination showed a population of monomorphic medium-sized cells with slightly recessed nuclei, broad and eosinophilic cytoplasm, and sharply defined cell boarders. They were presenting mainly giant cells of the osteoclastic type without atypia, but widespread necrosis and consistent mitosis (mitotic rate 10/10 HPF). Birefringent crystal material compatible with calcium pyrophosphate focally accumulated. Moreover, areas with production of chondroid matrix and enclosure of differentiated chondroid cells were recognized (Fig. 3). Bone destruction, infiltration of adjacent muscles and subcutaneous soft tissue were found thus establishing the diagnosis of an aggressive chondroblastoma. The tumor above the right mandible branch showed slight CT enhancement. Histology revealed the identical morphology of the scapular chondroblastoma.

Postoperatively, neither lung metastasis nor any other filia were seen in CT. However, the right mandible tumor showed slight enhancement in 99mTc bone scintigraphy with the histological diagnosis of a metastasis of the scapular chondroblastoma. Two and a half years after the final surgery, the patient still presented free of metastases with an acceptable range of motion regarding his left upper limb.

Discussion

The first description of chondroblastoma was given by Codman in 1931, who designated it as "epiphyseal chondromatous giant cell tumor" [3]. Jaffe and Lichtenstein differentiated in 1942 the chondroblastoma from giant cell tumors and established the term "benign chondroblastoma" [12]. Chondroblastoma is a rare tumor with an incidence of 1% of all benign bone tumors. In up to 95% it occurs in the second decade of life with a male:female ratio of 2 : 1 [24]. Especially in older patients, there were reported a few atypical cases of chondroblastoma, which tend to involve unusual sites and have a greater tendency to expand the affected bone. This observation was confirmed by the present case in an 68-year old male. Chondroblastoma has a predilection for the epiphysis of the femur, humerus, tibia and tarsal bones. Only 16% of cases are found in flat bones [1, 5]. Scapular location of a chondroblastoma, as described in our case, has been reported since 1931 in only eleven cases (Table 1). Hereby, our patient is the oldest reported case of scapular affection in the entire described 12 cases at all. Most patients reported pain and local tenderness associated with limitation of motion of the adjacent joints. A pathologic fracture as the primary presentation is exceedingly rare, and local swelling is present in less than 10 percent [11].

Histogenesis of chondroblastoma is controversial, but derivation from epiphyseal cartilage cells rather than from reticulo-histiocytic cells seems to be most

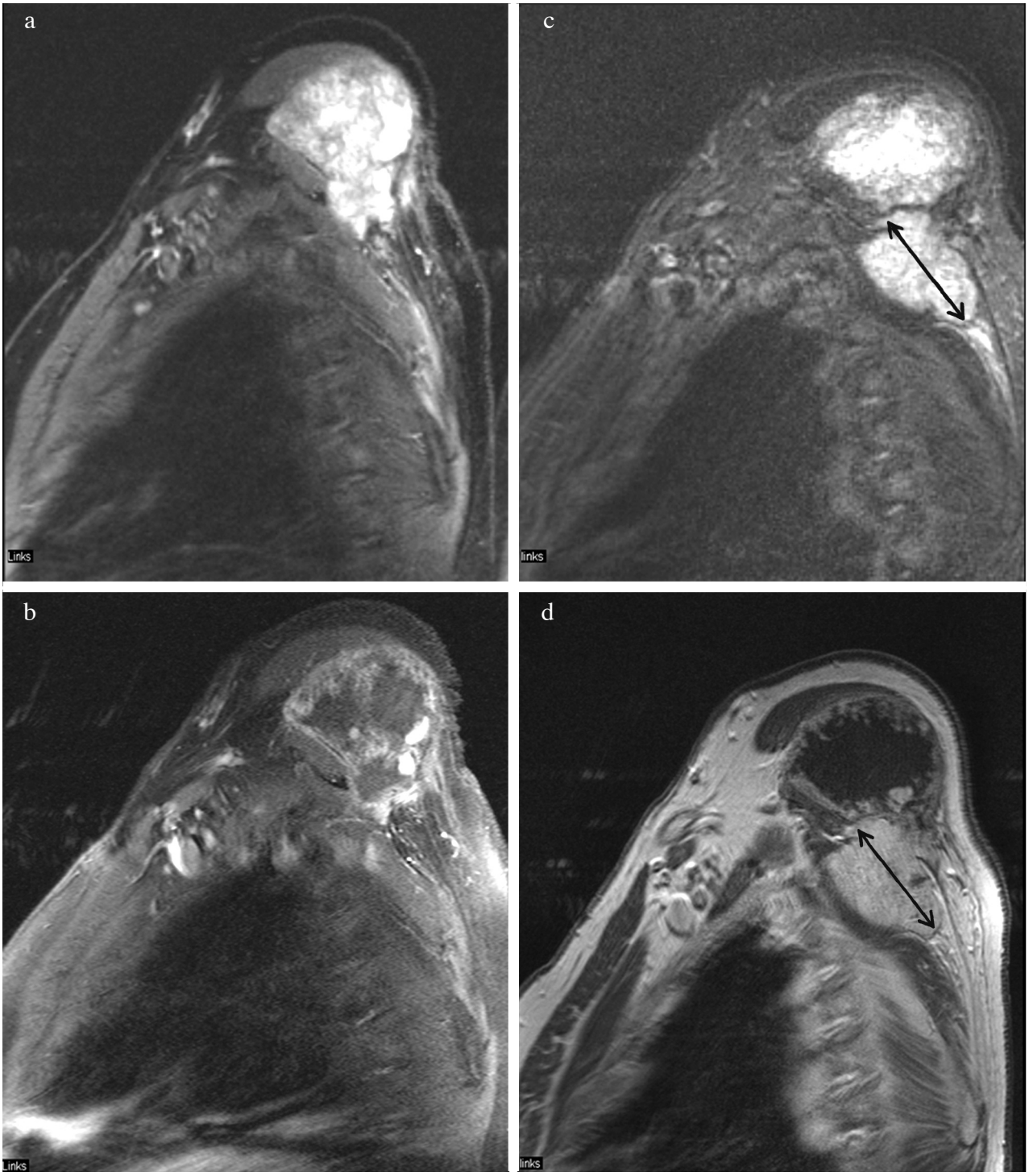

Fig. 3. Magnetic Resonance Images (MRI) of the left scapula in the parasagittal plane: On the left side (3a, b), MR-images of the year 2000 are shown: A huge tumorous mass, in the soft tissue beneath the deltoid muscle is visible. The lesion measures 11x7x9 cm in size. On fat-suppressed images (3a), a hyperintense, inhomogeneous signal results whereas after contrast application (3b) a rich enhancement is shown indicating a necrotic central zone. On the right side (3c, d), MR-images 3 years later are displayed: A second tumor nodule is now recognizable, located just dorso-caudal to the primary tumor mass (indicated by the red arrow). This nodule is of homogeneous hyperintense signal on fat-suppressed images (3c) and shows homogeneous contrast enhancement (3d) indicating viability.

likely [5, 24]. The histological diagnosis of typical chondroblastoma is usually not difficult due to their characteristic appearance with rounded or polygonal chondroblasts, multinucleated giant cells, and eosinophilic chondroid extracellular matrix with focal (chicken wire) calcification [4]. Nonetheless, it is important to be aware of a wide morphologic spectrum causing possible diagnostic problems. Therefore, the differentiation between chondroblastoma and giant cell tumor can be difficult in case of the former con-

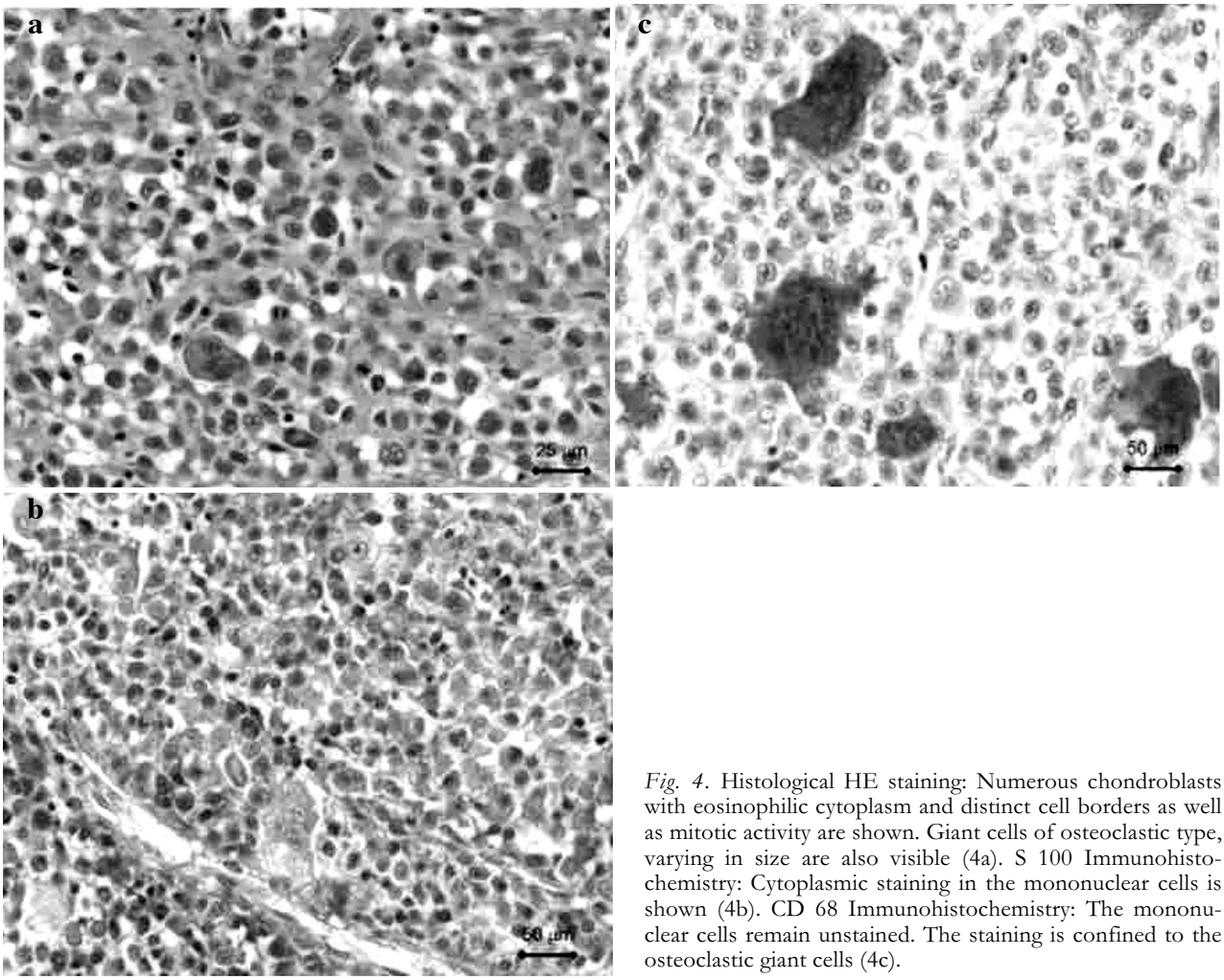

Fig. 4. Histological HE staining: Numerous chondroblasts with eosinophilic cytoplasm and distinct cell borders as well as mitotic activity are shown. Giant cells of osteoclastic type, varying in size are also visible (4a). S 100 Immunohistochemistry: Cytoplasmic staining in the mononuclear cells is shown (4b). CD 68 Immunohistochemistry: The mononuclear cells remain unstained. The staining is confined to the osteoclastic giant cells (4c).

taining a large number of giant cells and scanty chondroid matrix. The epiphyseal location and lytic radiographic appearance may add to the confusion, but chondroblastoma usually occur in patients younger than 20 years with open epiphyseal plates, often involving less than one half of the epiphyseal diameter. The mononuclear cells in chondroblastoma will contain irregular, ridged nuclei with longitudinal clefts, while in giant cell tumors the cells resemble histiocytes with nuclei, similar to those of the giant cells [2]. Focally, a network of calcification (chicken wire) between the tumor cells exist, whereas clumps of calcification were observable in some areas [22].

Chondroid plaques are not a feature of giant cell tumors. In difficult cases, the demonstration of S100 positivity in chondroblasts will be helpful [28]. One of the most difficult entities being differentiated from a chondroblastoma is the Langerhans' cell histiocytosis, which was considered the primary diagnosis in our patient and consecutively led to inadequate initial treatment [7]. Cytologically, chondroblasts exhibit rounded contours and folded or reniform-shaped nuclei, even containing prominent grooves. Furthermore, binucleate and multinucleate forms are usually present. These cytomorphologic features also characterize the diagnostic histiocytes of Langerhans' cell histiocytosis, which is not associated with any form of matrix production [7]. As shown in the present case, immunohistochemical results may even not be conclusive for the exclusion of Langerhans' cell histiocytosis showing unequivocal expression of CD1a.

In an older group of age, the differential diagnosis of a low graded chondrosarcoma may also be considered. However, concerning cytology the cells in a chondrosarcoma are larger, with mild to moderate pleomorphism and present in lacunae. Binucleate and multinucleate cells are frequent along with the presence of hyaline cartilage [20].

Features supportive for a benign lesion will be the absence of abnormal mitoses and a low mitotic count. The mitotic count of chondroblastoma does not exceed 5/10 HPF in 81% of tumors. In cases with unusual histologic features, correlation with radiographic features will usually help with the diagnosis. Radiologically, chondroblastoma are usually presented as well-defined eccentric lesions in epiphyseal location with a rim of sclerosis with or without punctuate calcifications occurring in approximately 60%. Occasionally, large bubbly bone expansion with varying amounts of stippled calcifications and periosteal reaction can be evident on radiographs and a secondary aneurismal bone cyst should be considered [5, 6]. A distinctive feature of chondroblastoma on MRI scans is a predominant low-to-intermediate signal intensity on T1-

weighted images with heterogeneous intermediate signal on T2-weighted images, with only scattered foci of high signal intensity. This low-to-intermediate signal intensity appears due to cellular chondroid matrix and also calcification [14].

According to malignant tumor behavior concerning the spread of metastases, there are a few documented fatal cases of chondroblastoma showing pulmonary metastasis of the same histologic characteristics as the removed tumor, [10, 13, 19] thus presenting a metastatic chondroblastoma. Those cases have in common that surgical therapy always happened prior to the appearance of metastases. Therefore, metastases may represent a vascular transport phenomenon during vigorous curettage [13]. Our patient also seems to be one-of-a-kind due to the fact that except fine needle puncture no tumor manipulation was performed. Chondroblastoma is generally treated by curettage with or without bone grafting with a curative result in approximately 90% [19]. Cementation or excision and reconstruction may be required for large lesions. The recurrence rates for chondroblastoma in previous studies ranged from 5.7% to 20%; in case of secondary aneurismal bone cyst identification, an even higher local recurrence rate was reported [10]. In general, local recurrence is more likely to occur in flat than in long bones. In some rare cases, chondroblastoma grow quite large, like in our case, or tend to recur with or without soft tissue seeding. These large and/or local recurrent lesions have been described as aggressive variants of chondroblastoma [10, 21]. One might think that in these cases a separate, own tumor entity is concerned whereas the cytopathological specific characteristics have yet not been described in literature due to its rare occurrence [21]. Also the present report proves that in case of the chondroblastoma remaining untreated, it can show distinct size-progression, and thus making an *en bloc* resection necessary, which may result in a loss of joint function and growth disturbance due to the location in the epi- and metaphyseal region [22, 27].

SUMMARY

In summary, the need for a combined and extended clinical, radiologic, and histologic approach to the correct diagnosis of chondroblastoma is emphasized. As shown in the present patient, most of the classic criteria such as typical location, age, histology and radiological appearance are not met in these cases. The patient might be endangered for an inadequate primary treatment leading to fatal consequences. Therefore, we strongly suggest multiple biopsies of the tumor to get a distinct histological diagnosis. However, the occurrence of metastatic and malignant behaviour of chondroblastoma is extremely rare. It should not be taken as an indication for radical therapy like en bloc resection necessary for every primary appearance of chondroblastoma.

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Received: December 7, 2005 / Accepted: February 6, 2006

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