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Case Study on Langerhans Cell Histiocytosis of Bone

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MD and MS wrote the first manuscript and managed the literature searches. Authors HM and SM managed the investigation analyses of the study. Authors FF, SM and ZB approved the final manuscript. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Aims: To precise, the epidemiological, clinical, para-clinical, therapeutic and prognostic characteristics of skeletal involvement in Langerhans cell histiocytosis

Materials and Methods: A retrospective and descriptive study of patients with Langerhans cell histiocytosis admitted in Internal Medicine Departments of Hedi Chaker University Hospital of Sfax between 1996 and 2018. Cases of Langerhans cell histiocytois confirmed with histo- pathological examination were included.

Results: Four cases of LCH with bone involvement were noted. All patients enrolled were male and the mean age at diagnosis was 23.25 years. The bone lesions were unifocal in two cases and

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multifocal with multisystemic LCH in the others. The treatment consisted of curettage in two cases and two patients received systemic therapy with corticosteroids and vinblastine respectively. The outcome was favorable in two patients with eosinophilic ganuloma and systemic replases were noted with novel bone lesions in two patients presenting the systemic form of the disease.
Conclusion: LCH is a rare disease in children and young adult males. In the present series, bone was the most frequently involved site. The circumstances of discovery of bone localization were the pain swelling lesion in different sites. Biopsy is necessary to obtain diagnosis confirmation. The prognosis of this pathology depends largely on early diagnosis, other organs affected and the response to treatment. The new class of BRAF inhibitors may be a promising therapeutic option in LCH which needs to be assessed in prospective studies mainly in bone lesions.

Keywords: Langerhans cell histiocytois; bone involvement; adult.

1. INTRODUCTION

Langerhans cell histiocytosis (LCH) represents a spectrum of disorders that share in common a tissue infiltration by dendritic Langerhans cells organized in granulomas. The Langerhans nature is confirmed in immuno- histochemistry by expressing CD1a or langerin / CD207 and in electron microscopy by the presence of Birbeck granules [1,2]. Although several etiopathogenic hypotheses have been advanced (infectious, immunological, genetic or neoplastic), the etiology remains unknown [3,4,5]. LCH can occur at any age, but it affects preferentially the child and the young adult [1]. It covers a series of entities with a widely varied clinical presentation and prognosis from single organ to multisystem involvement. Any organ or system of the human body can be involved. Bone is the most frequent site noted in about 80% of cases, nonetheless few studies have been conducted to precise its characteristics [6]. The aim of the present study is to precise the epidemiological, clinical, para- clinical, therapeutic and prognostic characteristics of skeletal involvement in Langerhans cell histiocytosis.

2. MATERIALS AND METHODS

A retrospective study of patients with Langerhans cell histiocytosis admitted in Internal Medicine Departments of Hedi Chaker University Hospital of Sfax between 1996 and 2018. Cases of Langerhans cell histiocytois confirmed with histo-pathological examination were included.

3. RESULTS

Case 1

A 22-year- old patient was admitted in January 2005 to internal medicine department for disseminated LCH. At the age of 14, the patient presented a diffuse alveolysis with general bone pain. The patient was referred first to the maxillofacial and Orthodontics department. To explore these unexplained symptoms, a skeletal scintigraphy showed diffuse hyperfixation at the base and the cranial vault, the jaws, the upper extremity of the left femur, the diaphysis and the left femoral condyle, the left iliac wing, the lower extremity of the left tibia and the head of the right fibula. The body scan revealed multiple lytic and blowers lesions affecting the whole skeleton. In the skull, these lesions concerned the frontal bone, the temporal bone, the mastoid bone, the sphenoid bone, the occipital bone, the two rocks complicated with otitis media, the left malar bone and the mandible. The bone involvement concerned also the spine and costal arcs. The lesions affected even the left iliac bone and the acetabular region (Fig. 1). In upper limbs, there were bilateral lesions in carpal bones. In the lower limbs, the bone lesions were extended in the left femur and in tarsal bones. The thoracic and abdominal tomography showed a multiple micro-nodular, reticular, cystic lung lesions and homogeneous hepato-splenomegaly. The association of diffuse osteolytic lesions, lung and liver involvements evoked the diagnosis of systemic LCH confirmed by the presence of increased numbers of Langerhans' cells in the bronchoalveolar-lavage fluid and identified by staining with antibodies against CD1a (Fig. 2) .The patient was treated with 8 weekly pulses of vinblastine (5 mg / m2) with a favorable outcome particularly of bone lesions at the control scintigraphy. Three years later, the patient presented with a mandibular pain. The dental panoramic showed multi-compartmental extended osteolytic lesions affecting the hemi mandible, especially on the right (Fig. 3). Maxillofacial CT scan revealed aggressive lytic lesions affecting the mandibular branches. The thoraco-abdominal CT showed the extension of

nodular and cystic pulmonary lesions**.** The patient was treated with 6 weekly pulses of vinblastine (5 mg/m^2), steroids at high doses and methotrexate 15 mg per week with good clinical therapeutic response. The combination of methotrexate and steroid was interrupted after 3 years of sustained remission.

Case 2

A 21-year-old patient was admitted in September 2011 to otolaryngology department with a history of lower right maxillary pain since 4 months. A facial CT tomography revealed a right maxillary lytic lesion extending to the floor of the ipsilateral orbit associated with a lamellar periosteal reaction without infiltration of the adjacent tissues. The surgical exploration confirmed the presence of a tumor process in the right sinus. Histopathological examination of the biopsied tumor showed a cluster of histiocytic cells with a polymorphic infiltrate particularly rich in eosinophilic poly-nuclear cells and rare giant multinucleated cells without associated necrosis. In immunohistochemistry, histiocytic cells were labeled by anti-CD1a, anti-PS100 and anti-CD68 antibodies. Then the patient was referred to internal medicine department. The physical examination was normal. The sinus radiography revealed an osteolytic lesion next to the right maxillary sinus (Fig. 4). All other investigations including complete blood count, chemistries, liver function, skeletal scintigraphy and the thoracic tomography were within normal. The diagnosis of eosinophilic bone granuloma in right maxillary was retained. The treatment consisted of curettage of the lesion already done at the same time of the diagnostic biopsy.

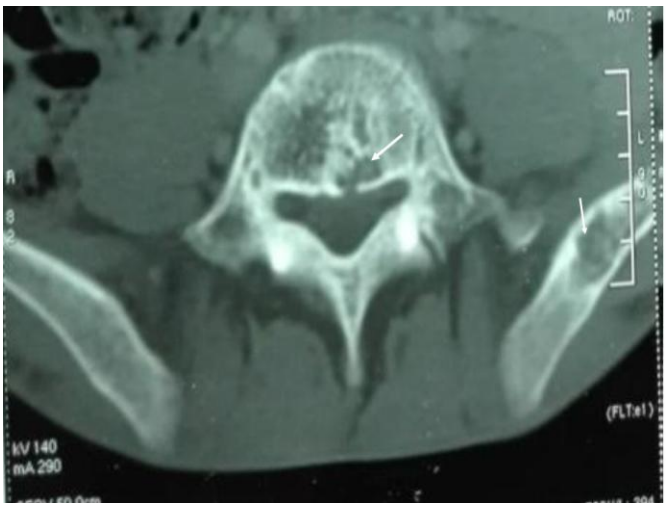

Fig. 1. Vertebral and iliac bone langerhans cell histiocytosis in CT tomography

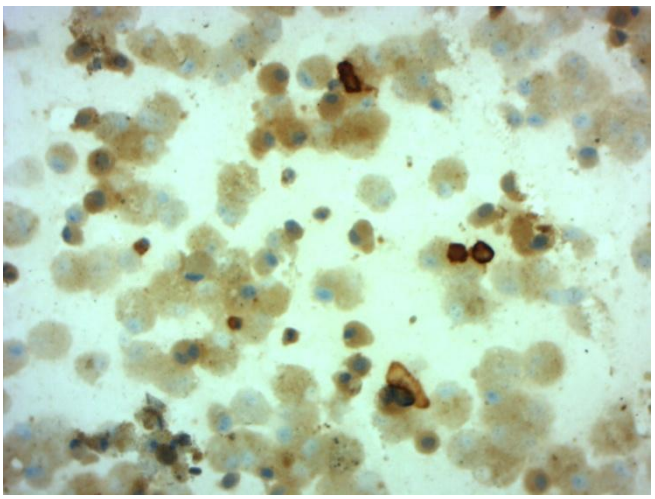

Fig. 2. Langerhans cell CD1a(+) in broncho-alveolar liquid

Table 1. Clinical characteristics, treatment and outcome of our patients

patient no	Location of bone lesion	Systemic involvements	Type of disease	Treatment and outcome
1	-The skull: the frontal, temporal, mastoidian, sphenoid and occipital bone, the two rocks, the left malar bone and the mandible. -The spine and costal arcs. -The left iliac bone and the acetabular region. -The left femur. -The tarsal and carpal bones.	Lung, spleen and liver involvements.	Systemic LCH with risk organs involvement.	Initial treatment: 8 weekly pulses of vinblastine with a favorable outcome. Treatment of systemic relapse after three years: The vinblastine in combination of steroids and methotrexate with good therapeutic response
2	-The right maxillary bone		Eosinophilic bone granuloma	The treatment consisted of curettage of the lesion with no relapses
3	-The maxillomandibular bone -The bilateral petrous apex	lung and post-pituitary endocrine involvements	Systemic LCH	Initial treatment: high-dose corticosteroid therapy with substitutive treatment with DDAVP Treatment of systemic relapse after three years: Vinblastine combined with high dose of corticosteroid therapy with persistent irreversible bilateral deafness and sequellar lung lesions.
4	-The left fronto-temporal bone.	-	Eosinophilic bone granuloma	The treatment consisted of surgical excision of the lesion with favorable outcome

Case 3

A 38-year-old patient was admitted in 2004 in endocrinology department with progressive polydipsia with concomitant polyuria and nocturia. Diagnosis of diabetes insipidus was established after a water deprivation test. Cerebral MRI showed maxillomandibular multifocal osteolytic lesions, thickening of the pituitary stalk and disappearance of the T1 post-pituitary hyper signal. Histopathological examination of the bone lesion revealed a granulomatous infiltrate rich in histiocytes and eosinophilic polynuclear cells with positive immunostaining of the CD1a +, PS100 + and CD68 + type. The diagnosis of LCH was made. The patient received high-dose of corticosteroid therapy with substitutive treatment with DDAVP. Three years later, the patient experienced bilateral mixed deafness related to bilateral bone lysis of the petrous apex confirmed with the rock tomography.Then, the patient was referred to the internal medicine department. The thoracic tomography showed a diffuse micro-cystic lesions of the lung. The patient was treated with 8 courses of vinblastine combined with high dose corticosteroid therapy. Three years after the treatment, the disease was considered in remission with persistent irreversible bilateral deafness and sequellar lung lesions.

Case 4

A 12-year-old patient was referred to neurosurgery department in January 2013 with a one month history of pain and swelling of the temporal area. The brain tomography showed a left temporal osteolytic lesion (Fig. 5). Cerebral MRI concluded to a left fronto-temporal lytic lesion. The anatomo-pathological examination of the biopsied lesion revealed a polymorphic granulation tissue consisting of a typical nucleus histiocytes, multinucleate giant cells like osteoclastic type, numerous foam cells associated with lymphocytes and plasma cells with some poly-nuclear cells. In immuno-histochemistry, the cells were strongly positive for CD68 and PS100, and they were irregularly positive for CD1a. The patient was addressed to internal medicine department. Physical examination, biological and radiological assessments were normal. The diagnosis of eosinophilic bone granuloma in the temporal bone was retained. Five years following the surgery, there were no signs of recurrence of the lesion.

3. DISCUSSION

Bone is the most frequent involvement in LCH noted in about 80% of cases and represents approximately 50% of the localizations in the adult [6,7]. There is a predilection of location for the flat bone (skull, ribs, sternum, iliac bones and scapula), the vertebrae and also the long bones (femur, humerus and tibia). The small bones of the hands or feet are rarely affected [8,9,10]. Bone lesions may be asymptomatic and revealed in radiological findings or cause localized painful swelling of the soft tissues or pathological fracture [11]. Some bone lesions can be discovered during complications [12]. In the cranial vault, the lesion is manifested by the appearance of soft swelling as reported in our fourth case report [13]. The involvement of the temporal bone can be manifested by otorrhea, hypoacusis or repeated otitis and even a sequential deafness [14]. These clinical symptoms were observed in our third patient. The maxillary and mandibular localization is frequent and its symptoms are non specific as in 3 of our patients and the most common clinical signs are intraoral mass, pain, gingivitis, dental exfoliation and mucous ulceration [15]. Spinal involvement accounts for 15 to 30% of localizations in systemic LCH and about 10 to 15% in eosinophilic granulomas [16]. The level of vertebral involvement varies with age. In adults, 47% of reported cases involve the cervical spine, 33% the thoracic spine, and 20% the lumbar spine [17]. Some authors emphasize the exceptional nature of neurological disorders [18]. The iliac bone is most often reached [19]. The involvement of the peripheral skeleton is rare and classically localized in the long bones (femur, humerus).In the present series, vertebral and iliac bone involvement was detected in our first patient with no neurological disorders. On standard radiography, single or multiple bone lesions are typically lytic known as "geography maps" or "punch" with or without peripheral sclerosis. In the skull, the typical appearance of a LCH lesion is a well-defined lytic lesion, with non-sclerotic margins, involving both inner and outer table, resulting in a double-contour appearance, sometimes associated with an adjacent soft tissue mass [13]. In the long bones, the lesions are essentially diaphyseal producing images of oval osteolysis with periosteal and often lamellar, appositions [12,20]. In all cases of base skull and facial mass involvement, computed tomography (CT) allows to better analyze the osteolysis, and especially the invasion of the soft

Fig. 3. Osteolytic lesions of langerhans cell histiocytosis affecting the hemi mandible and the cranial vault

parts [21]. In the spine, the involvement predominates in the vertebral body. The typical aspect corresponds to the vertebra plana described by Calvé in 1924 [22]. The MRI is the most effective examination to analyze the expansion of the tumor in the marrow and the nerve roots and to check the integrity of the inter vertebral disc [12,20]. Skeletal scintigraphy allows evaluation of bone lesion extension and follow-up of lesions after treatment. The present series is particular by the richness of the radiological signs. A bone biopsy is crucial to confirm the diagnosis and shows langerhans's cell histocytosis [18]. Therapeutic strategy of skeletal involvement in Langerhans cell histiocytosis depends on clinical form. The unifocal bone lesion responds well to local therapy such as curettage, excision or possibly intra-tumoral steroid injections [8]. Persistence symptoms of disease, or expansion of the lesion after surgical intervention, may respond to the subsequent radiotherapy [23]. The use of bisphosphonates in monthly treatment has been successfully reported in some patients [24,25,26,27]. In the present series, complete excision of the bone lesion (curettage) was effective in two cases.In the multifocal bone lesions or associated with multisystem lesions of LCH, the systemic reference treatment is based on the combination of vinblastine and corticosteroids. In a retrospective multicenter study, vinblastine was shown to have good response in adults as a first line treatment; however, many patients experienced reactivation in long-term follow-up [28]. The first-line systemic treatment of our patients was based on high-dose corticosteroid therapy which was proposed in multifocal LCH bone with post-pituitary involvement in the third case. Eight courses of vinblastine were indicated in disseminated LCH with pulmonary and liver involvement in the first case. In both cases relapses were noted affecting the maxillofacial bone, the lung and the liver in the first case and the auricular bone as well as the lung in the second case. Induction therapy with vinblastine has been indicated in combination with corticosteroid therapy in two cases. Methotrexate was also introduced in the case with organ risk involvement.

LCH is also a source of late sequelae. Prevalence of squelae is as follow: Orthopaedic related 27%, diabetes insipidus 19%, growth retardation 13%, cosmetic 10%, neurological 7%, hearing 7%, anterior pituitary hormone deficiency 7%, hepatobiliary 4% and ophthalmological 3%

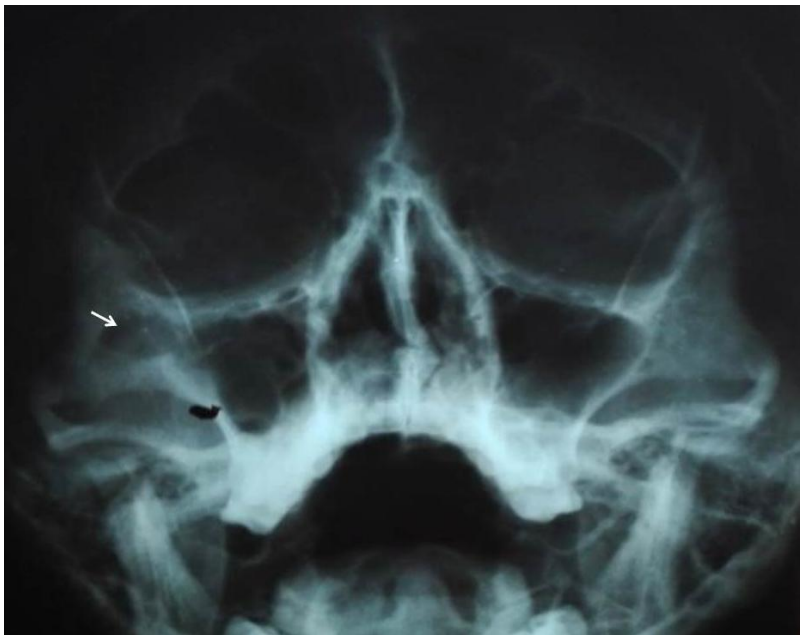

Fig. 4. Osteolytic lesion of Langerhans cell Histiocytosis next to the right maxillary sinus

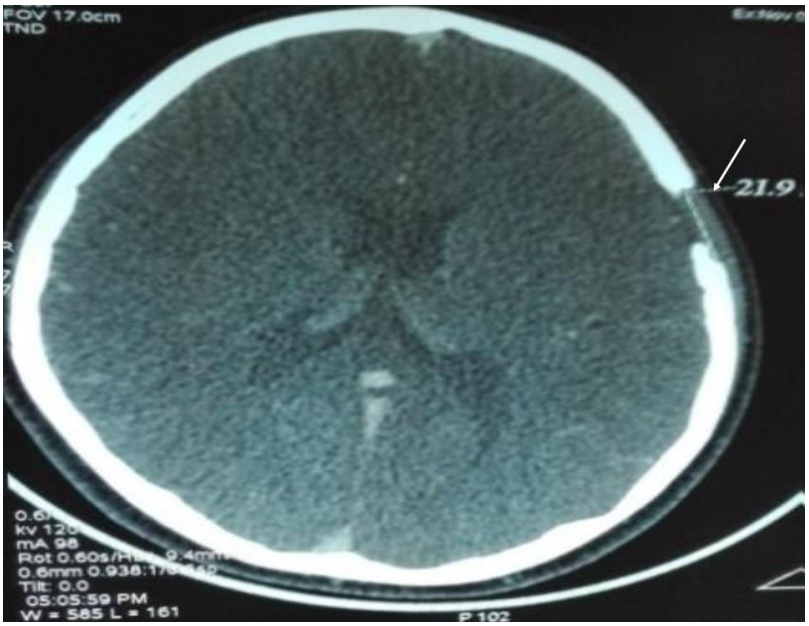

Fig. 5. Temporal osteolytic lesion of langerhans cell histiocytosis on the brain tomography

[29]. Orthopedic sequelae are common in plurifocal form: vertebra plana, cyphoscolioses and bone deformities responsible for functional disorders, tooth loss, dental articular disorder [30]. In the present series, the subsequent evolution was favorable in 3 cases. LCH was responsible for mixed bilateral sequelal deafness and diabetes insipidus in one case.

In this,study, researchers tried to highlight clinical para-clinical and therapeutic features of bone involvements in LCH characterized by its recurrence and multifocal localizations in disseminated form of the disease. However, its main limitations are the small size of our population and it is also a retrospective study.Vemurafenib, a BRAF inhibitor is effecticve in an open- label, non- randomized study in cases of LCH with BRAF- V600E mutation. Dabrafenib is another BRAF inhibitor that was efficient in refractory cases of LCH with more safety. This new therapeutic option is still not well

documented [31,32,33,34]. Therefore, further experiences need to be gained especially in the treatment with prospective trials targeting the genetic pathogenesis pathways which are the mutation of BRAF-V600E and MAPK genes [35, 36,37,38,39,40,41].

4. CONCLUSION

LCH is a rare disease in children and young adult males. Bone is the most frequently involved site. The circumstances of discovery of bone localization are the pain swelling lesion in different sites. It is characterized by lytic lesions of variable aggression. CT and/or MRI may complement radiography. Biopsy is necessary to obtain diagnosis confirmation. The prognosis of this pathology depends largely on early diagnosis, other organs affected and by the response to treatment.

CONSENT

As per international standard written informed participant consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard written ethical permission has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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