Autopsy Case Reports

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Infantile systemic juvenile xanthogranuloma case with massive liver infiltration

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ABSTRACT

Infantile systemic juvenile xanthogranuloma (ISJXG) is an uncommon form of juvenile xanthogranuloma, a non-Langerhans cell proliferation of infancy and early childhood. In a small percentage of patients, the visceral involvement—most commonly to the central nervous system, liver, spleen, or lungs—may be associated with severe morbidity, and eventually fatal outcome. Here we describe the clinical and pathological findings of a 28-day-old girl with ISJXG who died with respiratory distress syndrome. She had few cutaneous lesions but massive liver and spleen infiltration; other affected organs were multiple lymph nodes, thoracic parasympathetic nodule, pleura, pancreas, and kidneys. Additional findings were mild pulmonary hypoplasia and bacteremia. Immunohistochemistry on fixed tissues is the standard for diagnosis. Immunophenotype cells express CD14, CD68, CD163, Factor XIIIa, Stabilin-1, and fascin; S100 was positive in less than 20% of the cases; CD1a and langerin were negative. No consistent cytogenetic or molecular genetic defect has been identified. This case demonstrates that the autopsy is a handy tool, because hepatic infiltration, which was not considered clinically, determined a restrictive respiratory impairment. In our opinion, this was the direct cause of death.

Keywords
Autopsy; Congenital; Xanthogranuloma, Juvenile; Liver Diseases.

INTRODUCTION

Dendritic and histiocytic neoplasms are rare, and together make up less than 1% of neoplasms presenting in the lymph nodes or soft tissues.[1] These tumors are usually classified into two main groups based on their derivation from either mesenchymal cells or bone marrow precursors.[2,3] They occur less often during the perinatal period, and there is a study suggesting that there has been an increased incidence of spontaneous regression of certain histiocytic lesions in neonates compared to older individuals.[4]

Infantile systemic juvenile xanthogranuloma (ISJXG), an uncommon non-Langerhans cell proliferation of infancy and early childhood,[5,6] is one of the many clinical variants, with a common histopathology of the juvenile xanthogranuloma (JXG) family disorders namely (i) solitary or multiple dermal; (ii) infantile systemic; (iii) deep (soft tissue, "giant"); (iv) xanthoma disseminatum; (v) papular/generalized eruptive; (vi) benign cephalic histiocytosis; (vii) adult orbital XG; (viii) progressive nodular histiocytosis; and

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(ix) Erdheim-Chester disease.[5-8] Over the last decade, systemic forms have been increasingly reported.[9]

Stromal dendritic cells have been proposed (i.e., mesenchymal in origin) as the cells of origin, based on immunoreactivity to fascin and factor XIIIa. Immunohistochemistry, on fixed tissues, is the standard for diagnosis, and a panel of antibodies is required due to a lack of a unique cell marker.[5-8]

Although the biology of ISJXG is not clear, it often presents spontaneous regression over several years,[4] as in the isolated cutaneous form, the reason why the removal of these benign lesions is dissuaded. However, prompt and accurate diagnosis is essential. In a small percentage of patients with visceral involvement—most commonly in the central nervous system (CNS), liver, spleen, or lungs—ISJXG may be associated with severe morbidity.[10-14] Surgery, chemotherapy, and radiotherapy have been used with favorable results.[10] However, occasionally fatal outcome may occur.[10,15]

In a PubMed search, we found five reports of congenital fatal cases of ISJXG.[8,13,15-23] Herein we describe the clinical and pathological findings of a 28-day-old girl with congenital ISJXG who died with respiratory distress syndrome. In our opinion, the massive hepatomegaly caused lung restriction (which could have been present since the late gestation) hampering the pulmonary development, resulting in mild pulmonary hypoplasia. She had few cutaneous lesions but massive liver and spleen infiltration; other affected organs were multiple lymph nodes, the thoracic parasympathetic nodule, the pleura, the pancreas, and the kidneys. Additional findings were hypoplastic lungs and bacteremia.

CASE REPORT

This is the case of a 28-day-old girl without a remarkable family history, who was delivered at term after an uneventful pregnancy. She was born with counted bluish palpable nodular lesions from 0.5 to 1 cm, which were initially located on the face. At the age of 21 days, she was presented to a general hospital with irritability and progressive abdominal distention. On admission, she was pale and presented 13 visible and 6 palpable skin nodules located on her face, thorax, and extremities, and massive hepatomegaly and splenomegaly. Blood tests showed mild anemia and thrombocytopenia. The abdominal echography revealed multiple nodular lesions throughout the enlarged liver. After 24 hours, the mother decided to take her to a tertiary care hospital, where clinically congenital leukemia was suspected. The anemia and thrombocytopenia worsened, but leukocytes were normal. Serologic studies for HIV, cytomegalovirus, Epstein-Barr virus and *Toxoplasma* were negative. Serum tumor markers as alpha-fetoprotein, human chorionic gonadotropin, and carcinoembryonic antigen were negative. The platelet count ranged from 4,000 to 18,000/ mm^3 (reference range [RR]; 142-424 x $10^3/mm^3$), hemoglobin range was 7.5-11.3 g/dL (RR;12.2-18.1 g/dL); peripheral blood leukocyte count range was 4,580-8,520/mm^3 (RR; 4.60-10.20 x $10^3/mm^3$). Electrolytes showed persistent hyponatremia (sodium range 124-133 mEq/L [RR; 132-144 mEq/L]). However, potassium and renal function tests were within the normal limits. Three days after admission she was suffering from anasarca, and liver function tests showed low serum albumin 1.4 g/dL (RR; 3.50-5.00 g/dL) and notable coagulopathy with an increased Prothrombin Time and a I.N.R of 2.52 (RR; 1); serum aspartate aminotransferase range was 11-325 UI/L (RR; 12-50 UI/L), alanine aminotransferase range was 1.1-55 UI/L (RR; 10-40 UI/L), γ-glutamyl transpeptidase 24.3 UI/L (RR; 10-40 UI/L), total bilirubin range 2.59-8.75 mg/dL (RR; 0.20-1.00 mg/dL), alkaline phosphatase 38.54 UI/L (RR; 50-136 UI/L), and C-reactive protein 47.72 mg/L (RR;< 5 mg/L). Serum immunoglobulin levels were: IgG 169 mg/dL (RR; 100-360 mg/dL), IgM 14 mg/dL (RR; 26-122 mg/dL), IgA 3 mg/dL (RR; 7-37 mg/dL), and IgE 0.71 (UI/mL, <1.5). Serologic testing for syphilis was negative. A second abdominal ultrasound revealed retroperitoneal lymphadenopathy and ascites, and the kidneys were normal.

The clinical course following admission was of rapid deterioration with worsening hepatomegaly, hyperbilirubinemia, abdominal distention, abdominal circumference 43.5 cm (Figure 1A) and ascites, radiological thoracoabdominal images showed bilateral diaphragm elevation (Figure 1B) and intestinal distention.

On the fourth day a limited bone marrow aspirate showed no abnormal infiltrate or hemophagocytosis, and an excisional skin biopsy was taken. The patient died on the fifth day with respiratory distress syndrome (respiratory rate 70 breaths per minute), without evidence of hemorrhage.

PATHOLOGIC FINDINGS

Due to the working diagnosis of congenital leukemia, a skin excisional biopsy was received and was evaluated immediately by fine needle aspiration (FNA) (caliber 26), which disclosed large histiocytic-like cells (Figure 2); therefore, the diagnosis of histiocytosis was suggested. The surgical specimen was studied on formalin-fixed and paraffin-embedded tissue sections.

Light microscopic study at low magnification revealed a dense cellular nodule poorly demarcated involving the entire dermis. At higher magnification,

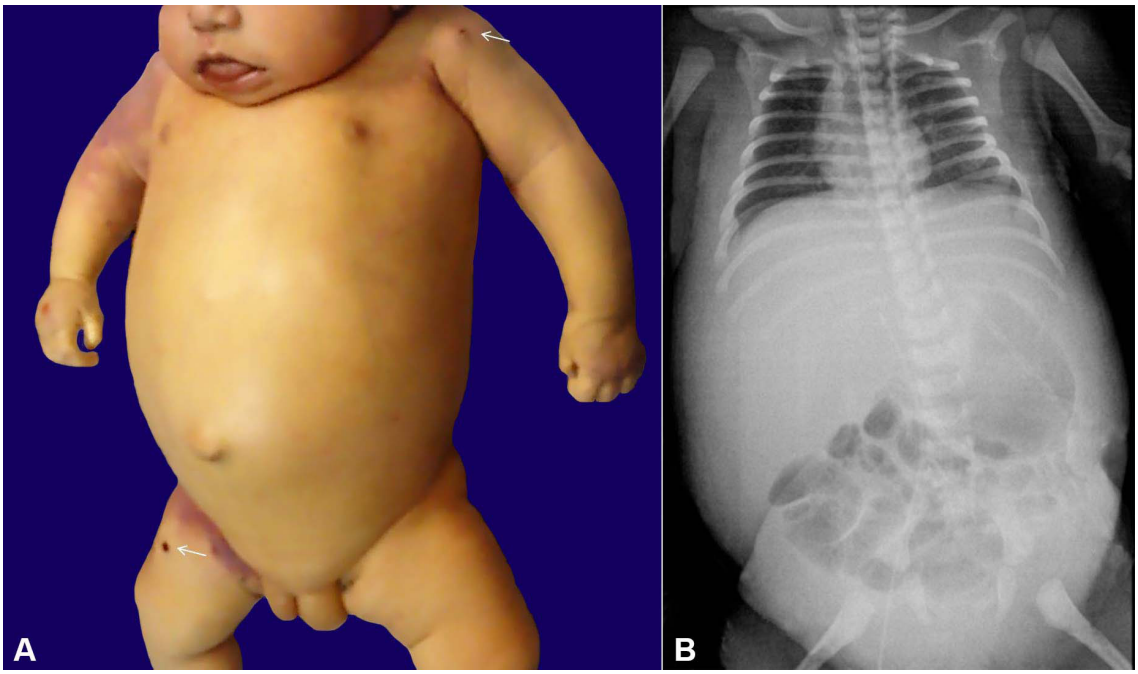

Figure 1. A – Gross examination of the corpse showing marked abdominal distention (abdominal circumference 43.5 cm). Note the skin nodules (arrows) on the upper left extremity and lower right extremity, and genital edema; **B –** Plain thoraco-abdominal radiograph demonstrating the enlarged liver and diaphragm elevation.

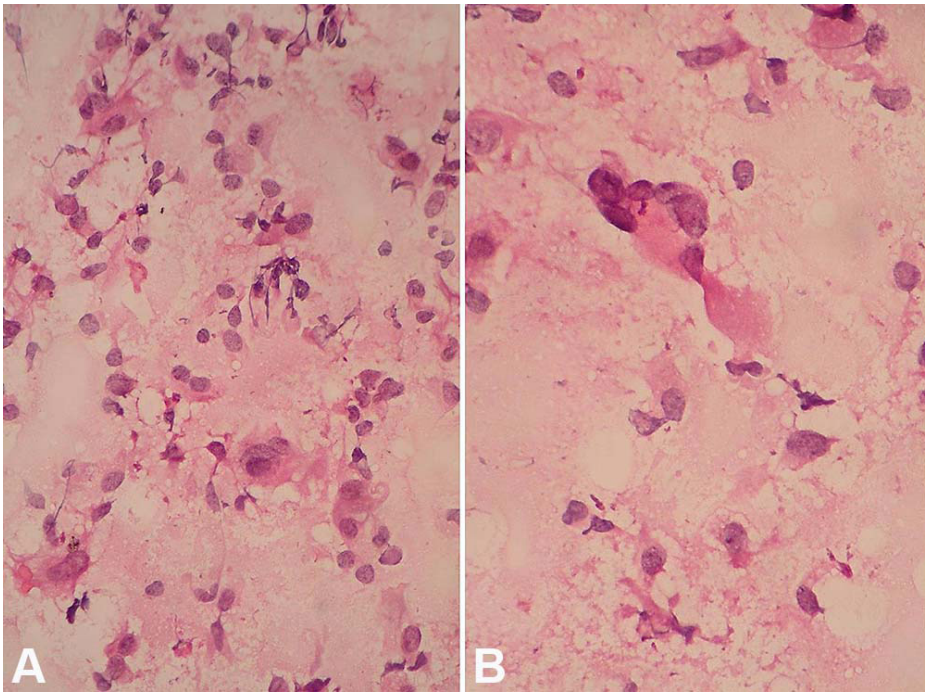

Figure 2. Cytological example obtained by FNA of the skin biopsy. Disclosed monotonous histiocytic type cells. Cytologic features allowed us to suggest the diagnosis of histiocytosis. FNA = fine needle aspiration. (H&E stain), **A** (100 X), **B** (400 X).

the predominant cells appeared to be histiocytes, with occasional eosinophils. There were few Touton giant cells (Figure 3), but no cells with foamy cytoplasm, nuclear atypia, or mitotic figures.

The diagnosis of JXG was made. Immunohistochemical staining showed that all histiocytes were positive for CD68, CD163, and Factor XIIIa, and negative for S-100, CD1a, and langerin (Figure 4) (CD68/KP-1:700/Biocare, CD163/1:50/BioSb, Factor XIIIa/1:200/Biocare, S-100/1:3800/Dako, CD1a/1:500/Dako, and langerin/1:40/BioSb, respectively).

Autopsy permission was restricted to the thoracic and abdominal organs. The infant had generalized edema, an abdominal circumference of 43.5 cm, ascites, and mild jaundice. The postmortem examination revealed intense small bowel distention; the liver weighed 500 g (RR; 121 ±39.2 g); and was extensively infiltrated by irregular micronodular tumor (Figure 5).

At the cut surface, the liver gave off a fetid odor. The histology showed that tumor cells consisted of no plump histiocytes and spindle cell forms, and a few Touton giant cells were present. The tumor obliterated many portal and hepatic veins. In the liver, the tumor was preferentially located within the portal triads, but the biliary epithelium was spared (Figure 6).

Macroscopically the spleen was apparently free of tumor, but microscopically there were abundant plump histiocytic cells, positive for CD163, which obliterated the sinusoids (Figure 7).

Nodular tumor lesions were also present in the thoracic lymph nodes, pleura (Figure 8), mesenteric lymph nodes, perirectal fat (Figure 9), pancreas (Figure 10), periadrenal, and both kidneys (Figure 11). Multiple bacterial colonies were identified in the hepatic, splenic, and pulmonary vascular spaces (Figure 12), however, blood cultures were not performed. Other relevant findings were pulmonary atelectasis and mild pulmonary hypoplasia (Figure 13). Death was attributed to sepsis and respiratory distress syndrome secondary to pulmonary hypoplasia worsened by severe abdominal distention.

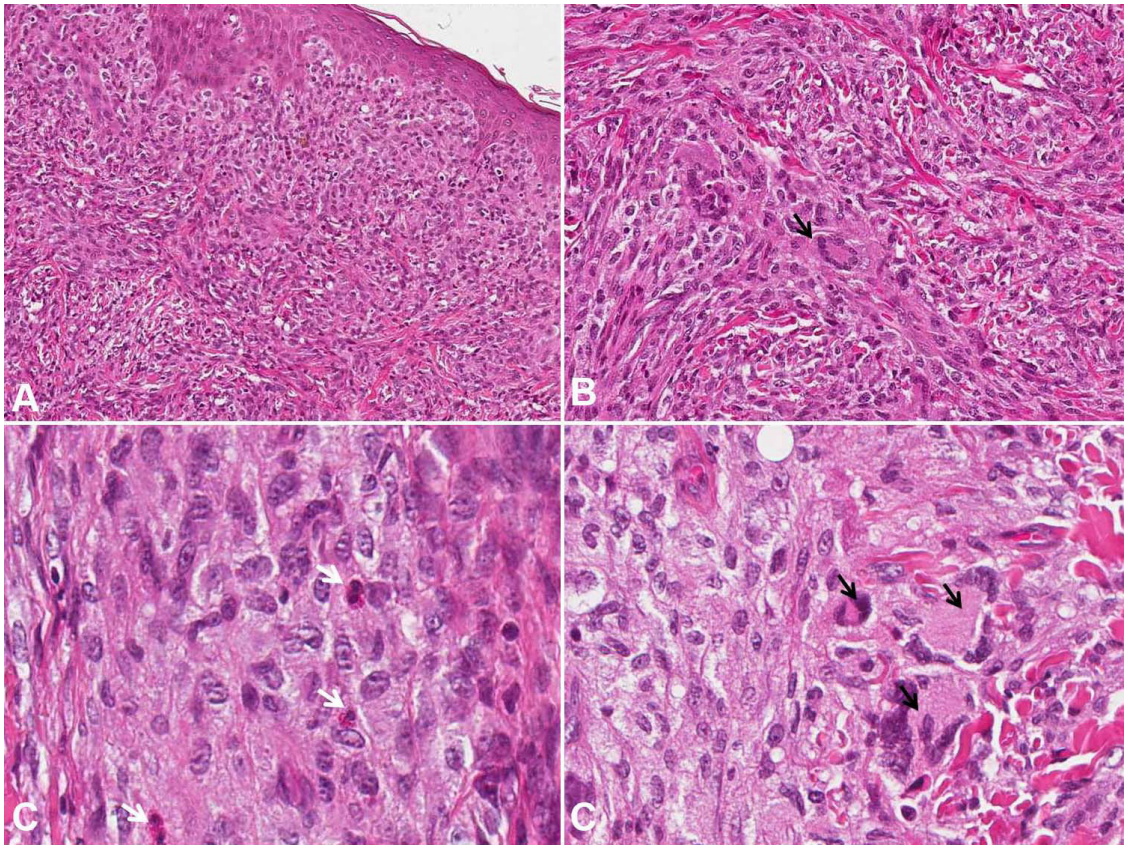

Figure 3. Photomicrographs of the skin biopsy showing dermal expansion for infiltration of histiocytes and occasional Touton giant and eosinophil cells (H&E stain) **A** (40X), **B** (100X), **C** (400 X), and **D** (400_X).

DISCUSSION

The aid of recent advances in immunohistochemistry enabled better classification of dendritic and histiocytic cell neoplasms and improved the knowledge of tumor biology and histogenesis, which may be helpful in the management of these rare diseases. Dermal and interstitial dendrocytes are responsible for JXG.[2,3] JXG and Langerhans cell histiocytosis (LCH), together in the category of "dendritic cell-related proliferations",

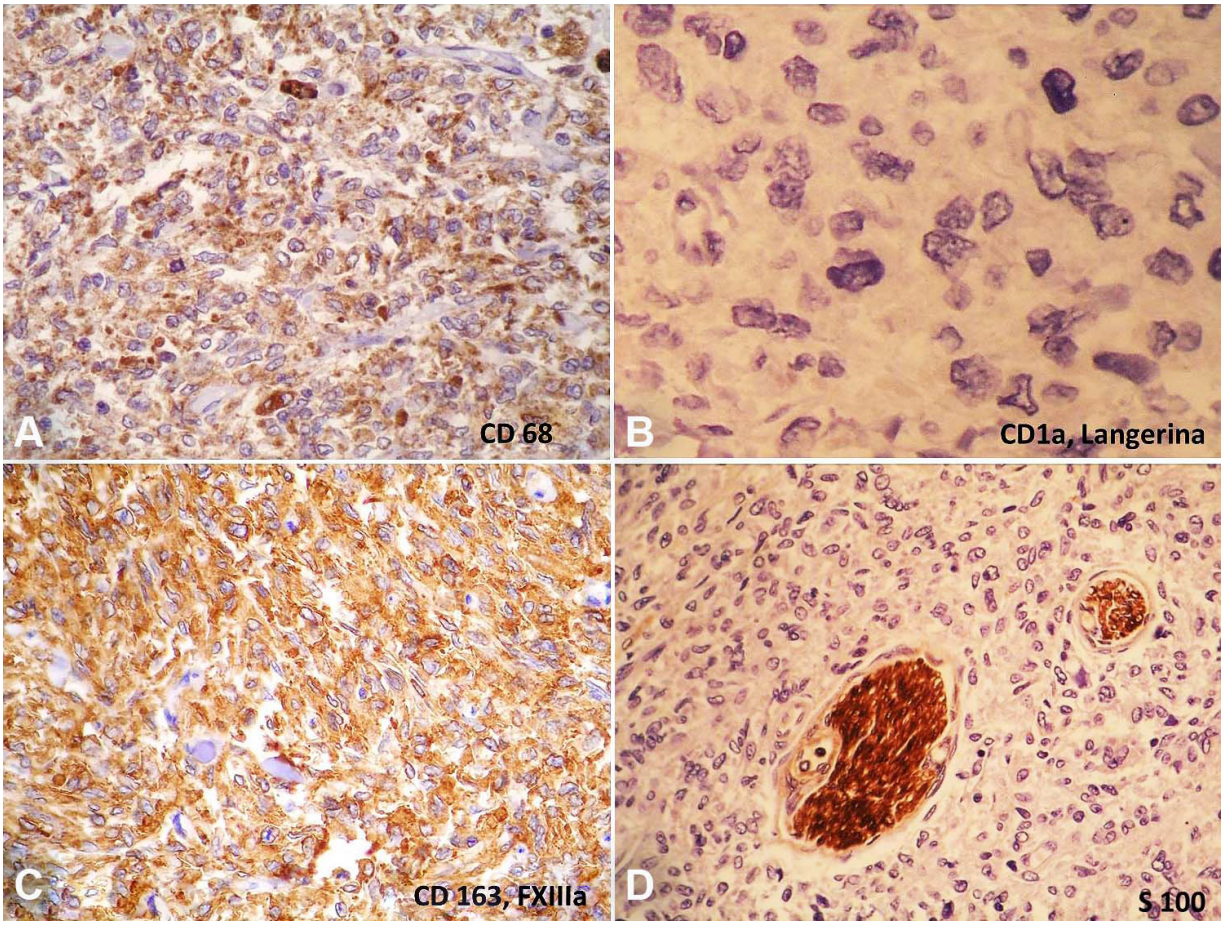

Figure 4. Photomicrographs of the skin biopsy. Immunohistochemistry was positive for CD68 (**A**) and Factor XIIIa (**C**), and negative for CD1a (**B**) and S-100 (**D**).

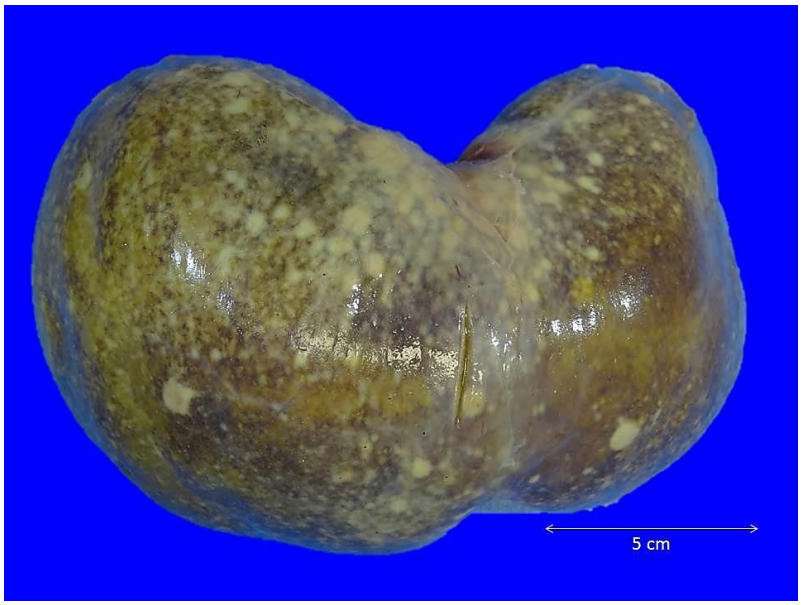

Figure 5. Gross view of the liver showing the parenchyma diffusely infiltrated by the tumor.

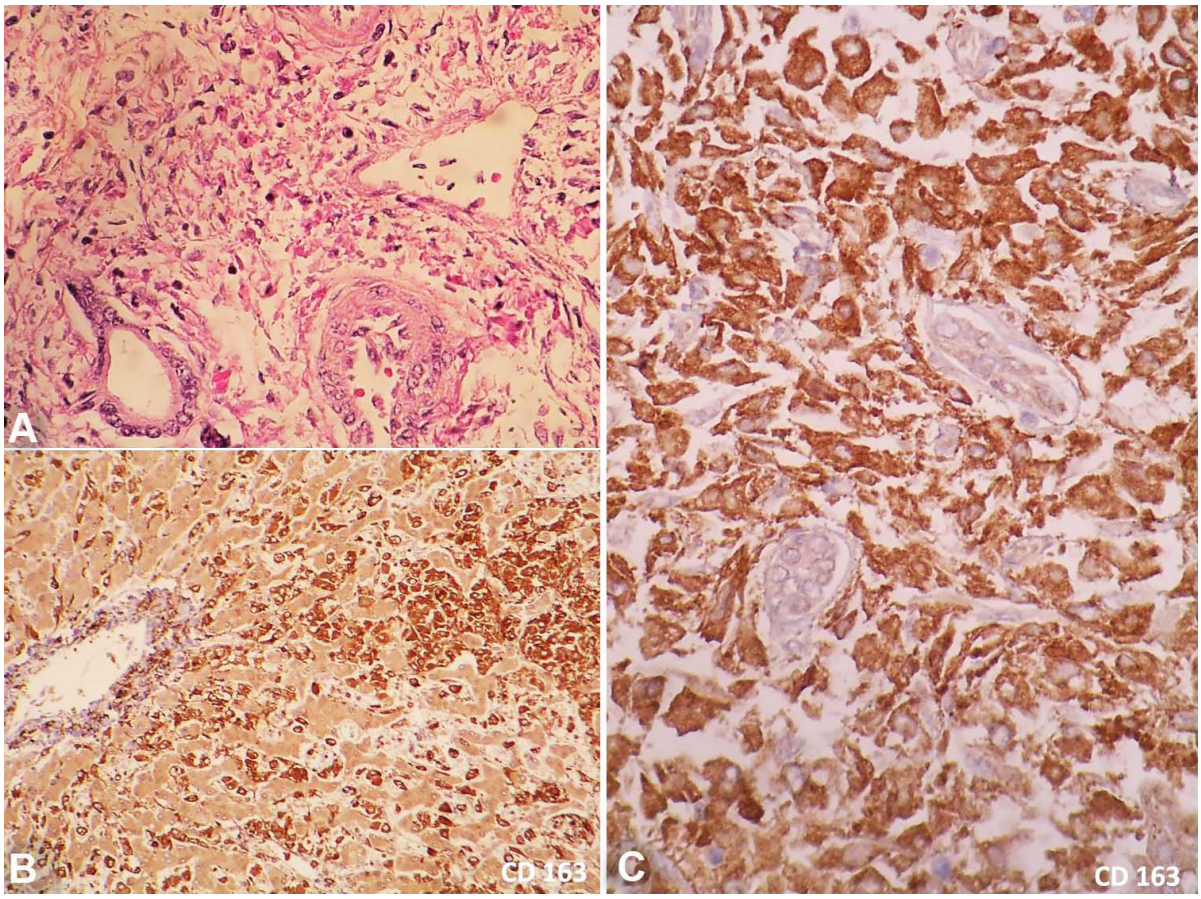

Figure 6. Photomicrographs of the liver. **A**, and **C** show the portal tract with diffuse infiltration by histiocytes and in **B** a central vein. The bile ducts are not affected, which is clearly seen with CD163. **A** (H&E, 100X), **B** (400X) and **C** (100X).

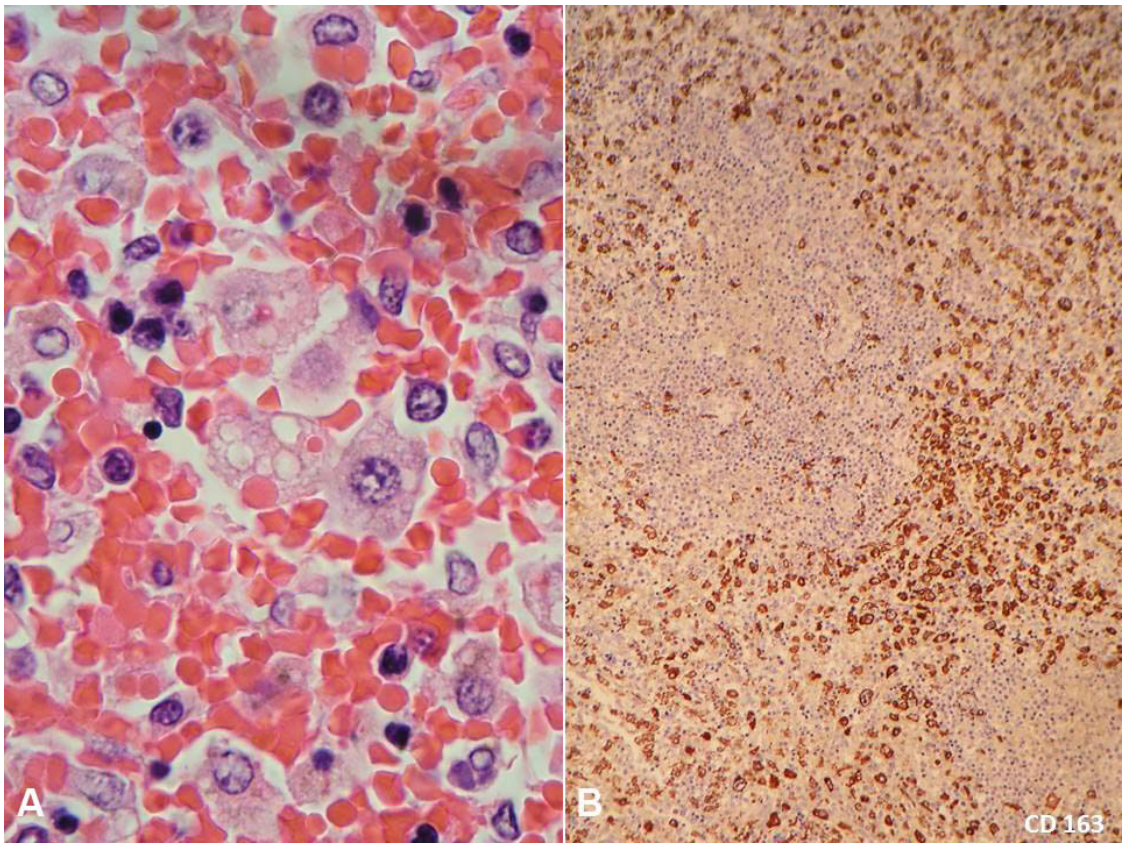

Figure 7. Photomicrographs of the spleen. **A** and **B –** High magnification of multisystemic juvenile xanthogranuloma with diffuse infiltration by plump histiocytes, which is strongly positive for CD163. **A** (H&E, 400X) and **B** (100X).

Figure 8. Gross back view of the cardiopulmonary block showing yellowish pleural nodes in both lungs.

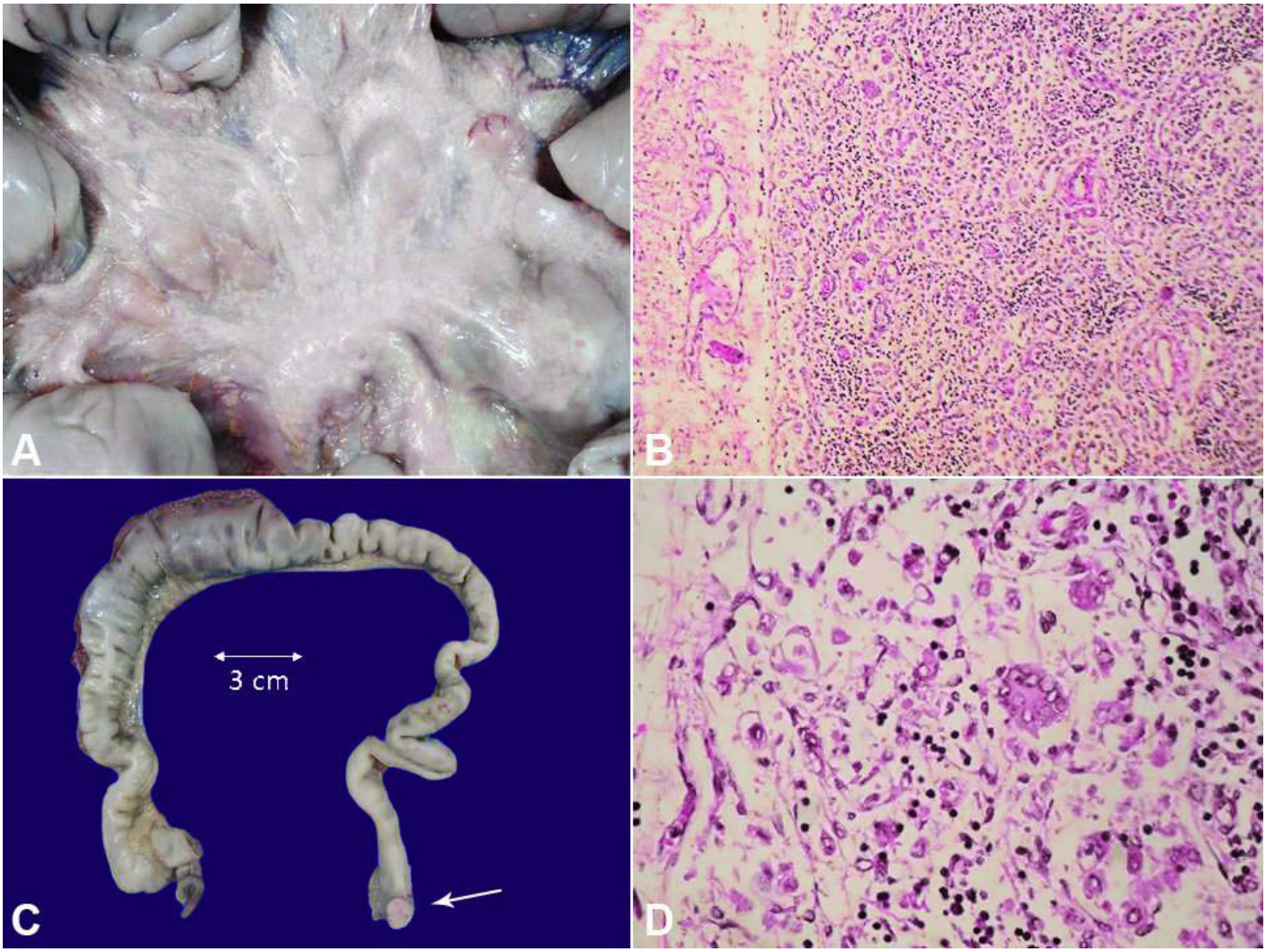

Figure 9. A – Gross view of the mesenteric and perirectal lymph nodes (**C**). The lymph nodes are infiltrated by foamy macrophages and Touton giant cells (**B** and **D** respectively) (H&E, B(40X) and D(400X).

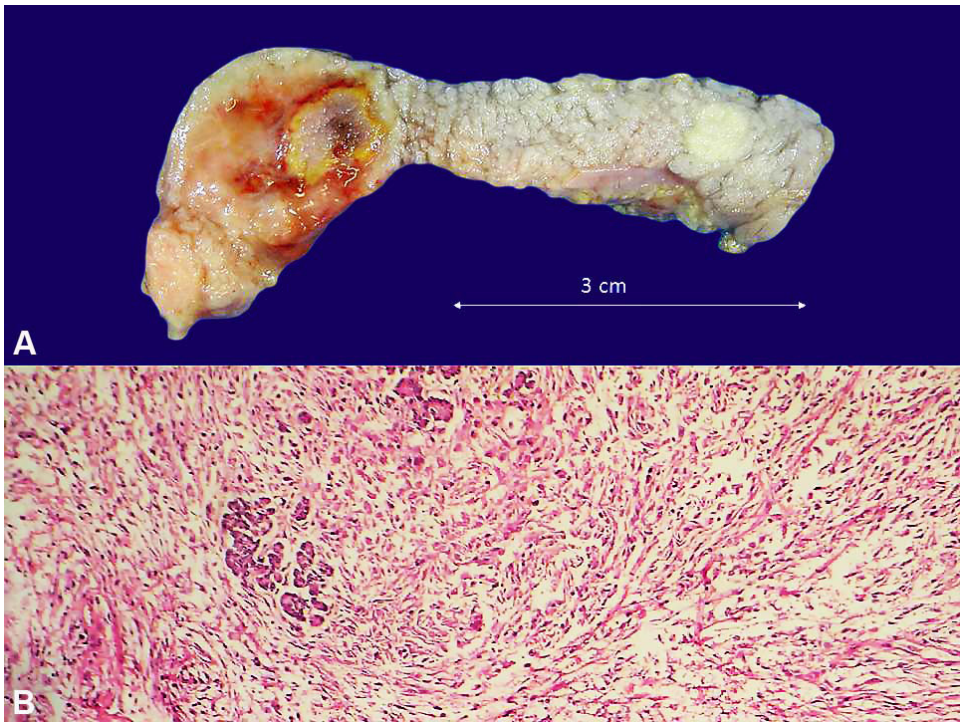

Figure 10. A – Gross view of the pancreas revealed nodular infiltration of the tale. The head of the organ shows a necrotic area surrounded by a hemorrhagic halo; **B –** Photomicrograph of the pancreas showing substitution of the normal parenchyma by the neoplasm. H&E (40X).

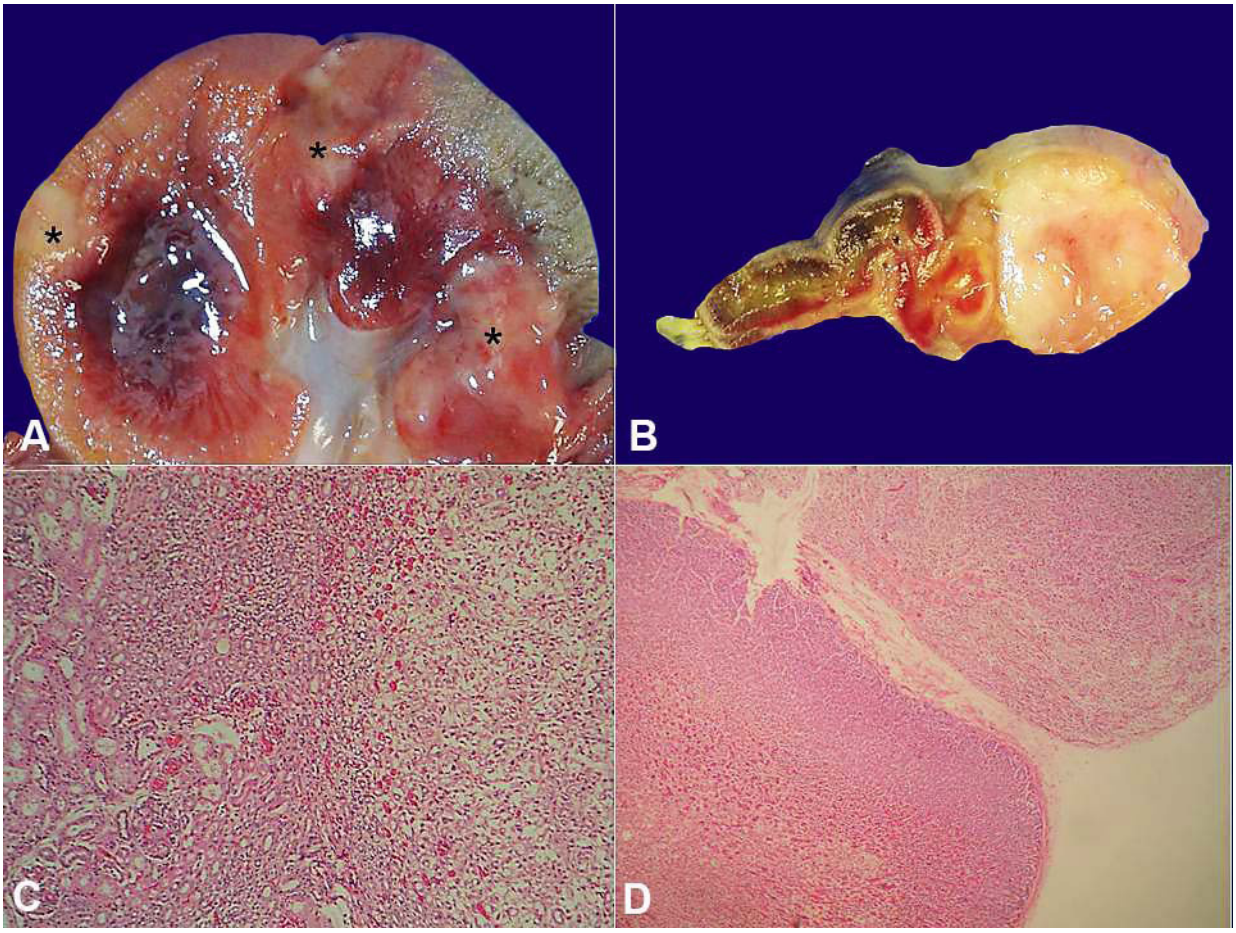

Figure 11. Gross view of the kidney in **A** and adrenal gland in **B**. The macroscopic examination shows nodular renal infiltration (asterisks) and periadrenal nodular lesion; **C –** Photomicrograph of the kidney with neoplastic infiltration (H&E, 100X) and **D** depicts the peripheral adrenal neoplastic nodule (H&E, 40X).

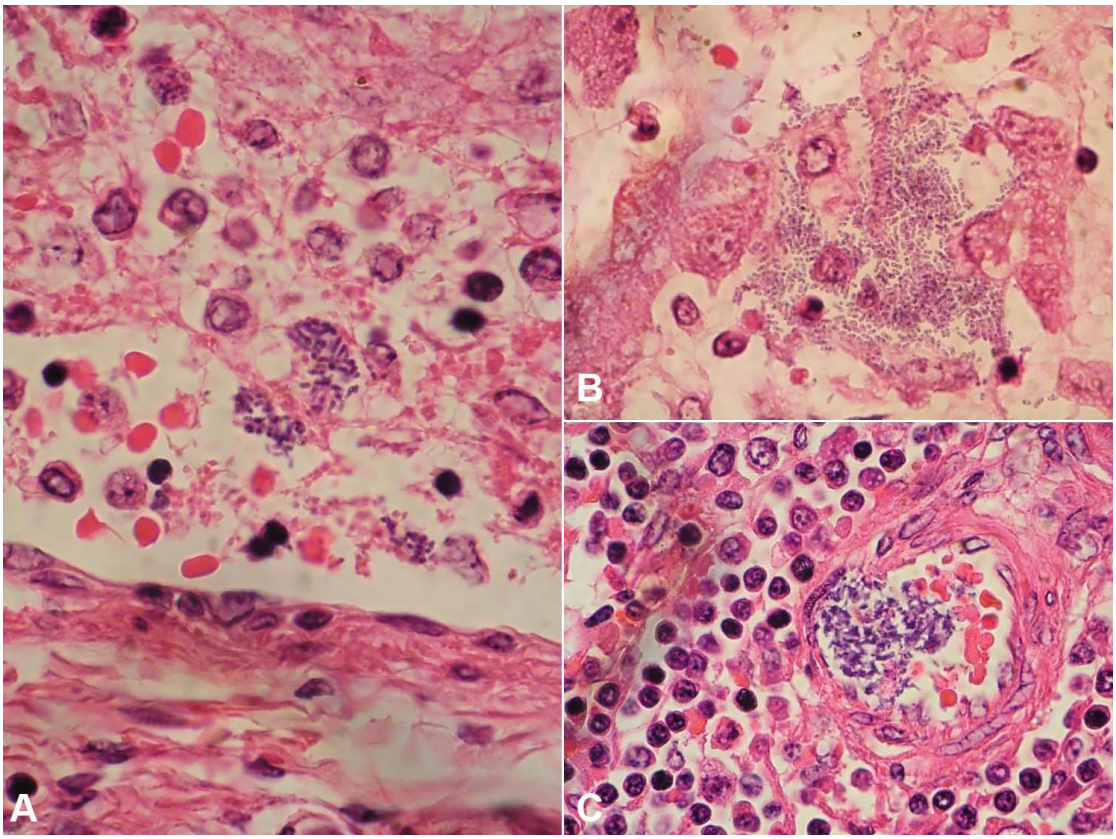

Figure 12. Photomicrograph of the blood vessels with colonies of bacteria in the **A –** lung (H&E, 1000X); **B –** liver (H&E, 1000X); and **C –** spleen (H&E, 1000X).

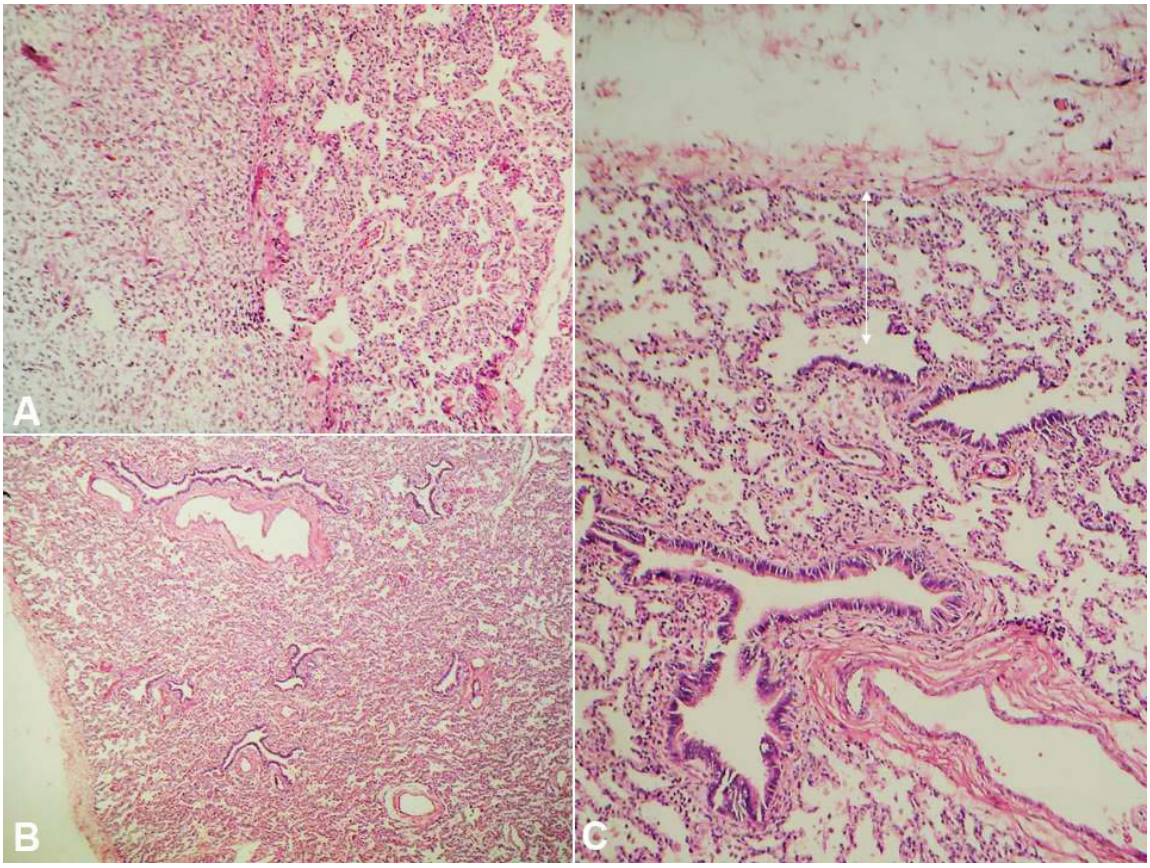

Figure 13. Photomicrographs of the lung showing in **A –** nodular pleural infiltration (H&E, 100X); **B –** atelectasis (H&E, 40X), and at the periphery of an acinus in this hypoplastic lung (right); **C –** A radial count (arrow) is below the normal of 4 to 6 for a term infant, confirming the diagnosis of hypoplasia (H&E, 100X).

currently are separated from the macrophage-related proliferations. The reported cases with the coexistence of JXG and LCH suggest their common origin.[24,25] Patients with JXG and neurofibromatosis types 1 and 2, as well as a triad with juvenile chronic myelogenous leukemia, has been reported.[26] In contrast to other Xanthomatous diseases, JXG is a normolipemic disorder.[18,27]

The Kiel Pediatric Tumor Registry reported 129 cases of JXG over 36 year (0.52% among 24,600 children), showing the very low frequency of the disease.[8] JXG affects mainly children younger than 2 years of age.[8,28] In the analysis of Janssen and Harms,[8] there were 71.3% of patients younger than 12 months; in contrast, Dehner[15] reported a frequency of 45% within the first year. According to various authors, the male to female ratio goes from "1.1:1" to .7:1".[8,26,29] However, when considering only newborns, the ratio of male to female is 1:2.4 (Table 1). Clinically there is a broad spectrum of differential diagnoses, including reactive processes, or benign or malignant tumors.

The literature is replete with single-case reports of cutaneous JXG—the most common form of non-LCH of childhood—but JXG may occur at any site of the body, and only 4-5% of children with JXG have the infantile systemic variant of the disease.[8,10,15,16,19,20,30,31] A PubMed search revealed very few congenital and lethal ISJXG cases similar to ours (Table 1), with none having more than five affected sites; however, in our case, there were eight affected sites. In ISJXG, the most important morphologic differential diagnosis is with LCH, the most common form of dendritic cell proliferations.[1-3]

In ISJXG, the skin is involved in only 50% of cases, and the liver is involved in most of these cases, with predominantly portal infiltrate spilling over into the adjacent lobule but sparing the biliary tree, which contrasts with LCH.[7] As Fan and Sun[30] reported, when JXG has liver involvement, it is a relatively benign disease in its worst form. The location and character of hepatic lesions are important clues to the differential diagnosis, as reported by Favara.[32] Other involved sites include: soft tissue, upper aerodigestive tract, CNS, lymph node, bone marrow, kidneys, and lung; other more unusual sites affected are spleen, myocardium, retroperitoneum, pancreas, and adrenal glands.[33,34]

From the 174 JXG cases reviewed by Denher,[15] 8 had systemic disease, 2 were diagnosed at birth with hepatosplenomegaly and died of acute hepatic failure, but 1 survived after systemic chemotherapy. From 1996 to 2011 there were at last 31 informed cases of the clinical variant ISJXG; in 17 cases the condition was present at birth, 6 of these cases were fatal (35.2%) (Table 1). The reported ISJXG fatal cases of the neonates had a similar clinical presentation to our patient. This supports the concept that ISJXG, complicated by the hepatic infiltration in the neonatal period, is a life-threatening disease caused by hepatic failure, or mainly because severe hepatosplenomegaly induced respiratory failure, as happened in our case. The severe hepatosplenomegaly in our case could have been present since late gestation and compressed the thoracic cavity resulting in mild pulmonary hypoplasia by upward compression the diaphragm—a finding not previously reported in ISJXG.

This patient with JXG, which was apparently limited to the skin, must have had a complete physical examination to detect the systemic form, with laboratory and imaging studies if other abnormalities were suspected. Diagnostic studies may include computed tomography or magnetic resonance imaging (MRI), ultrasonography of the abdomen, a radionuclide bone scan, and a detailed ophthalmologic examination. In the instance of neonatal ISJXG where a quick diagnosis is required, FNA cytology made from the surgical biopsies is a useful tool for the initial differential diagnostic procedure and management.[21,35,36] In our case, with the working diagnosis of congenital leukemia, the cytology of the skin biopsy allowed the proposed diagnosis of histiocytosis within a few minutes. Clinical presentations include anemia and thrombocytopenia; however, there is little reliable information on their natural history or the treatment of choice. The vast majority of congenital ISJXG cases, even those with visceral involvement, experience disease regression without specific treatment;[4] however, severe morbidity has been reported in some cases, which need supportive interventions and chemotherapy.[10,22,28]

Treatment protocols recommended for patients with symptoms who have unresectable lesions are those used for LCH. The LCH-III protocol—the most common treatment strategy—was first suggested by Nakatani et al.[23] Although most patients with the multisystemic disease are infants and particularly susceptible to the adverse effects of chemotherapy, a prudent approach should emphasize the supportive

care, reserving chemotherapy or radiation when this treatment is perceived as necessary.

Immunophenotypically, cells express CD14, CD68, CD163, Factor XIIIa, Stabilin-1, and fascin; S100 is a variable positive in less than 20% of the cases; nevertheless, none of these markers are specific for ISJXG,[37] and CD1a and langerin are negative. In our case, CD163 and Factor XIIIa were positive,

Table 1. Reported cases of infantile systemic juvenile xanthogranuloma, detected at birth, with liver affection (n=17), searched in PubMed. Six cases (35.2%) were fatal

Author/year	No. cases	Age at diagnosis	Sex	Sites	Treatment	Outcome
Janssen and Harms[8]	1	Birth	F	Skin, lung, heart, **liver**, spleen, kidney, small and large intestine, BM	VP16, DX, Ig	**DOD**, 34 days
Freyer et al.[10]	2	Birth	F	Skin, soft tissue, lung, **liver,** retroperitoneum	Supportive	Well/2 m
		Birth	F	Bone, l**iver**, spleen, adrenal gland	MPD	Well/2 y
Haughton et al.[12]	1	Birth	F	Skin, **liver**	Liver transplantation	ADF/2 y
Chantorn et al.[13]	2 (twins)	Birth	F	Skin, **liver**	PDN	AWD/17 m
		Birth	F	Skin, **liver**	PDN	
Papadakis et al.[14]	1	Birth	M	Skin, **liver**	VBL, VP16, 6-MP	AWD/7.5 m
Dehner[15]	3	Birth	M	**Liver**, spleen and lung	VA, corticosteroids	**DOD**/2 m
		Birth*	M	Skin, soft tissue, **liver**, spleen	CSA, VBL, MPN	ADF/8 y
		Birth	F	**Liver**, spleen, adrenal, intestine and lymph nodes	VA, corticosteroids	**DOD**/1 m
Hu et al.[16]	1	Birth	F	Skin, **liver**, spleen, pancreas, adrenal gland, mesenteric lymph nodes	VP16, DX	**Died** on day 29 from multiorgan failure and sepsis
Azorín et al.[17]	1	Birth	F	Skin, BM, **liver**	MPN, VBL, Cytarabine, MTX and RT of the liver	**DOD**/78th day of life
Fan and Sun[30]	1	Birth	M	**Liver**, spleen, BM, lymph node, lung	PD, VBL, 6-MP and MTX	AWD/20 m
Takeuchi et al.[19]	1	Birth	M	Skin, placental, around portal vein	LCH oriented chemotherapy	ADF/2 y
Santiago et al.[20]	1	Birth	F	Soft tissue, **liver**, BM	VBL, cytarabine	**Died** on day 65 with septic shock
Nakatani et al.[23]	1	Birth	F	CNS, hip, **liver** and spleen	Cytarabine, vincristine, PDN, MTX	ADF/2 y
This case	1	Birth	F	Skin, **liver**, spleen, pancreas, kidneys, lymph nodes, pleura, parasympathetic nodes	Managed symptomatically	**Died** on day 120 with respiratory distress and septic shock

*Previously reported by Freyer et al. *J Pediatr* 1996;129:227–37; 6-MP = 6-mercaptopurine; ADF = alive disease-free; AWD = alive with disease; BM = bone marrow; CNS = central nervous system; CSA = cyclosporine; DOD = dead of disease; DX = dexamethasone; F = female; Ig = immunoglobulins; LCH = Langerhans cell histiocytosis; M = male; MPN = metilprednisolone; MTX = methrotexate; PDN = prednisone; RT = radiation therapy; VA = Vinca alkaloids; VBL = vinblastine; VP16 = etopsoside.

while S100 and CD1a were negative. No consistent cytogenetic or molecular genetic alterations have been identified.[16,17]

CONCLUSIONS

Infantile systemic forms of JXG have different presentation, response to the treatment and outcome. Incidence rates are about 0.1 case/1,000.000 of children younger than 15 years old. Although this report has the inherent limitation of a case report, it presents the importance of the autopsy examination, which can still influence medical practice and show several problems that were clinically undetected. In this case, the disseminated neoplasms could have been diagnosed earlier, because, in neonatal patients in whom JXG is considered, systemic forms could be underestimated, as in this case. For new patients with cutaneous JXG who have other symptoms, clinicians must be alert to refer the patient to a tertiary care center where tests, including (at the very least) MRI of the brain and ultrasonography of the abdomen, can be undertaken to enable accurate diagnosis. Adjuvant chemotherapy could have changed the course of the disease in our case. Although JXG is the most common benign type of histiocytosis in infants, the ISJXG variant is a very rare and distinctive clinicopathologic entity, generating a challenging group of patients. More than 70% of the patients are younger than 1 year. ISJXG must be distinguished principally from LCH. The clinical findings are attributable to sites of disease and can be severe. No published case has eight affected sites of the body, as in our case. The most common sites of disease beyond subcutaneous soft tissue are liver, spleen (or both), lung, and CNS. Exceptionally, liver, spleen, or lung involvement cause serious consequences, and the gold standard for diagnosis is the biopsy. The respiratory distress and bacteremia, as in our case, may be the cause of death in most cases.

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