# COMPUTED TOMOGRAPHY FINDINGS IN PATIENTS LESS THAN 20 YEARS OLD WITH LYMPHOMA*

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**Abstract**   OBJECTIVE: To describe the general findings of lymphoma and their histological patterns in patients less than 20 years old. MATERIALS AND METHODS: Twenty-two cases (16 male and 6 female, mean age 11.5 years) from the digital archive of computed tomography at the Cancer Control Center of "Hospital Universitário Pedro Ernesto – Universidade do Estado do Rio de Janeiro", Rio de Janeiro, RJ, Brazil, were retrospectively analyzed in the period between March 2003 and July 2005. Of these 22 cases, 12 were Hodgkin's and 10 were non-Hodgkin's. RESULTS: Overall, mediastinal lymphadenomegaly was the most frequent finding (59%), with predominance in the Hodgkin's subgroup (75%), followed by hepatosplenomegaly (50%) and cervical and retroperitoneal lymphadenomegaly (27.3%). The Hodgkin's subgroup presented a prevalence of lymphadenopathy, in many lymph node chains, followed by hepatosplenomegaly (50%). One case was found with unilateral tonsillar mass, pulmonary ground-glass opacities, and renal nodules. In the non-Hodgkin's subgroup, the disease was predominantly extranodal, characterized by hepatosplenomegaly (50%), thickening of the intestinal wall (40%), pleural effusion (30%), pulmonary nodule (20%), ascites (10%), pericardial effusion (10%) and mixed bone lesions (10%). CONCLUSION: Computed tomography is an extremely useful method for detection, staging and follow-up of lymphomas, with alert findings like mediastinal lymphadenopathy, hepatosplenomegaly, unilateral tonsillar mass and thickening of intestinal wall.
*Keywords:* Lymphoma; Computed tomography.

**Resumo**   *Aspectos da tomografia computadorizada no linfoma em pacientes abaixo de 20 anos de idade.*
OBJETIVO: Descrever os achados gerais do linfoma em pacientes abaixo de 20 anos de idade e por subtipo histológico. MATERIAIS E MÉTODOS: Estudo retrospectivo do arquivo digital de tomografia computadorizada do Centro de Controle do Câncer do Hospital Universitário Pedro Ernesto da Universidade do Estado do Rio de Janeiro, no período de março de 2003 a julho de 2005. Dos 22 casos — 16 do sexo masculino e 6 do sexo feminino, com média de idade de 11,5 anos —, 12 eram do subtipo Hodgkin e 10 eram não-Hodgkin. RESULTADOS: Dos achados gerais, verificamos as linfonodomegalias mediastinais como o mais freqüente (59%), com predomínio no grupo Hodgkin (75%), seguido por hepatoesplenomegalia (50%) e linfonodomegalias cervicais e retroperitoneais (27,3%). No subtipo Hodgkin houve predomínio do acometimento linfonodal, em sucessivas cadeias, seguido pela hepatoesplenomegalia (50%). Verificamos um caso de massa tonsilar unilateral, opacidade pulmonar em "vidro-fosco" e nódulos renais. No subtipo não-Hodgkin houve predomínio extranodal caracterizado por hepatoesplenomegalia (50%), espessamento de alça intestinal (40%), derrame pleural (30%), nódulo pulmonar (20%), ascite (10%), derrame pericárdico (10%) e lesões ósseas mistas (10%). CONCLUSÃO: A tomografia computadorizada é de grande valia no diagnóstico, estadiamento e seguimento do linfoma, com achados de alerta como massa linfonodal, notadamente mediastinal, hepatoesplenomegalia, massa unilateral na tonsila e espessamento parietal de alça intestinal.
*Unitermos*: Linfoma; Tomografia computadorizada.

## INTRODUCTION

The term lymphomas refer to malignant neoplasms of specific cells in the lymphatic system (T-cells, B-cells and histiocytes)[1,2].

They are subdivided into two groups, Hodgkin's lymphomas (HL) and non-Hodgkin's lymphoma (NHL)[1]. NHL is more frequent in the childhood than HL, and is the third most common neoplasm after leukemia and central nervous system tumors in children less than 16 years of age. HL represents about 5% of all cancers in infants and children[3].

NHL is prevalent in children less than 16 years of age, while HL most frequently affects children with more than five years of age and is rare under this age. The inci-

dence is higher in males at a 3:1 ratio for NHL, and 2:1 for HL[3].

Clinical characteristics, radiological findings, histological patterns, therapy and prognosis of pediatric Hodgkin's disease are similar to those of Hodgkin's disease in adults[3]. Generally, HL is characterized by the orderly spread of the disease from a lymph node group to another[4]; so frequently the involvement of upper mediastinal lymph nodes (both prevascular and paratracheal) is observed in about 98% of patients with intrathoracic disease. Approximately one third of these patients present unilateral or bilateral hilar lymphadenopathy[5]. Thymic involvement is observed in up to 70% of patients with mediastinal Hodgkin's disease, generally associated with an increase of lymph nodes in other sites of the mediastinum[5].

In the childhood, the majority of NHL is extranodal, in contrast to both the NHL in the adult and Hodgkin's disease at any age range. In the childhood, the most frequent primary site is the abdomen, particularly the ileocecal region, followed by the mediastinum (approximately 25%)[3].

Imaging methods, particularly computed tomography, are invaluable tools for evaluating the disease extent, planning the treatment and analyzing the subsequent response to the therapy[6].

The aim of the present study was to describe general findings of computed tomography according their histological subtype in less-than-20-year-old patients with diagnosis of lymphoma.

## MATERIALS AND METHODS

Retrospective study of digital files of the Computed Tomography Unit in Centro Universitário de Controle do Câncer at Hospital Universitário Pedro Ernesto – Universidade do Estado do Rio de Janeiro, Rio de Janeiro, RJ, Brazil, during the period between March 2003 and July 2005. In this period 1,356 computed tomography studies were performed in patients with less than 20 years of age. Of these patients, 22 were diagnosed with lymphoma - 12 of them HL, and 10 NHL.

Inclusion criteria were: age under 20, and diagnostic and histopathological confirmation of lymphoma type. Two patients

were excluded due the absence of histological categorization (follow-up in another hospital unit).

The equipment utilized was a GE HiSpeed helical model, with a protocol including base of the neck, chest, abdomen and pelvis.

All of the studies were reviewed by two investigators, and only those where there was a consensus were taken into consideration.

Of a total of 22 cases, 12 were HL, and 10 NHL. Sixteen patients were men and six women, with ages ranging between three and 20 years (mean age 11.5). In the HL group was in the age range between six and 20 years, and the NHL, between three and 20 years.

In the HL group, eight patients were male and four, female. In order of frequency, the following histological subtypes were found: mixed cellularity (41.6%), nodular sclerosis (33.3%), lymphocytic predominance (16.6%), and lymphocytic depletion (8.5%). In the NHL group, eight were men, and two were women. Predominant histological subtypes were: diffuse large B cell lymphomas (40%); Burkitt's lymphomas (40%), followed by T-lymphoblastic lymphomas (10%) and small-cell lymphomas (10%).

Of a total of 22 patients, 14 (63%) underwent examination for the first time, and eight (36%) for follow-up. No patients presented with coexistent infection. One patient died during the study period.

## RESULTS

Among the computed tomography findings, we observed that mediastinal lymphadenopathy was the most frequent finding (59%), predominating in the HL group (75%), followed by hepatosplenomegaly (50%), cervical and retroperitoneal lymphadenopathy (27.3%) (Tables 1 and 2).

As regards the presence of lymphadenopathy (Table 1) a high predominance in the HL group compared with the NHL group. In the majority of cases, the lymph node mass presented homogeneous contrast enhancement, with the exception of two cases: one in the HL group, and another in the NHL group (Figure 1). No calcified lymph node was detected.

Cervical lymphadenopathies were predominantly bilateral, most frequently detected in the HL group, without the pres-
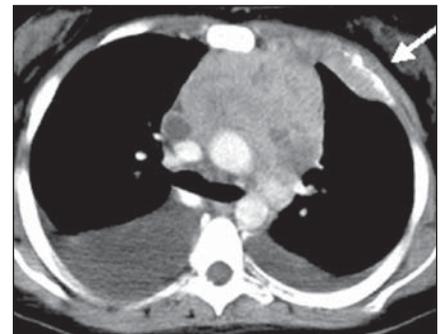


**Figure 1.** Heterogeneous mediastinal lymphadenopathy with signs of vascular compression (NHL, large B-cell subtype). Note lytic lesion (arrow) of rib at left, and bilateral pleural effusion.

**Table 1** Computed tomography findings in the total of cases of lymphoma categorized by histological subtype in lymphadenopathies.

| CT findings | Total (n = 22) Frequency in 100% | HL (n = 12) Frequency in 100% | NHL (n = 10) Frequency in 100% |
|---|---|---|---|
| Mediastinal lymphadenopathies | 59% (n = 13) | 75% (n = 9)/(n = 1)* | 40% (n = 4)/(n = 1)* |
| Hilar lymphadenopathies | 4.5% (n = 1) | 8.3% (n = 1) | — |
| Cervical lymphadenopathies | 27.3% (n = 6) | 33.3% (n = 4)/(n = 3)† | 20% (n = 2)/(n = 1)† |
| Periceliac lymphadenopathies | 9% (n = 2) | 8.3% (n = 1) | 10% (n = 1) |
| Retroperitoneal lymphadenopathies | 27.3% (n = 6) | 33.3% (n = 4) | 20% (n = 2) |
| Pelvic lymphadenopathies | 4.5% (n = 1) | — | 10% (n = 1)† |
| Inguinal lymphadenopathies | 4.5% (n=1) | 8.3% (n = 1)‡ | — |

HL, Hodgkin lymphoma; NHL, non-Hodgkin lymphoma; * Heterogeneous; † Bilateral; ‡ Unilateral.

**Table 2** Extranodal findings on computed tomography in the total of cases of lymphoma categorized by histological subtype.

| CT findings | Total (n = 22) Frequency in 100% | HL (n = 12) Frequency in 100% | NHL (n=10) Frequency in 100% |
|---|---|---|---|
| Hepatosplenomegaly | 50% (n = 11) | 50% (n = 6) | 50% (n = 5 )/(n = 1)* |
| Hepatomegaly | 9% (n = 2) | 16.7% (n = 2) | — |
| Thickening of intestinal loop | 18.2% (n = 4) | — | 40% (n = 4) Burkitt (n = 2) |
| Ascites | 4.5% (n = 1) | — | 10% (n = 1) |
| Pleural effusion | 13.6% (n = 3) | — | 30% (n = 3)/(n = 2)† |
| Pericardial effusion | 4.5% (n = 1) | — | 10% (n = 1) |
| Pulmonary nodule(s) | 9% (n = 2) | — | 20% (n = 2) |
| Pulmonary ground-glass opacity | 9% (n = 2) | 8.3% (n = 1) | 10% (n = 1 |
| Tonsil mass | 4.5% (n = 1) | 8.3% (n = 1)† | — |
| Mixed bone lesions | 4.5% (n = 1) | — | 10% (n = 1) |
| Renal nodules | 4.5% (n = 1) | 8.3% (n = 1)‡ | — |

HL, Hodgkin lymphoma; NHL, non-Hodgkin lymphoma; * Heterogeneous splenomegaly; † Unilateral; ‡ Bilateral.

ence of necrosis and/or calcification. The other lymph node chains affected showed variable presentations, highlighting especially the pelvic ones in the most severe case (Figure 2).

Extranodal findings were more frequent in the NHL group, as shown on Table 2. Lymphadenopathy was the most frequent one, and in one of these cases, the splenomegaly was heterogeneous (Figure 3).

Hepatomegaly as an isolate finding was observed only in the HL group (n = 2).

Small bowel parietal thickening (n = 4) was found in four patients, all of them in the NHL group, 50% of Burkitt subtype. This alteration was associated exclusively with hepatosplenomegaly in three of the four cases (75%), and was found as a single manifestation in only one case (Figure 4).

Pleural effusion (n = 3), pericardial effusion (n = 1), and ascites (n = 1) were found only in the NHL group.

Pulmonary involvement represented by nodule(s) (n = 2) was found only in the NHL group. Ground-glass opacities (n = 2) were equivalent in both groups (Figure 5). Associated infection was not found in any of the cases.

Only one unilateral mass was found in the tonsil, associated with cervical lymphadenopathy, in the HL group, nodular sclerosis subtype (Figure 6).

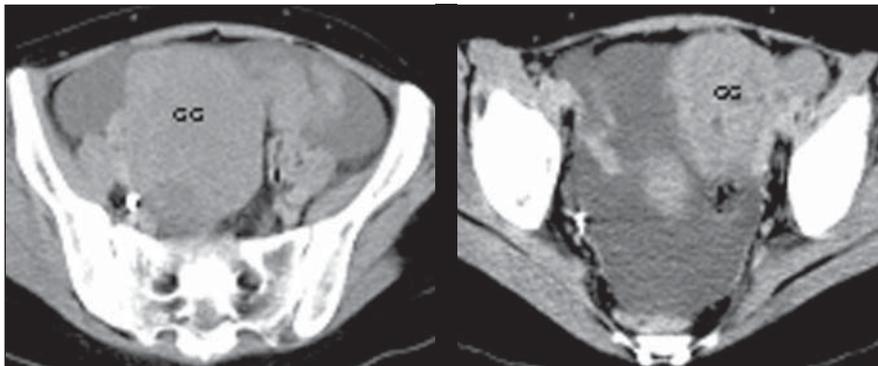Bone lesions, in the most severe case of NHL group (large B cell subtype) were



**Figure 2**. Heterogeneous, bilateral pelvic lymphadenopathy (GG) at left (NHL, large B-cell subtype).



**Figure 3**. Hepatosplenomegaly with spleen presenting hypodense nodules (NHL, large B-cell subtype).
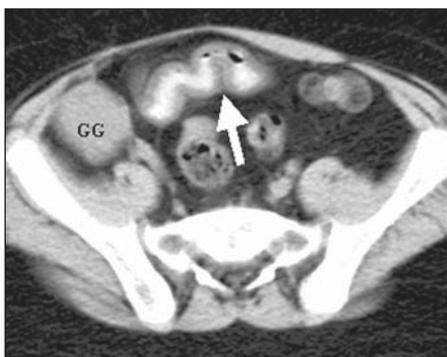


**Figure 4**. Parietal thickening of small intestinal loop (arrow); note lymphadenopathy (GG) at right (NHL, Burkitt subtype).
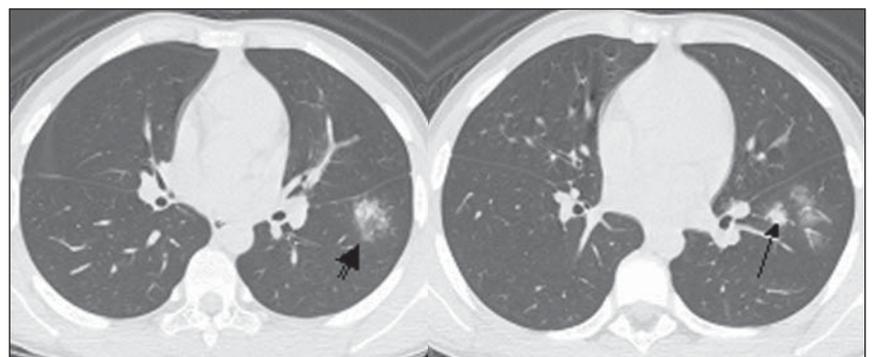


**Figure 5**. Ground-glass opacity (double arrow) and nodule (arrow) in the lower lobe of the left lung (NHL, large B-cell subtype).
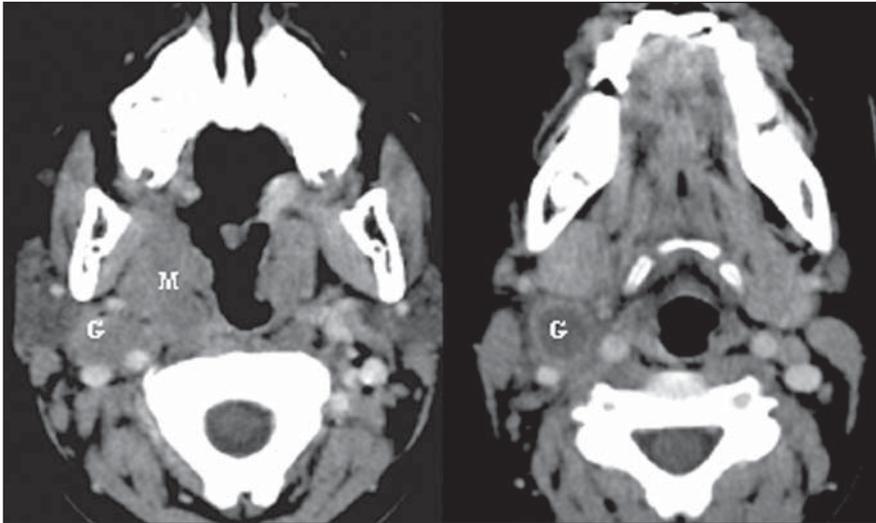
**Figure 6.** Mass in the tonsil at right (M) associated with unilateral lymphadenopathy (G) (HL, nodular sclerosis subtype).
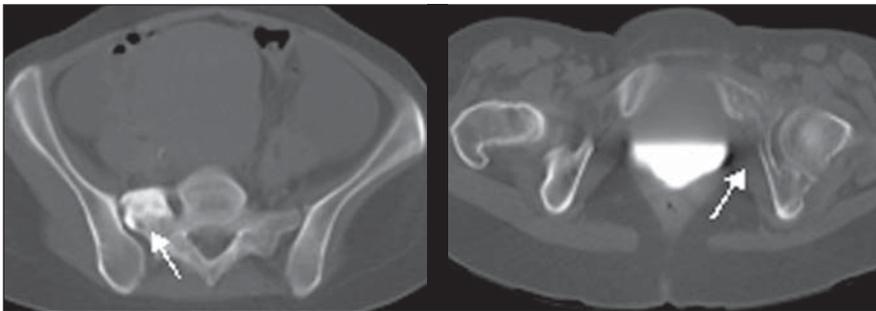


**Figure 7**. Blastic lesion in the sacrum at right (arrow), and lytic lesion in the ischiopubic branch at left (NHL, large B-cell subtype).
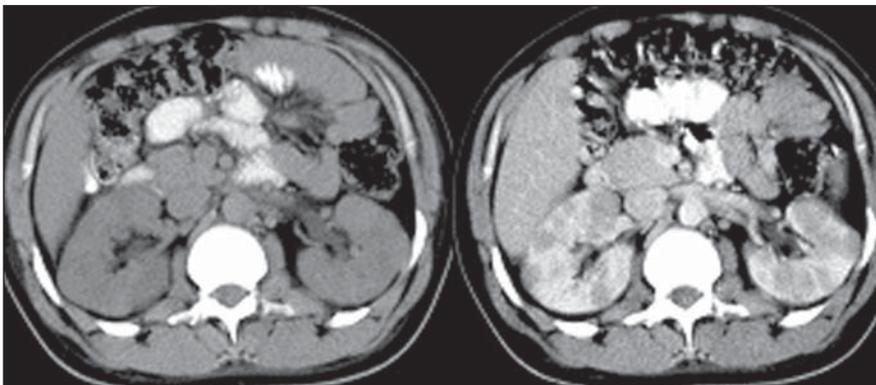


**Figure 8**. Bilateral, solid renal nodules - pre-contrast at left, and post-contrast at right. Note hypodense nodules. Hepatomegaly (HL, lymphoblastic).

multiple and mixed (lytic and blastic aspect) (Figure 7).

There was one case of renal involvement characterized by multiple and bilateral solid nodules (Figure 8) in the HL subtype.

**DISCUSSION**

The utilization of imaging methods for diagnosis, follow-up and healing management of patients with lymphoma has increasingly assumed an essential role in the management of this disease. According to the Ann Arbor System, the staging itself justifies the use of imaging methods, since it is based on a systematized analysis of the disease extent[4,6].

Computed tomography, due the fast images acquisition in comparison with magnetic resonance imaging, allows a rapid and comprehensive staging, which is essential for definition of the clinical oncological treatment. Reports in the literature describe, for example, changes in the planning of up to 10% of cases, based on data from computed tomography[6], as well as the identification of non-suspect sites of intrathoracic diseases or the elucidation of questionable radiological abnormalities which eventually might change therapeutic decisions[5].

As regards the frequency of general imaging findings, our data are consistent with the literature reviewed[3,7].

The pattern of thoracic involvement in patients with lymphoma is variable, and, at the moment of the diagnosis this involvement is more frequent in HL than in NHL, with presence in up to 11.6% of cases of HL. In these patients, the pulmonary involvement is associated with the presence of the disease in hilar or mediastinal lymph node chains. In cases with unilateral hilar adenopathy, parenchymal involvement, when present, occurs in the ipsilateral lung[8,9]. The pulmonary disease, without lymph node involvement is more frequent in recurrent lymphomas. Pulmonary involvement is frequently asymptomatic and symptoms, when present, are usually nonspecific[8,10]. One characteristic of HL in the lung is the dissemination along the lymphatic route[10] and, in the mediastinum, the dissemination contiguously from a lymph node group to the next, with initial presentation in about 65%–80% of patients with abnormal chest x-ray[5,10]. In other studies[5] reporting a 98% frequency in patients with intrathoracic disease, we have observed a prevalence of mediastinal lymphadenopathy in relation to other sites, in the HL group, inclusive.

We have not identified calcifications which rarely are seen before the therapy, even in cases of follow-up; but areas with necrosis were detected in both subtypes[7]. Differently from carcinomas, lymphoma

masses are more likely to displace adjacent structures than invade them[5], just as the cases of vascular compression observed in the present study. Approximately one third of patients with thoracic disease present unilateral or bilateral hilar lymphadenopathy[5], a finding observed in only one case in our study.

Contrarily to HL, NHL tends to manifest as a single, bulky lymph node mass, and not as individually increased lymph nodes. According to our results, in the chest, other sites are usually involved, such as pulmonary parenchyma, pleura and pericardium[2,10].

In patients with mediastinal HL and NHL mediastinal, a secondary pulmonary involvement usually is seen later with the progress of the disease. Only 12% of patients with HL and 4% of those with NHL present pulmonary involvement as a primary manifestation of the disease. The most frequent patterns observed on computed tomography studies are parenchymal consolidation, nodules or masses, and lymphatic dissemination. Among these patterns, nodules are the most frequent ones (50% to 90% of cases), and can be solitary or, most frequently, multiple.

Cavitation is rare (< 10%), but may occur, especially in the HL subtype. Another aspect described is the presence of ground-glass halo surrounding a nodule (halo sign) or isolatedly, due to alveolar septa infiltration by neoplastic cells, with preserved alveolar spaces[10]. In the present study, only one case of nodule presented this pattern, and, when in association with ground-glass opacity, there was a random distribution.

The protocol for chest examination must include the base of the neck as a routine, to discard head & neck involvement[5,7,11]. Cervical lymphadenopathies were the second main finding in general frequency order, predominating in the HL group. Lymphoma is the second most frequent malignant neoplasm in the neck, besides being the most common extralaryngeal malignant neoplasm. NHL is one of the most frequent malignant neoplasms in children. Neck lymphoma usually involves the adenoids as well as the lingual and pharyngeal tonsils (Waldeyer's ring); the unilateral tonsillar increase in children is highly suspect for malignancy. Cervical lymph nodes, especially internal jugular and spinal accessory lymph nodes which generally also are involved. In imaging studies groups of non-necrotic lymph nodes are observed[5,11]. In the case of tonsilar mass, we observed association with cervical lymphadenopathies, some of them with a hypodense nucleus.

The greatest part of NHLs in the childhood is extranodal, in contrast to both the NHL in adults and Hodgkin's disease at any age. The most frequent primary site of NHL in children is the abdomen; particularly the ileocecal region[3], literally in agreement, and according to our results, predominantly associated with hepatosplenomegaly.

Common findings of computed tomography in all the types of small bowel lymphoma are: intestinal wall thickening, sometimes nodular in a diffuse or focal distribution, and also distinct lymph node masses in the mesenteric folds of the involved segment; in some cases, the CT shows a single focal, frequently cecal, colonic mass.

The evaluation of the liver and spleen is an essential part of the computed tomography study. Although an organ enlargement is an indicator of its involvement, this is not a reliable diagnostic criterion, and the sensitivity for detection of focal lesion in dubious cases of lymphomas is significantly increased with sequential CT slices obtained after contrast bolus injection[12]. Secondary splenic involvement is frequent both in HL and NHL, and malignant splenic neoplasm is the most common. It is estimated that at the moment of the diagnosis there is splenic involvement in one-fourth to one-third of patients with HL or NHL. In patients with NHL, the splenic involvement is associated with infiltration of paraaortic lymph nodes in approximately 70% of them. Homogeneous organ enlargement, miliary nodules, multifocal lesions between 1 cm and 10 cm, and solitary mass are some forms of presentation. In cases of necrosis in large lesions, an irregular, cystic pattern is observed, and a case of a patient with fever associated with lymphoma mimicking splenic abscess is reported in the literature[5]. In the present study, multiple lesions did not present peripheral contrast enhancement, which in association with clinical data, characterized the disease manifestation.

Most frequently, in NHL, the small bowel mesentery and omentum are involved by a tumor disseminated via the intraperitoneal pathway. The four general patterns of computed tomography imaging are: rounded masses, cake-like masses, ill-defined masses, and stellate mesentery. Rounded masses are more frequent in NHL, basically due to the lymphadenopathy, and not to the intraperitoneal dissemination[5,13]. The presence of ascites suggests this forma of dissemination.

Bone lymphoma causes diffuse or focal osseous pain and usually corresponds to dissemination from any other primary site. Manifestations of systemic dissemination, such as anaplastic lymphoma of the skin, may occur in association with alterations related to the local tumor[2,14]. The case of bone involvement identified in the present study was exactly the one with more extensive systemic manifestation (large B-cell NHL), where chest, abdomen and pelvis presented with extensive lesions.

Generally, renal lymphoma is not clinically evident; most of times it is detected in the imaging evaluation or follow-up of patients with lymphoma. NHL is considerably more frequent than HL, notwithstanding the similarity between imaging findings. Renal lymphoma is extremely rare, since normally lymphatic tissue is absent in the kidney. Renal involvement may occur by direct contiguous or hematogenic dissemination. In about 50% of cases, renal lymphoma is a recidivation in patients with previously treated lymphomas. Distinct, solid masses are frequent, and generally are homogeneous and isodense in relation to the renal parenchyma in pre-contrast images, although some times they may present slightly lower or higher densities. A significantly lower homogeneous enhancement (10 UH to 30 UH) than the renal parenchyma enhancement is typical after contrast injection. Necrosis or calcification frequently occurs after the therapy. Extension to the perirenal space occurs in 40% of patients with renal lymphoma, and some times this is the only manifestation of the disease, possibly in the form of multiple distinct nodules in the perirenal fat[5,12,15].

## CONCLUSION

Computed tomography is an invaluable tool for the diagnosis, staging and follow-up of lymphomas, with alert findings such as lymph node masses (especially the mediastinal ones), hepatosplenomegaly, unilateral tonsilar mass, and parietal thickening of intestinal loop.

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