Diagnostic Value of Multi Detector Computed Tomography in Evaluation of Abdominopelvic Extra-nodal Lymphoma with Assessment of Therapeutic Response

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ABSTRACT

Background: Patients with lymphoproliferative diseases frequently develop non-Hodgkin lymphoma or Hodgkin disease outside of the lymph nodes, a condition known as extra-nodal lymphoma. Non-Hodgkin lymphomas and Hodgkin disease are best imaged anatomically using Multi Detector Computed Tomography (MDCT).

Aim and Objectives: To evaluate the possible MDCT imaging findings in patients with pelviabdominal extra-nodal lymphoma before and after therapy. **Patients and methods:** This quasi-experimental study involved 18 cases, whose ages ranged from 18 to 81 years (10 males and 8 females), with extra-nodal lymphoma of the abdominal and pelvic organs. The study was conducted at the Radiology Department, Suez Canal University, and Mansoura Oncology Hospital, with an assessment of therapy response by MDCT scan. **Results:** The spleen was found to have the highest number of diseases among the pelvic and solid organs, followed by the liver and the uterus. Regarding the GIT affection, in descending order, the stomach, intestine, and esophagus were affected**.** MDCT scan showed diffuse intestinal wall thickening with luminal dilation of intestinal loops. The majority of cases were found to be non-Hodgkin lymphoma (83.3%), with diffuse large B cell lymphoma being the most prevalent subtype (15 individuals). Hodgkin lymphoma was found in 3 patients (16.6%) with mixed cellularity. **Conclusion:** MDCT is the most preferred and widely used imaging modality to evaluate lymphomatous involvement in extra-nodal sites. It provides details about the nature and extension of the lesion. Also, it can be used to guide needle biopsy into a suspicious area.

Keywords: Abdominopelvic, Extra-nodal Lymphoma, Multi Detector Computed Tomography.

INTRODUCTION

Extra-nodal lymphomas are lympho-proliferative illnesses that arise outside of the lymph nodes or other lymphoid tissues where they are normally expected to originate from extra-nodal structures, such as solid organs (liver, spleen, kidney, and pancreas) and hollow gastrointestinal tract organs. They can be found in the abdomen and pelvis of people with non-Hodgkin lymphomas and Hodgkin's disease [(1)]. Patients with recurrent illness or disease associated with immunodeficiency are more likely to experience extra-nodal involvement than those with a first presentation [(2)]. US, CT, MRI, and scans are all examples of anatomic imaging techniques. Because of its superior ability to identify lesion size, shape, and relationship to neighboring tissues, MDCT is the modality of choice for anatomic imaging of non-Hodgkin lymphomas and Hodgkin disease. Furthermore, MDCT provides anatomic imaging examination of nearly all parts of the body, which is not possible with other modalities [(3)]. There are three possible patterns of lymphomatous involvement of solid organs: localized, multifocal, and diffuse. Distinct solid nodules can be seen in cases of focal and multifocal illness, whereas in diffuse disease, the affected area is infiltrated on a systemic level. Single or numerous nodules have the same uniformity in shape and size. Mild and consistent enhancement is typical following intravenous contrast material [(3)]. Central necrosis, however, can cause a patchy appearance on both normal and contrast-enhanced imaging [(4)].

Mild to moderate luminal thickening, dilatation, or cavitation, as well as circumferential thickening of the stomach or intestinal wall, are common CT findings. Single or numerous lesions are often homogeneous in appearance, but big lesions that involve regions of internal bleeding or ischemia may provide that impression [(5)]. MDCT provides important pretherapeutic information about tumor location, morphology and extension. As well as about the involvement of lymph nodes and other organs. MDCT staging has important therapeutic values because stage I and stage II disease may be excised, whereas stage III and IV disease must be treated with radiation, chemotherapy, or both. In addition, MDCT allows accurate monitoring of the response to therapy. [(1)].

The purpose of this study was to assess the possible MDCT imaging findings in patients with pelviabdominal extra-nodal lymphoma before and after therapy.

PATIENTS AND METHODS

Eighteen individuals, 18 to 81 years age, were enrolled in our study. Patients with a clinical suspicion of lymphoma are sent from the outpatient clinic to the Radiology Department for an ultrasound and MDCT scan. Needle biopsy was performed for all cases. The study was conducted in the Radiology Departments of Suez Canal University and the Mansoura Oncology Hospital.

Clinical suspicions of lymphoma included asymptomatic lymphadenopathy, fever, night sweats, weight loss, easily fatigability, and pruritus.

Inclusion criteria: patients with pathologically proven abdominopelvic extra-nodal lymphoma referred to the Radiology Department before and after chemotherapy, radiotherapy, or surgical resection for assessment of therapy response.

Exclusion criteria: patients with contrast allergies and pregnancy, and patients refusing to participate in the study.

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Radiological evaluation: All patients performed abdominal and pelvic CT, pre- and post-therapy.
Equipment: MDCT (Philips 64-slice).

CT Technique: Scanning by MDCT (abdominopelvic scan).

The images of the abdomen and pelvis were taken using a 64-section MDCT (Sensation 64-Section

Medical Solutions, Forchheim, Germany). Prior scanner while the patient was holding their breath. Patient position: supine and elevated arm. Scan range: 1 cm superior to the diaphragm to the symphysis pubis, Scanogram: AP (120 kV, 100 mA), Contrast: IV = nonionic contrast media ultravist (100–150 cc) (Weight < 75 kg: 100 cc, Weight 75–90 kg: 120 cc, and Weight > 90: 150 cc), Slice thickness: 3 mm, IV injection rate: 3–4 ml/sec, Scan delay: 35–45 seconds (arterial phase), 60–70 seconds (portal venous phase), 5 minutes (delayed phase), Bowel visualization by administration of 2000 ml of water 30–60 min prior to the examination used as neutral oral contrast and reconstructions 1. Sagittal and coronal multi-planar reformations and MIP reconstruction of the arterial and venous phases (sent to PACS for interpretation).

Image analysis: Two consultant radiologists reviewed and analyzed CT images on PACS, analyzing the abdomen and pelvic portion of the abdominopelvic CT scan (ranging from the included lung bases to the symphysis pubis), looking for: extra-nodal lymphoma location and size, shape, regional lymph nodes (enlargement, necrosis), omental or mesenteric nodularity or deposits, and ascites volume (if present).

Ethical considerations:

Approval from Research Ethics Committee (REC) of Faculty of Medicine, Suez Canal University was obtained before starting any work. Administrative approval was obtained from the dean of the Faculty of Medicine. An Informed consent was obtained from the participants before taking any data or doing any physical examination. All the data were strictly confidential (for research purpose only). All participants were informed about the results of the research. Each individual was permitted to withdraw from the research at any time, without explanation, and with no impact on their treatment plan. Individuals were given the researcher's phone number and all potential communication channels so they could return at any time for clarification. There was no conflict of interest in the trial. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical analysis

Information was recorded in Microsoft Excel 2010. Quantitative data were presented as median, mean, and range. Qualitative information was presented as frequencies and percentages.

RESULTS

There was a total of 18 patients in the study (10 male and 8 female, ages 18–81), with a median age of 50. 15 patients (83.3 percent; 9 males and 6 females) were diagnosed with non-Hodgkin lymphoma (NHL), and 3 patients (16.7 percent; 2 males and 1 female) were diagnosed with Hodgkin disease (HD) based on histopathological investigation. The average age of NHL patient was 50, while that of HD patient was 40 Table (1).

Table (1): Age and sex distribution in patients with HD and NHL in this study.

Age (years)	Male	female	Total N=18	HDL	NHL
Less than 10	-	-	-	-	-
10 – less than 20	1	-	1 (5.6%)	1(100%)	-
20 – less than 30	1	-	1 (5.6%)	-	1 (100%)
30 – less than 40	1	1	2 (11.1%)	-	2 (100%)
40 – less than 50	2	1	3 (16.7%)	-	3 (100%)
50 – less than 60	1	3	4 (22.2%)	1 (25%)	3 (75%)
Above 60	4	3	7 (38.9%)	1 (14.3)	6 (85.7%)
Total	10	8	18	3 (16.7%)	15 (83.3%)

HD: Hodgkin disease
NHL: Non-Hodgkin Lymphoma.

The spleen was the most common affected solid organ with 7 patients (38.9%) affected, followed by the liver in 2 patients (11.1%), and finally the uterus in one patient (5.6%). We found 8 individuals (44.4%) with gastrointestinal lymphoma. The esophagus, small intestine, and stomach were all affected in that order **(Table 2)**.

Table (2): Extra-nodal lymphoma sites affection in abdominal and pelvic organs.

Site	No=18	Percentage %
Solid organs	10	(55.6 %)
Spleen	7	(38.9 %)
Liver	2	(11.1%)
Uterus	1	(5.6 %)
Gastrointestinal tract	8	(44.4%)
Esophagus	1	(5.6%)
Stomach	4	(22.2 %)
Intestine	3	(16.7 %)

Seven out of 18 cases (38.9%) had splenic affection, 4 males and 3 females. None of the seven individuals had a single isolated lesion in their spleen, but all had several splenic lesions. Five patients (71.4%), had enlarged para-aortic lymph nodes had splenic focal lesions. In four cases (57.1%), the spleen was enlarged. Five of the focal lesions (71.4% of the total) were hypodense and not enhanced. A regressive course following therapy, with a reduction in the size and number of splenic focal lesions, was found in 7 patients (100%) **(Table 3)**.

Table (3): MDCT findings of splenic lymphoma cases:

No of patients No=7	Organ size	No of lesions	Enhancement	Assessment of therapy
7	Enlarged 4 (57.1%) Normal 3 (42.9%)	Multiple lesions in 7 cases	Hypodense no enhancement 5 (71.4 %) Heterogeneous enhancement 2 (28.6%).	Regressive course in 7 cases Complete response in 3 cases Partial response in 4 cases

In this study, hepatic lymphomas were seen in 2 female patients (11.1%). Hepatic lymphoma appeared as multifocal masses that were hypodense and homogenous. As for the pattern of enhancement, the MDCT scan showed no enhancement (100%). The liver was enlarged in 1 case (5.6%), the span varied from 16 cm to 18 cm, and it was shrunken in the other case (5.6%). Hepatic lymphoma was associated with HCV in one case. Upper abdominal lymph node enlargement was found in the two cases (100%). Therapy assessment: One case had regressive course with partial resolution; while the other had a stationary course **(Table 4)**.

Table (4): MDCT findings of hepatic lymphoma cases:

No=2	Organ appearance	No, of lesions	Enhancement	Assessment of therapy
2	● 1 Enlarged- non cirrhotic (5.6 %) ● 1 Shrunken cirrhotic 5.6 %),	● 2 Multiple lesions (100%) ● 0 Single lesions	● Homogenous 2 ● Hypodense 2 ● No enhancement 2	Regressive 1 Stationary 1 Progressive 0

Esophageal lymphoma was found in one patient (5.6%,). The esophageal lumen was narrowed, and esophageal wall was thick. **Gastric lymphoma:** lymphoma spread to the stomach in 4 cases. Two patients, or 50%, had widespread mural thickening of the fundus and antrum, and two patients, or 50%, had circumferential wall thickening of the pylorus. Evaluation of treatment: three cases out of four were resolved (75%, resolution).

Intestinal Lymphoma: were identified in 3 cases. In 2 of them (66.7%), the MDCT revealed diffuse intestinal wall thickening with luminal dilatation, and in one patient (33.3%), the infiltration was in the fat plane. One patient had a well-defined tumor; one case had encased superior mesenteric arteries; and no intestinal obstruction was discovered. Analysis of treatment: the three patients experienced a regressive trajectory. There was one complete resolution and two cases showed partial resolution **(Table 5)**.

Table (5): Assessment of therapy in patients of GIT lymphoma of the studied group:

Site	No=18	Assessment of therapy
Esophagus	1 (5.6%)	1 partial resolution, regressive course
Stomach	4 (22.2%)	2 partial resolution, regressive course 2 total resolution, regressive course
Intestine	3 (16.7)	1 total resolution, regressive course 2 partial resolution, regressive course

The majority of cases (15 individuals) were found to be non-Hodgkin lymphoma (83.3%), with diffuse large B cell lymphoma being the most prevalent subtype. Hodgkin lymphoma was found in 3 patients (16.7%) with mixed cellularity **(Table 6)**.

Table (6): Histopathology among the studied group.

Pathology	No=18	Percent (%)
Non-Hodgkin Lymphoma (DLBCL)	15	83.3%
Hodgkin Lymphoma (Mixed cellularity)	3	16.7%

ILLUSTRATED CASES

CASE 1: Hepatic lymphoma

- **Clinical presentation: A** 38-year-old female patient presented with abdominal pain and accidentally discovered hepatic focal lesions by US.
- **MDCT finding:** Post contrast axial MDCT-before therapy**:** The two arrows showed multiple hypodense, non-enhancing HFLs in both lobes, the largest of which was 30 x 16 mm, as shown in **figure 1A**. **After therapy, post contrast axial MDCT** showed a regressive course (partial resolution) with regard to the number and size of hepatic lymphomas. the largest was 7 x 9 mm (subcapsular in segment II), as shown in **figure 1B**.
- **Pathology:** Biopsy from HFLs: non-Hodgkin lymphoma, diffuse large B cell type of germinal center origin.
- **Assessment of therapy: a** regressive course (Partial resolution).

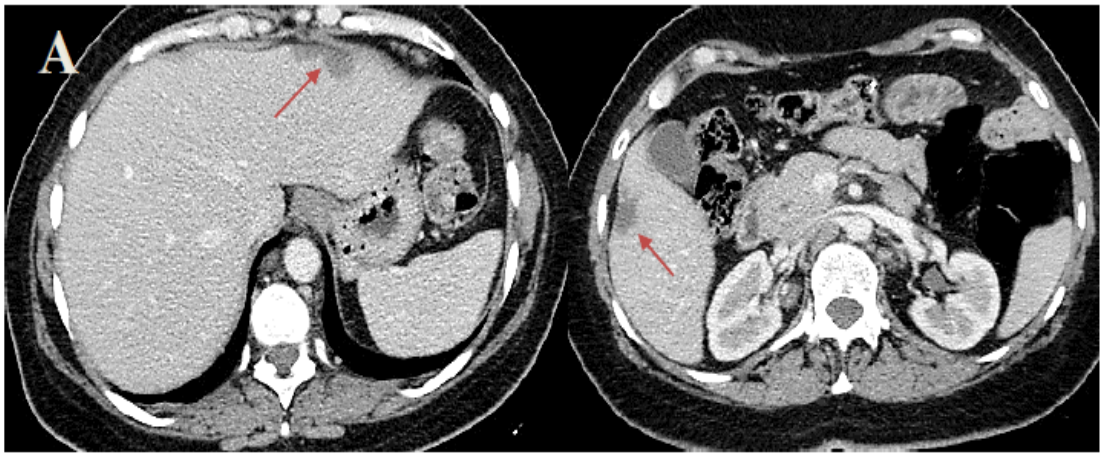

Figure 1A: Axial MDCT scan pre therapy showing (hepatic lymphoma). The two arrows showed multiple hypodense HFLs in both lobes, the largest size was 30 x16 mm.)

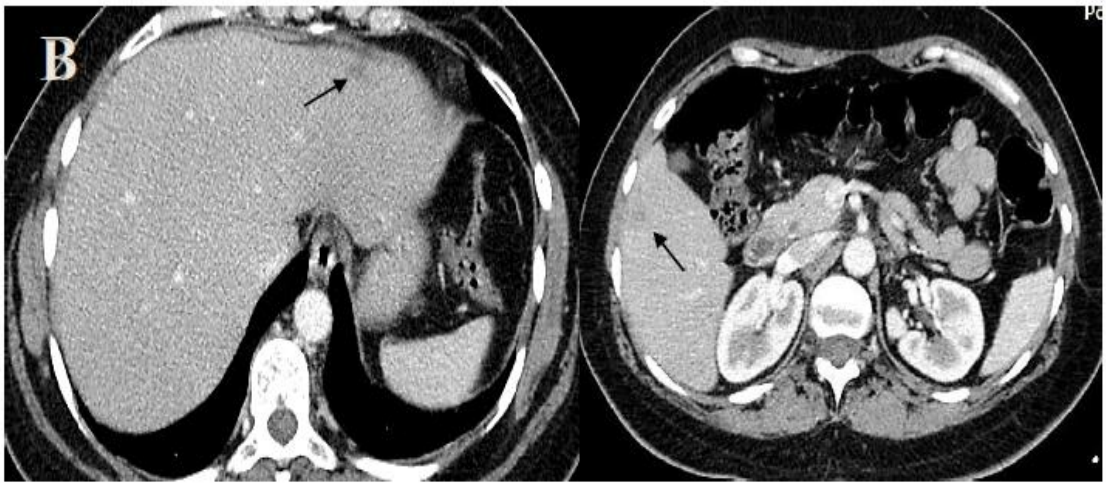

Figure 1B: Axial MDCT scan after therapy. The two arrows showed regressive course as regard number and size of hepatic lymphoma. The largest size was 7 x 9 mm.

CASE 2: Gastric lymphoma

Clinical presentation: **A** 40-year-old male case presented with epigastric pain and weight loss.

MDCT findings: Post contrast axial MDCT before therapy: the arrow showed diffuse circumferential mural thickening of the stomach, which was about 16 mm in maximum thickness, as shown in **figure 2A**. Post contrast axial MDCT: after therapy, the arrow showed a decrease in circumferential mural thickening of the stomach to the normal level of less than 3 mm, as shown in **figure 2B**.

Pathology: Endoscopic biopsy: non-Hodgkin lymphoma (diffuse large B cell type of germinal center origin).

Assessment of therapy: a regression course (Total resolution).

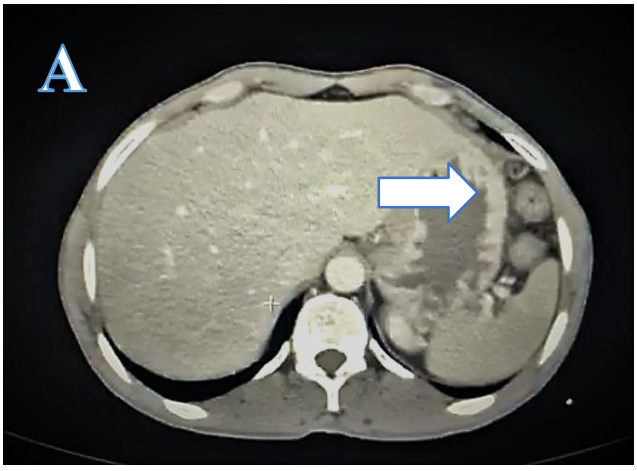

Figure 2A: Post contrast axial MDCT scan pre therapy of gastric lymphoma. The arrow showed diffuse circumferential mural thickening of the stomach was seen about 16 mm in max thickness.

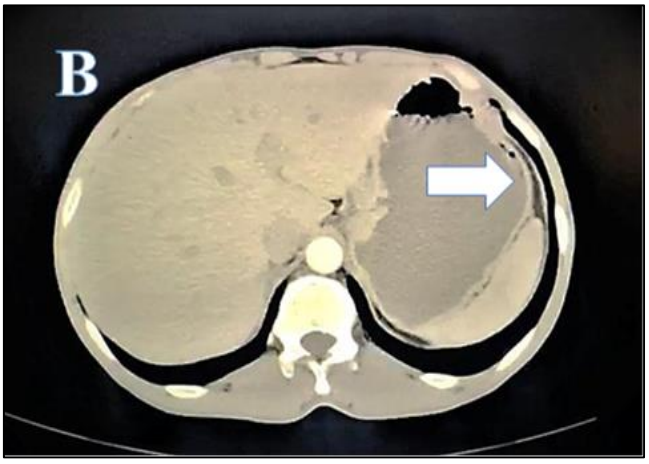

Figure 2B: Post contrast axial MDCT scan post therapy of gastric lymphoma. The arrow showed decrease circumferential mural thickening of the stomach to the normal level of less than 3 mm.

DISCUSSION

Leite *et al.* [1] reported that MDCT provides important pretherapeutic information about tumor location, morphology, relation and extension. Also, CT declares the involvement of lymph nodes and other organs. CT staging has important therapeutic values because stage I and II disease may be excised, whereas stage III and IV disease must be treated with radiation, chemotherapy, or both. In addition, CT is the imaging modality, used for accurate monitoring of the response to therapy and familiarity with the features specific to lymphomas, may help improve the accuracy of diagnosis and staging so it allows better disease management.

In this work, the mean age for patients with NHL was 50 years, with about one-third of the included patients over 60 years. Also, a male predominance was observed. As for HD, the mean age was 40 years. This is in agreement with **Alexander *et al.*** [6] who reported that the peak incidence of NHL is at 60 years and males' affection is greater than females, and so is **Mueller *et al.*** [7] who said that HD reaches its initial peak at age 25, and the 2 peak at an advanced age.

De Jong *et al.* [8] observed that 10–40% of patients have splenic involvement, which is in line with the results of our study (38.9% splenic involvement). The majority of these instances were hypodense, exhibiting either little or slight homogeneous augmentation**.**

About 44.4% of the cases in this study involved the digestive system**.** **Extra-nodal** gastrointestinal lymphoma is seen in 30–40% of patients, which is consistent with the findings of **Thomas *et al.*** [9].

The esophagus was infiltrated with lymphoma in only one patient. There was circumferential mural thickening of the esophagus with subsequent luminal thickening,

Four patients, all adults, were diagnosed with lymphoma that had spread to the stomach. Case 3–4, and 10-circumferential wall thickening—were the most prevalent types. This is in keeping with the findings of **Manning *et al.*** [10]**,** who found that MDCT scans of the stomach often reveal a uniform, gastric wall thickening (i.e., >1 cm) with delayed tumoral enhancement that can be distinguished from early mucosal enhancement**.**

In this analysis, we focused on three instances of intestinal lymphoma in adults, all of which were detected in the ileum. The NHL diffuse B cell type accounted for 100% of all cases. Primary non-Hodgkin lymphoma (both B-cell and T-cell) is a cancer of the immune system, which is consistent with the findings of **Ghai *et al.*** [11]**.**

Twenty to thirty percent of primary gastrointestinal lymphomas were found in the small intestine. Since the distal ileum contains a disproportionately high quantity

of lymphoid tissue, it has traditionally been considered the most prevalent location of small intestinal B-cell lymphoma. [12].

B-cell lymphoma of the small intestine often presents as a circumferential, bulky mass in the intestinal wall, with possible spread into the mesentery and regional lymph nodes. In contrast to adenocarcinoma, which frequently causes bowel obstruction and adjacent-structure fibrosis, small-bowel obstruction is uncommon [13].

Pelvic organs with extra-nodal infiltration, such as prostate, were not found in our study, coping with **Leite *et al.*** [1] who documented the rarity of pelvic organ affection. The uterus was found in only one case in the study. We found a mass, mostly cervical, in a region. It was homogenous and seen infiltrating the uterus and posterior wall of the UB, with possible infiltration of both ureters, and pathology reveals non-Hodgkins's lymphoma and diffuse large B-cell type.

In this work, MDCT examination was performed using a tube voltage of about 120 KV and a tube current of about 100–200 mA in adults according to patient height and weight, keeping in mind what **Adams *et al.*** [14] said about the importance of optimizing radiation dose during examination in order to achieve the full advantage of MDCT.

CONCLUSIONS

We conclude that MDCT is the most preferred and widely used imaging modality to evaluate lymphomatous involvement in extra-nodal sites because it determines lesion size, shape, and anatomical relation to adjacent structures. It provides details about the nature and extension of the lesion**.** Also, MDCT can be used to guide a biopsy needle into a suspicious area in order to obtain a more accurate pathological diagnosis and is important for the staging and assessment of therapy.

DECLARATIONS

- **Consent for publication:** I attest that all authors have agreed to submit the work
- **Availability of data and material:** Available
- **Competing interests:** None
- **Funding:** No fund
- **Conflicts of interest:** No conflicts of interest.

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