ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES SCHOOL OF GRADUATE STUDIES DEPARTMENT OF RADIOLOGY

Role of CT for imaging gastric tumor with histopathology correlation at TASH, Addis Ababa University, Addis Ababa, Ethiopia from September 2019 –August 2020.

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A research report of senior paper to be submitted to radiology department, college of health sciences, Addis Ababa University in preparation for partial fulfillment of the requirements for the post graduate study in Radiology

September 2020, Addis Ababa, Ethiopia

Retrospective Study of role of CT for imaging gastric tumor with histopathology correlation at TASH, Addis Ababa University, Addis Ababa, Ethiopia from September 2019 –August 2020.

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Advisor: Dr. Assefa Getachew (MD, consultant Radiologist)

Acknowledgement

I am very grateful to my advisor, Dr.Assefa Getachew (MD, consultant body radiologist) for his unreserved guidance and constructive suggestions from the stage of proposal development to this end. I also like to express my gratitude to my colleagues and oncology department staffs who helped me in searching, providing necessary literatures and patient charts.

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Abbreviations

CHS:College of Health Science

BLH:Black Lion Hospital

CT :Competarized Tomography

MPR:multiplanar reconstructionT:tumor

TASH:Tikur Anbessa Specialized HospitalN:node

GC:Gastric carc

GIST:gastrointestinal stromal tumor

EGC:Early gastric cancer

AGC:advanced gastric cancer

T0:no evidence of alteration of the gastric wall with a normalfat plane;

T1: invasion to mucosa or submucosa,

T2 :invasion to muscularis propria or subserosa

T3 :invasion to serosa

T4 :invasion to adjacent organs or structures

N0, no evidence of lymph node metastasis; EGC:early gastric carcinoma

N1, less than 3 regional LN

N2:3-5regional LN

N3:6-15 egiona LN

Mo:no distant metastasisM1:evidence of distant

M1-Distal metastasis

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Abstract

Introduction: Gastric tumor is relatively common disease entity in day to day radiologic pratice.Gastric cancer acounts for the majority of gastric neoplasm followed by GIST and gastric lymphoma. Imaging plays a vital role in diagnosis and staging of gastric neoplasm particularly gastric cancer.Computed tomography remains the most common and widespread tool for the staging of the diseases

The role of computed tomography in the study of gastric carcinoma is mainly for preoperative local and distant staging; post-therapeutic control and follow-up

Method: The study was conducted at TASH ,Addis Ababa ,Ethiopia from September 2019 to August 2020.Hospital based retrospective cross sectional study was conducted to address the specific objective during study period. The Study was conducted among patients being evaluated at Tikur Anbessa Specialized Hospital oncology department who have both MDCT result reported by senior radiologist and pathology result . Data was collected by evaluating the MDCT report and biopsy result from pathology and oncology department by using structured questionnaires. The data was checked for clarity and completeness. Computerized data analysis was conducted by using SPSS version 20 software.

Result: Total of 80 gastric tumor patients were evaluated .66(82.5%) were gastric cancer ,12(15.5%) were gastric GIST and 2(2.5%) were primary gastric lymphoma. The age range of gastric cancer were 25 to 85 years with mean age of 52.6 year.The mean age of GIST was 54 year and the age range of the 2 lymphoma were 35 to 54 years.56.7 % of gastric cancer were men and 66 % of GIST were men. This study showed that 56 % of gastric cancer were intestinal histologic type, 33. 4 % were diffuse histologic type and 10.6% were indeterminate histologic adenocarcinoma .Acuracy of MDCT for staging T4 tumor is 90.9% and 44.5 % for T3 .

Conclusion: MDCT has relatively high diagnostic sensitivity and specificity for detection and diagnosis of gastric tumor .It has high acuracy to differentiate gastric GIST from other gastric tumor . MDCT has high acuracy for correctely staging T4 tumor but it had relatively low acuracy of staging T2, T3 tumor and nodal staging

1. Introduction

1.1. Background

Neoplasms of the stomach are classified into two large categories on the basis of the cell of origin (1): epithelial and non-epithelial. Epithelial neoplasms arise from the mucosa and account for the majority of gastric tumors, ranging from benign hyperplastic and adenomatous polyps to malignant adenocarcinomas (1). In contrast, non-epithelial tumor arises from the sub mucosa, muscularis propria, or serosa.

Gastric carcinoma, gastric lymphoma, and GIST comprise the majority of gastric tumor. (2)

Gastric carcinoma represents the most common gastric neoplasm accounting for 95% of all gastric tumors (3, 4). Concerning histopathology; the Jarvi and Lauren classify intestinal or diffuse histological forms, the latest representing about the 80-90% of all gastric forms (5). These two types not only look different under the microscope, but also differ in gender ratio, age at diagnosis, and other epidemiologic features (5)

Primary gastric lymphoma represents 1%–5% of gastric malignancies (6) and is the most common type of extra nodal lymphoma, accounting for 50%–70% of all primary gastrointestinal lymphomas(7)

Intramural gastric tumors are typically mesenchymal in origin and include gastrointestinal GIST, non-GIST sarcoma,lipoma, leiomyoma, schwannoma, glomus tumors,hemangiomas, inflammatory fibroid polyps, inflammatory myofibroblastic tumors and plexiform-fibromyxomas.GISTs account for 90% of mesenchymal tumors (8)

On imaging gastric cancer usually appears as focal or segmental wall thickening or a discrete mass. Gastric lymphoma can have a CT appearance similar to that of gastric cancer. Both gastric adenocarcinoma and lymphoma may be associated with adenopathy(3).

GISTs tend to appear as well-defined masses that arise from the gastric wall and may be exophytic when large. GISTs are usually not associated with significant adenopathy(9).Histologically, most GISTs are composed of spindle-shaped cells (70%). Some (10%-20%) are dominated by epithelioid cells and (10%-20%) have mixed morphologies (10)

1.2. Statement of the problem and significance of the study

Each year approximately 990,000 people are diagnosed with gastric cancer worldwide, of whom about 738,000 die from this disease (11) making gastric cancer the fourth most common incident cancer and the second most common cause of cancer death (12). Gastric cancer also causes one of the highest cancer burdens, as measured by disability-adjusted life years lost (12). The peak of incidence of gastric carcinoma is estimated between 50 and 70 years (11). Males are affected more commonly than females, with rates vary by geographic region commonly 2- to 3-folds higher in men than women (11).The highest incidence rates are observed in East Asia such as Japan, East Europe, and South America, whereas the lowest rates are observed in North America and most parts of Africa (13).But study showing incidence and prevalence of gastric cancer in Africa is limited (14)

Gastrointestinal lymphoma is the most frequently occurring extra nodal lymphoma and commonly of NHL type (7). Primary gastrointestinal lymphoma most commonly involves the stomach but can involve any part of the gastrointestinal tract from the esophagus to the rectum (15).

GC diagnosis usually is based on conventional barium radiological studies and endoscopy which often remains the first-line examination .MDCT remains the most common and widespread tool for the staging of the disease and its reported accuracy values vary depending on the study technique and the device used (16).

Accurate preoperative staging of gastric cancers is important in planning appropriate therapy and giving the prognosis of the disease (16).

Although gastrointestinal lymphoma has a wide variety of imaging appearances, the commonest finding is a gastric wall thickening or mass lesion with local lymphadenopathy but definitive diagnosis relies on histopathology analysis (7). Bulky mass or diffuse infiltration with preservation of fat planes and no obstruction, multiple site involvement, associated bulky lymphadenopathy can strongly suggest the diagnosis (7). Radiologic appearances of GISTs can vary widely depending on tumor size.GISTs frequently have an exophytic or intramural pattern of growth

There is much research literature about gastric tumor imaging in the west and Asia but there are only a few published studies from Africa in general and in Ethiopia in particular

2. Literature Review

In one research, CT findings of 50 patients with gastric cancer were retrospectively analyzed and correlated with pathologic findings at surgery (17). 12/50 cases of the tumor was located at the gastric cardia, 3/50 cases at fundus , 8/50 cases at the gastric body, 4/50 at the antrum 8 /50 cases at the gastric fundus and the body ,11/50 at the gastric body and antrum, and 2 /50 cases at three segments of the stomach .The accuracy rate of staging gastric cancer was 86%. The detection rate of lymph node metastases by CT was 60%

In other research of 89 patients with gastric tumor (18); 78 gastric cancer, five malignant lymphomas, and six mesenchymal tumors were evaluated. The detection ability of early and advanced gastric cancers was 53% and 92% respectively. Differentiation between infiltrating gastric cancer (n = 5) and malignant lymphoma (n = 5) was successful.

According to Shimizu et al.(19) , The detection rate of advanced gastric cancers with thin-sliced MPR images was excellent (96.2%) which is higher than the above research . The detection rate for mucosal cancer was 16.7% and 68.8% for sub mucosal cancer. The accuracies of CT staging using MPR for T1, T2, and T3 gastric cancers were 94.1%, 66.6%, and 77.8%, respectively with over all accuracy using thin-sliced MPR T staging was 85%, indicating that CT is useful in determining the depth of invasion of gastric tumor. Although there is inaccurate distinction between T2 and T3 tumors in some cases.

In other research by Takao and others (20) analyzed the detection rate and T staging accuracy by MDCT of 108 patients with gastric cancer .53 were EGC and 55 AGC. All 12 early cancers detected with spiral CT were most clearly depicted in the arterial-dominant phase. On the other hand, 15 (28%) of 54 advanced cancers were most clearly depicted in the equilibrium phase due to the gradual enhancement from the inner mucosal side of the tumor. The accuracy of spiral CT for tumor detection and T staging was 98 and 82% respectively in advanced gastric cancer and 23 and 15% respectively in early gastric cancer. This showed that MDCT has low detection rate and low accuracy of staging in EGC.But MDCT has higher detection and overall accuracy of T staging as compared with Shimizu et al.(19)

Yan et al (21) showed that the detection rate of primary tumor by MDCT was 70.37% for EGC and 98.93% for AGC, respectively. The accuracy of MDCT in determining the T stage of gastric carcinoma was 45.93% for T1, 53.03 % for T2, 86.4 % for T3, and 85.7% for T4. The overall accuracy of MDCT in this study for preoperative N staging was 75.22% (N0 76.17%, N1 68.81%, and N2 80.63%). The diagnostic sensitivity of MDCT in determining lymph node metastasis was closely related to the tumor size, T stage, N stage number of metastatic lymph nodes, and M stage.

Choi et al. (22) investigated 58 patients with malt lymphoma; 21 high grade malt lymphoma and 37 low grade

All 21 patients with high-grade MALT lymphoma showed abnormality in the gastric wall on CT. Of these patients, nine had lesions in both the antrum and body of the gastric wall, seven had lesions only in the body, four had lesions only in the antrum, and one had lesions in the body and fundus. Thus, 17 patients (81%) had involvement of the gastric body. Nineteen (51%) of the 37 patients with low-grade MALT lymphoma showed abnormal gastric wall thickening on CT. Of these patients, nine had lesions in the body of the gastric wall, seven had lesions in the antrum, and the remaining three had lesions in the antrum and body. Thus, 12 patients (63%) had involvement of the gastric body.

According to Fishman et al (23) most patients with gastric lymphoma have associated adenopathy. One of the key differencing features of gastric lymphoma and adenocarcinoma is that in lymphoma the nodes are usually bulky and wall thickness is larger

Kim et al.(24) tried to identify predictor of malignancy out of 81 patient with GIST the tumor size tumors ranged from 1 to 23 cm (mean, 8.1 ± 5.3 cm). Twenty-six cases 32% were classified as benign, 10% as having low malignant potential and 58% as malignant. The sizes of benign tumors ranged from 1 to 5 cm; those of tumors with low malignant potential, from 5.5 to 10 cm; and those of malignant tumors, from 1.5 to 23 cm. The locations were the fundus (30.9%), the body (54.3%), and the antrum (14.8%).

Heterogeneous tumor enhancement in 63 % tumors, and central fluid attenuation was present in 49.4%. Calcification was present in 5 % seen only in malignant lesions. 11% had metastatic

lesions on CT scans of this group 54% of which were diagnosed with liver metastases, 9 % whom also had peritoneal seeding, 27.7 % were diagnosed with peritoneal seeding.

Burkill et al (25) identified 116 patients with malignant GISTs (76 men and 40 women; mean age, 54.6 years). The primary tumor locations in descending order of frequency were the small bowel (n = 49), stomach (n = 43), colon (n = 7), rectum (n = 6), other (n = 3), and not specified (n = 8). Mean primary tumor size was 13 cm ± 6. Tumors were typically well defined (31 of 36 [86%]), with a heterogeneous rim of soft tissue with lower signal intensity than that of the contrast material–enhanced liver. Central fluid attenuation was seen in 24 of 36 (67%) patients. Metastases were seen in 23 of 38 (61%) patients at presentation. Spread was usually to the liver or peritoneum

In summary even though CT is not the primary modality for diagnosis of gastric cancer, it is important for evaluation of disease extent and staging. The treatment out come and treatment option depends on tumor stage and histologic property of a tumor; it is paramount importance to review the value of CT in diagnosing and staging gastric tumor particularly gastric cancer for proper and early intervention. There are also discrepancy between different articles in accuracy of detection and staging of gastric tumor and accurate differentiation between different types of tumor. So this research was done to solve these gaps by using gastric tumor patient in the study period at TASH which will be used as reference in imaging appearance of gastric tumor in Ethiopi+an population in the future.

3. Objectives

3.1. General objective

- To assess CT scan patterns and staging of gastric tumor patients at the time of diagnosis.

3.2 Specific objectives

- To assess the socio demographic distribution of gastric tumor patients.
- To identify the relative prevalence of the various gastric tumor
- To assess role of imaging to reach specific diagnosis in gastric tumor
- To asses role of CT for staging gastric cancer
- To assess degree of coherence between imaging and pathology
- To describe the imaging feature of gastric tumor.
- To determine the diagnostic accuracy of CT scan in the evaluation of gastric tumors.

4. Methods and Materials

4.1 Study area and period

The study was conducted at TASH, College of health science, Addis Ababa University, Addis Ababa Ethiopia,TASH ,located in the nation's capital Addis Ababa, is a largest referral as well as a main teaching hospital. The study was conducted from September 2019 –August2020 G.C

4.2 Study design

Retrospective cross-sectional study was employed

4.3 Population

4.3.1 Source population

The source populations were patients with abdominal CT scan exams during study period.

4.3.2 Study population

The study populations were consecutive gastric tumor patients who have both pathology and imaging result being evaluated at TASH during study period.

4.3.3 Inclusion and exclusion criteria

4.3.3.1 Inclusion criteria

All gastric tumor patients having both pathology and MDCT scan imaging during study period.

4.3.3.2 Exclusion criteria

All gastric tumor patients not having either pathology or CT scan during study periods.

4.4. Sampling technique and sample size

Non probability sampling technique was used. All patients that fulfill the inclusion criteria in study period were included.

4.5. Data collection procedure

First data collectors were taught on how to collect the data and adequate information regarding the questionnaire was given in order to minimize personal bias. Then data was collected using structured questionnaire. First patient's card was identified from the surgery and oncology clinics archives. Using questionnaire, data was retrieved from patient's chart, CT report and histopathology results. CT images of patient also were reviewed for completeness

4.6. Data quality control

Data from each collection format was checked for completeness, clarity, consistency and accuracy. Data were collected with principal investigator who is well trained to read and understand abdominal CT scan interpretation well.

4.7. Data processing and analysis

The data were checked for clarity and completeness. Data was analyzed by using SPSS version 20. Computer software. Then summarization and comparison of data was done.

4.8 Ethical considerations

In order to respect patient's bill of right, regulation of the hospital where the study was conducted and ethical considerations was taken in to account. Any piece of information is kept confidential by not recording names of patient.

Written formal letter were obtained from the respective authorities and formal letter was written from radiology department to surgery and Oncology clinic before commencing the data collection process.

4.9. Variables

4.9.1: Dependent variables

Imaging diagnosis

MDCT TNM stages of the disease

Pathologic TNM stage

Metastasis at the time of MDCT imaging

Nodal metastasis at the time of MDCT

4.9.2: Independent variables:

Age

Sex

Anatomic location involved

Histopathology diagnosis

Histology of the lesion of different type of gastric tumor

5. Result

5.1: Sociodemographic data

A total of 80 patients with a gastric tumor having pathologic results were investigated .Of these 80 patients, 66 were gastric cancer cases, 12 were gastric GIST and 2 were primary gastric lymphoma. The age ranges of gastric cancer were 25 years to 85 years; the mean age being 52.6 years. The commonest age group for gastric cancer was 46 -60 years accounting for about 40 % of total gastric cancer cases.

From 12 cases of gastric GIST age ranges from 15 to 80 years; the commonest age group being 46-60 years (41.6 %) and mean age of 54.3 year. From two cases of primary gastric lymphoma the age of the first case was 35 and female and the second was 54 years and male patient.

From total of gastric cancer patient male accounts for 37/66(56 %) and female 29/66 (44 %) while 8/12(66.6 %) of GIST were male

From all case of gastric tumor majority present with epigastric pain and vomiting (75 %) out of these 36.3 % have additional weight loss in addition to epigastric pain and vomiting. 8.8 % of patient presents with UGB, 11.3 % with abdominal mass and 2 cases with difficulty of swallowing .1/ 66 of gastric cancer (1.5%) cases presents with supraclavicular LAP and 1/66 of gastric cancer (1.5%) case with bone metastasis at initial presentation

Diagnosis			Age in years						Total	percent
			<15	15-30	31-45	46-60	61-75	>75		
gastric cancer	sex	male		1	7	16	9	4	37	56
		female		7	3	10	9		29	44
	Total			8	10	26	18	4	66	100
GIST	sex	male	1		1	4	1	1	8	66.7
		female			2	2			4	33.3
	Total		1		3	6	1	1	12	100
lymphoma	sex	male		0		1			1	50
		female		1					1	50
	Total			1		1			2	100
Total	sex	male	1	1	8	21	10	5	46	57.3
		female		8	5	12	9		34	42.7
	Total		1	9	13	33	19	5	80	100

Table 1: Socio demographic characteristics of gastric tumor patient at TASH in 2019 /2020 G.C

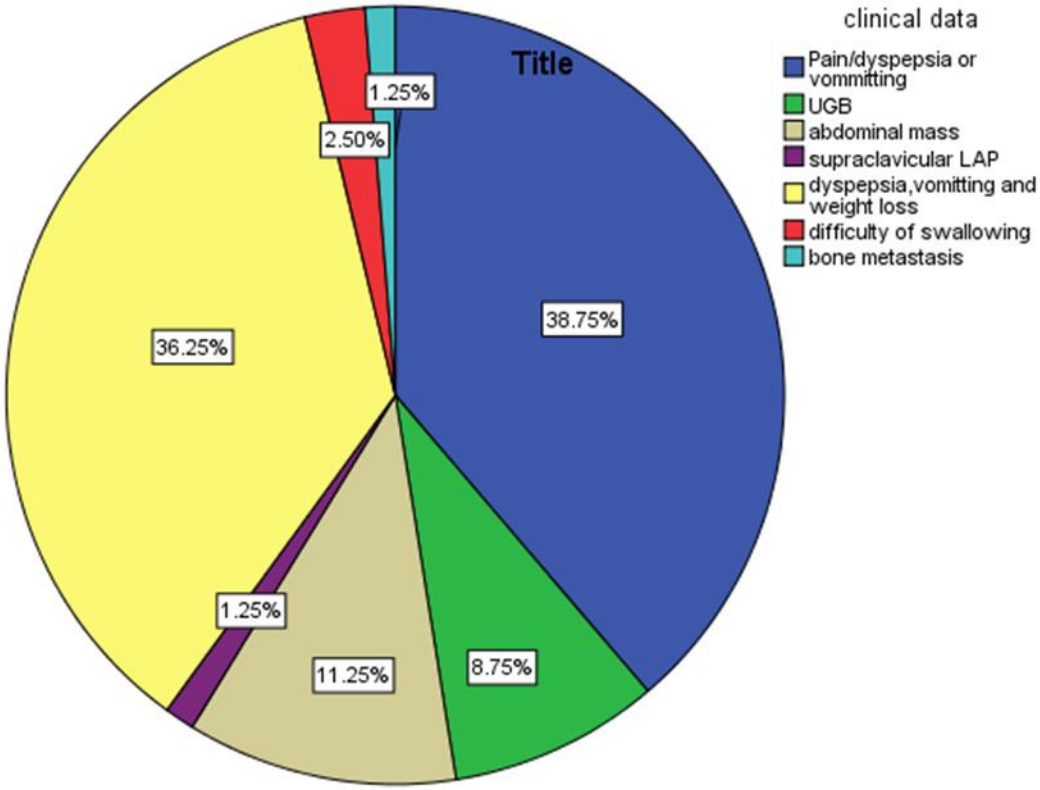

Figure 1: Clinical presentation of the all patients with gastric tumor in TASH l in 2019/2020 G.C

5.2: Imaging finding

The anatomic sub site involved in case of gastric cancer was evaluated. 9/66(13.6 %) cases of gastric cancer were limited in cardia of stomach ,9/66 (13%) were limited in body of the stomach . 7/66(10.6%) were located in the antrum ,5/66(7.6%) were located in pylorus ,6/66(9%) involves cardia and fundus,4/66(6%) involves cardia, fundus and body ; 3/66(4.6%) involves body ,antrum and pylorus ,8/66 (12.1%) involves antrum and pylorus ,9/66(13%) involves body and antrum, 4/66(6%) involves fundus and body and 2 /66(3.1%) had diffuse involvement with lentis plastica pattern .

Both of the primary gastric lymphoma cases were centered at antrum one of which has extension into pylorus.

From 12 cases of GIST; 5/12 (41.7%) were located at the body of the stomach, 2/12(16.6%) were located at antrum, 2/12 (16.7%) involved both body and antrum, 1/12(8.3%) were located at fundus and body of the stomach and 2/12(16.7%) were located at cardia/fundus

		Diagnosis			Total
		gastric cancer	GIST	lymphoma	
anatomic region	Cardia	9	1		10
	Body	9	5		14
	Antrum	7	2	2	11
	Pylorus	5			5
	cardia and fundus	6	1		7
	cardia ,fundus and body	4			4
	body ,antrum and pylorus	3			3
	antrum and pylorus	8			8
	body and antrum	9	2		11
	diffuse involvement(lentis plastica)	2			2
	fundus and body	4	1		5
Total		66	12	2	80

Table 2: Anatomic distribution of gastric tumor evaluated at TASH in 2019/2020

The gross appearance of tumor were also evaluated .58/66(87.9%) case of gastric cancer had gastric wall thickening, 2/66(3 %) cases appeared as intramural lesion and 6/66 (9.1%) had polypoid mass. Among gastric cancer patients with gastric wall thickening, 40/ 58 (68.9%) cases had asymmetric circumferential wall thickening, 18/58 (21.1%) had symmetric circumferential wall thickening.

Out of 12 cases of GIST, 10/12(83.3%) had exophytic pattern of growth, 1/12(8.3%) had intramural mass lesion and 1/12 (8.4%) had both exophytic and polypoid growth. Both cases of lymphoma had asymmetric circumferential wall thickening pattern.

				Gastric cancer	GIST	Lymphoma
Gross appearance		Polypoid mass		6		
	mass	Intramural mass		2	1	
		Exophytic mass			10	
		Both exophytic and polypoid			1	
	Thickening		Asymmetric	40		2
			Symmetric	18		
	Total			66	12	2

Table3: Gross CT appearance of all gastric tumor patients evaluated at TASH in 2019/2020 G.C

The thickest part range from 1 cm to 8 cm in all cases of gastric cancer cases and longitudinal dimension ranges from 1.9 cm to 11.6 cm while for GIST smallest dimension was 4.3 and the largest dimension being 28 cm .The mean thickness of thickest part for lymphoma was 1.7cm and longitudinal dimension was 5 cm.

Diagnosis		N	Minimum	Maximum	Mean	Std. Deviation
gastric cancer	thickness	66	1.00	8.00	2.6515	1.14559
	longitudnal size	66	1.90	11.60	5.8818	2.16055
		66				
GIST	thickness	12	4.30	10.50	7.4583	2.04382
	longitudnal size	12	5.40	28.00	11.8167	5.95999
	Total	12				
lymphoma	thickness	2	1.50	2.00	1.7500	.35355
	longitudnal size	2	4.00	6.00	5.0000	1.41421
	Total	2				

Table 4: Thickness and longitudinal size of tumor all gastric tumor patients evaluated at TASH in 2019/2020 G.C

Out of 66 case of gastric cancer 51(72.2%) had homogenously enhancing pattern and 15 (21.8 %) cases had heterogeneous enhancement .out 12 case of GIST 10(83.3%) had heterogeneous pattern of enhancement while 2 (17.7%) of GIST had homogenous enhancement pattern .Both cases of lymphoma have homogenous enhancement. 2 out of 66(3.3%) cases of gastric cancer had calcification and 3/12(25%) cases of GIST had calcification .8 out of 12(66.7%) GIST had internal cystic changes. Cross tabulation was done for cystic change and tumor size , the greatest tumor dimension was >9.7 cm for those with cystic change .From those 4 cases of GIST with no cystic changes all were spindle cell histologic type ;2 high risk 1 low risk .

		Diagnosis						Total
		gastric cancer		GIST		lymphoma		
		Frequenc	Percent	Frequenc	Percent	Frequency	Percent	Frequency
Tuenhancement	hetrogenous	15	22.7	10	83.3			25
	homogenous	51	77.3	2	16.7	2	100	55
Total		66	100	12	100	2	100	80

Table 5: Enhancement pattern of all gastric tumor seen at TASH in 2019/2020 G.C

Out of 66 case of gastric cancer 24(36.3 %) had metastasis at the time of initial CT scan imaging and 1/12 cases of GIST had metastasis

Out 24 cases of gastric cancer cases with metastasis ,9/24(37.5%) had metastasis to the liver only ,3/24 (12.5%) had metastasis to peritoneum and omentum,7/24(29.2%) had metastasis involving liver ,omentum and peritoneum , 2/24(8.3%) had involvement of liver, lung ,omentum and peritoneum .2(8.3%) cases had metastasis to lung, bone ,peritoneum and ovary .1(4.1%) had metastasis to supraclavicular lymph node in addition to other site of metastasis . 1/12 cases of metastasis from GIST was to the liver

38/66(57.6%) cases of gastric cancer had lymph node enlargement; the size ranging from 0.7 to 5.4 cm in short axis.

Both cases of gastric lymphoma has lymph node enlargement; the size ranging from 0.9 to 1.3 cm in short axis.

One case of GIST had lymph node enlargement measuring 1.6 cm along short axis .16 cases out of 38 (42%) cases of gastric cancer with lymph node enlargement the morphology were rounded ,10/38(26.3%) were oval and , 12/38(31.6%) were un labeled .In both cases of lymphoma the morphology of 1 case was labeled as rounded and the second as oval .The morphology of lymph node in GIST was unlabeled .

20 out 38 (52.6%) lymph node enlargement in gastric cancer had homogenous enhancement , 5/38(13.2%)had heterogeneous enhancement and 6(15.8%) had heterogeneous enhancement with central hypo density and the reset 7 (18.4%) were not characterized .All lymph node in cases of lymphoma and GIST had homogenous enhancement

		Diagnosis			Total
		gastric cancer	GIST	lymphoma	
metastasis at time of MDCT scanning	Yes	24	1	0	25
	No	42	11	2	56
Total		66	12	2	80

Table 6: Frequency of metastasis of gastric tumor at the time of MDCT scanning at TASH in 2019/2020

		pathologic dx			Total
		gastric cancer	%	GIST	
organ of metastasis	Liver	9	37.5	1	10
	Peritoneal/omental	3	12.5		3
	Supraclavicular	1	4.1		1
	liver,lung,peritonium /omentum	2	83		2
	lung,peritonium,bone,ovary	2	8.3		1
	liver and peritoneum /omentum	7	29.2		6
Total		24	100	1	25

Table 7: Frequency of secondary site of metastasis in gastric cancer evaluated in TASH in 2019/2020 G.C.

5.3. Pathologic diagnosis and correlation with CT diagnosis

Out 80 cases of gastric tumor evaluated in TASH the 60 were diagnosed as GA with MDCT, 13 were GIST and 1 was lymphoma, 3 reported as differential diagnosis of lymphoma and gastric cancer and the rest 2 was diagnosed as gastric cancer and gastritis as possible differential diagnosis.

Histopathologically out of 80 cases evaluated, 66(82.5%) were diagnosed as gastric cancer, 12(15 %) as GIST and 2(2.5%) as lymphoma.

From total of 66 gastric cancer patient 37(56%) were intestinal type adenocarcinoma, 22(33.3%) were diffuse type adenocarcinoma and 7(10.6 %) were indeterminate .From total of 12 GIST cases ,6(50%) were low risk spindle cell type , 2(16,6%) were high risk spindle cell type , 1(8.3%) were high risk epitheloid type, 1(8.3%) was low risk epitheloid type and 2(16.6%) were mixed histologic type .

Of 2 primary gastric cancer cases 1 was MALT lymphoma and the other was NHL

		pathologic diagnosis			Total
		gastric cancer	GIST	lymphoma	
Radiologic diagnosis	gastric cancer	60	0	1	61
	GIST	1	12	0	13
	Lyphoma	0	0	1	1
	ddx:Gastric cancer ,lyphoma	3	0	0	3
	gastric ca ,gastritis	2	0	0	2
Total		66	12	2	80

Table 8*: *Cross tabulation showing radiologic and pathologic diagnosis of all gastric tumor patient evaluated at TASH in 2019/2020G.C

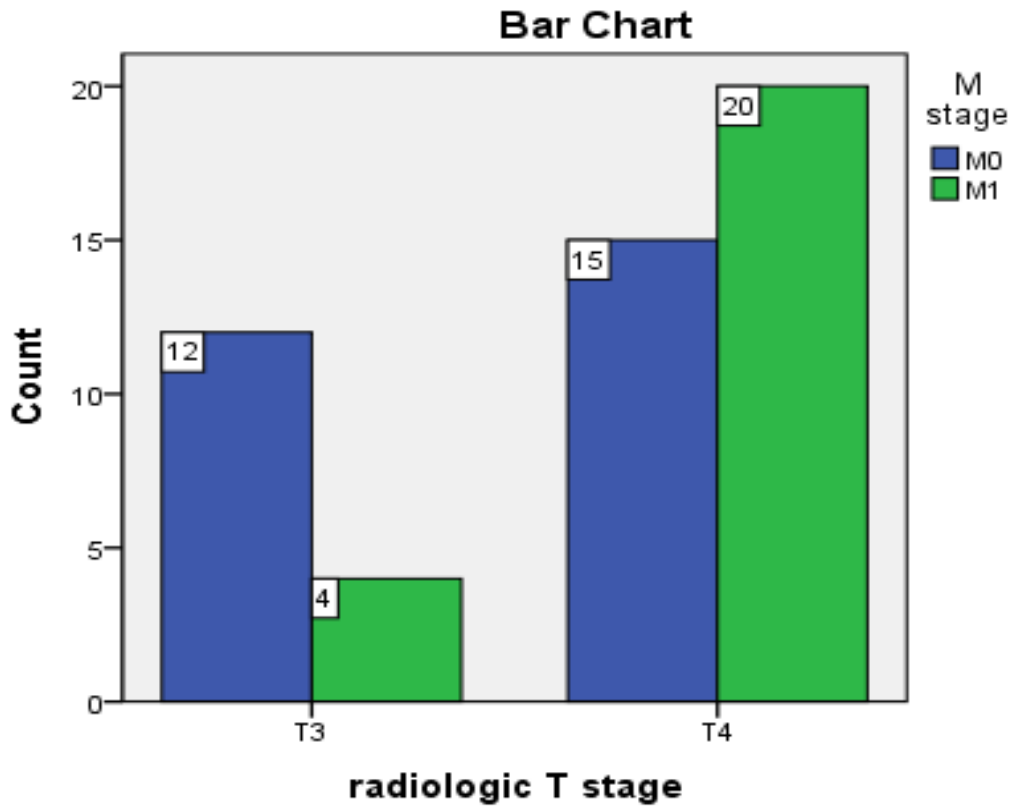

Figure 2: Graph showing T stage and M stage evaluated at TASH in 2019/2020 G.C

Among 66 cases of gastric cancer confirmed by pathology, 60(90.9%) cases were correctly diagnosed by CT as gastric cancer.

For 4 of the cases, gastric cancer and lymphoma were given as differential diagnosis which finally found to be gastric cancer by histology.

For 2/66(30%) cases, gastritis and gastric cancer were given as differential diagnosis .1/66(1.5%) cases was diagnosed as GIST by CT. 1/66(1.5%) of the patient diagnosed as gastric cancer by CT, the pathology result was lymphoma. Among 12 cases of GIST diagnosed by pathology, CT diagnoses all cases correctly .Among 2 cases of lymphoma, CT diagnose 1/2 (50%) correctly .the other was diagnosed as gastric cancer.

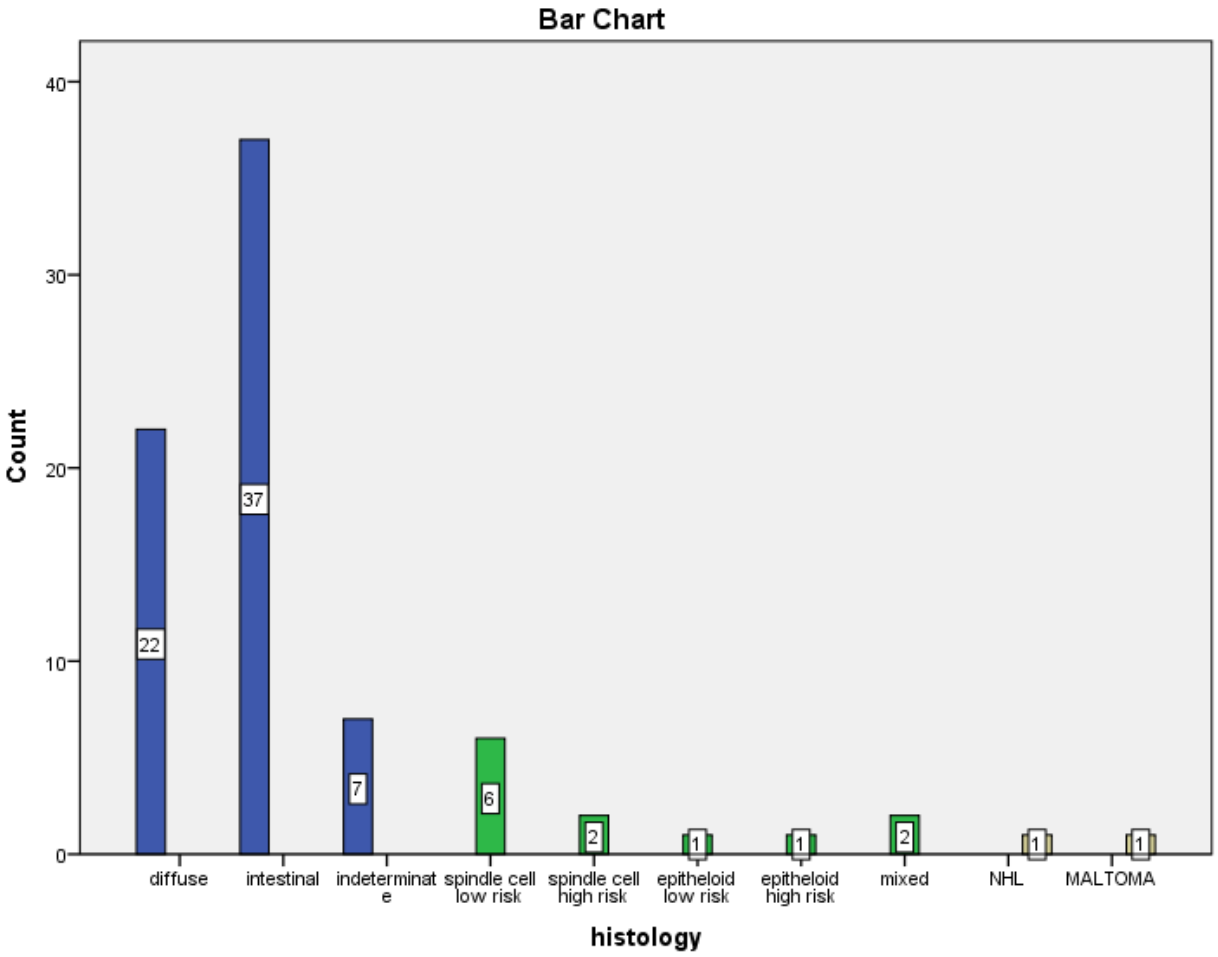

Figure 3: Histologic types of all gastric tumor patient evaluated at TASH i n 2019/2020

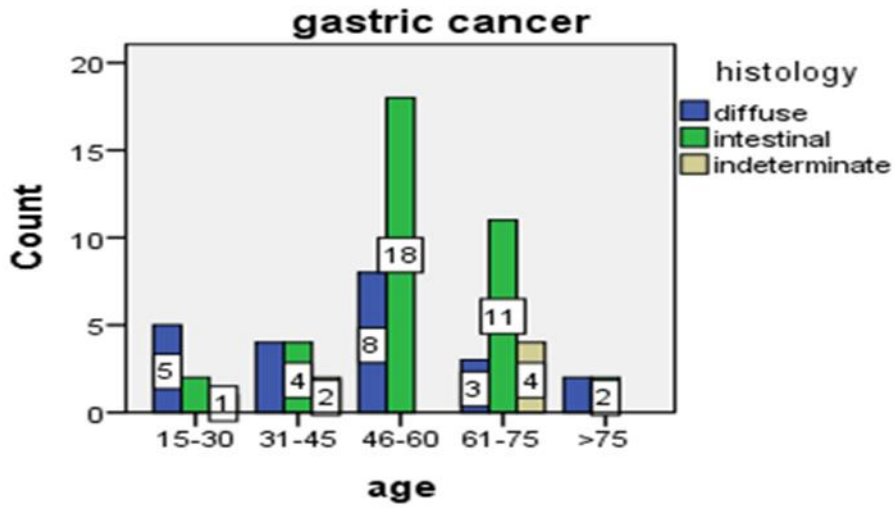

Figure4: Age distribution of gastric cancer histologic type in patient evaluated at TASH in 2019/2020

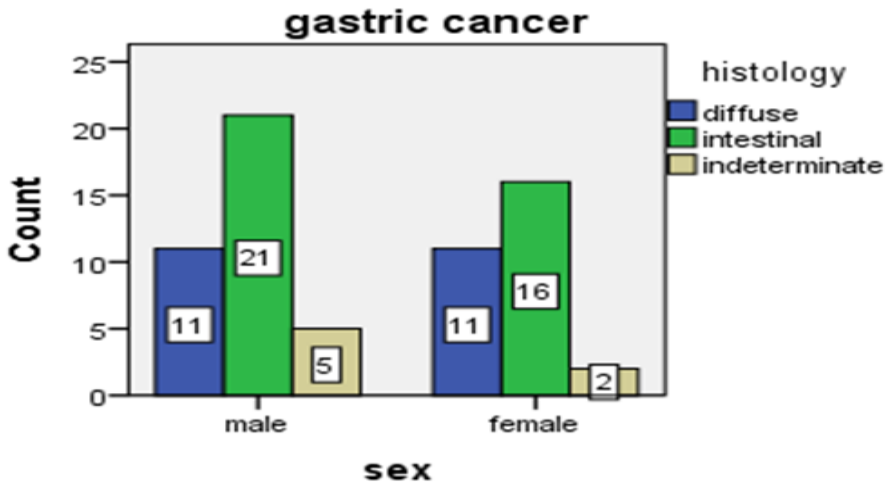

Figure 5: Sex distribution of gastric cancer histologic type in patient evaluated at TASH in 2019/2020

Out of 66 cases of gastric cancer confirmed histopathologically, 50 had radiologic TNM stages. Out of 50 cases of gastric cancer with CT TNM stages ,16/50(32%) were T3 and 34(68 %) were T4, out of 50 cases of gastric cancer with N staging 15/50 (30%)were N0 11/50 (22%) were N1, 14/50(28%) were N2 and 10/50(20%) were N3.

35 out 66 cases of gastric cancer had proper pathologic stage .6/35(17.1%) were PT2, 18/35 (51.4%) were PT3, 11/35 (31.4%) were PT4.From nodal staging, 9/35(25.7%) were PN0, 11/35(31.4%) were PN1, 9/35(25.7%) were PN2 and 6/35(17.1%) were PN3.From total 6 pathologic pT2 case 4/6(66.6%) were over staged as T3 by MDCT, 2/6 (33.3%) were over staged as T4 by MDCT

From a total of 18 pathologic PT3, 38/18(44.4%) were correctly staged a T3 by MDCT.10/18 (55.6%) were over staged as T4. from a total of 11 PT4 tumor, 10/11(90.9%) were correctly staged as T4 and 1/11(9.1%) were under staged as T3 by MDCT

The ability of CT in staging lymph node metastasis were also correlated with pathologic N staging .Out of 9 pathologic N0 stage, 5 (55.6 %) were correctly staged as N0 by MDCT, 3/9 (33.3 %) were over staged as N1 and 1/9 (11.1%) were over staged as N2.From 11 cases staged as pN1, 6/11(54.7 %) were correctly staged as N1 by MDCT, 3/11(27.3 %) were under staged as N0 , 1/11(9 %) were over staged as N2 and 1/11(9%) were over staged as N3. From 9 pathologic pN2, 3/9(33.3%) were staged correctly as N2 by MDCT and 3/9(33.3%) were under staged as N0 and 2/9 (22.2%) were under staged as N1 .1/9(11.1%) were over staged as N3 From 6 pN3 1/6(16.7%) were correctly staged as N3 by MDCT, 4/6(66.6 %) were under staged as N2 and1/6 (16.7 %) under staged as N1

		pathologic T stage			Total
		PT2	PT3	PT4	
radiologic T stage	T3	4	8	1	13
	T4	2	10	10	22
Total		6	18	11	35

Table 9: Correlation of MDCT T stage and pathologic T stage of patient with gastric cancer at TASH in 2019/2020

		radiologic N stage				Total
		N0	N1	N2	N3	
pathologic N stage	PN0	5	3	1	0	9
	PN1	3	6	1	1	11
	PN2	3	2	3	1	9
	PN3	0	1	4	1	6
Total		11	12	9	3	35

Table10: Correlation of MDCT and pathologic Nodal stage of patient with gastric cancer at TASH in 2019/2020

6. Discussion

In this study we found that the majority of the gastric tumors are gastric CA accounting for 82% which has male predominance (57.6 %) and mean age of 52.6yrs. The gender and age distribution of gastric cancer were similar with research done in Ethiopia by H.W. Gebresillasse et al (26) which reported mean age of 52yrs and male accounting 56%.

The second frequent gastric tumor is GIST accounting for. 15 % with mean age of 53.4yr and male predominance (66.5%). The age and gender distribution of gastric GIST in this study is comparable with findings of Guy J.c.burkil et al (25) which shows 65.5 % male and mean age of 54.6 year

The most commonly involved anatomic subsite by gastric cancer were distal stomach involving body and antrum of stomach in (71%) and cardia (22%) respectively which is in agreement with the report of B.B. Chen.et al(27) which showed involvement of body and antrum in 80%.

The most commonly involved region of stomach by GIST was body (41%) and antrum(16%), followed by involvement of both body and antrum (16%) this is in agreement with Kim etal (24) which showed the body is the commonest subsite (50%)

In this study, the majority (87.8 %) of gastric cancer showed circumferential gastric wall thickening .The rest 12.2 % had polypoid and intramural mass.

This study showed close agreement with research done in Egypt by Zytoon et al. (28) which showed 82 .8% had circumferential wall thickening and 12.5 with polypoid, fungating, and ulcerating masses.

In this study majority (72.3%) cases of gastric cancer had homogenous enhancement. This is in contrary to research done by Zytoon et al. (28) which showed 100 % of gastric cancer cases were homogenously enhancing in arterial phases .This could be due to the scan of patient included in this research is in portal phase

Majority (83.3%) of gastric GIST cases showed heterogeneous enhancement and internal cystic areas (66.6 %). The tumor size of patient showing heterogeneous tumor enhancement and cystic changes were large (>9.7) cm

This in close agreement with research done by GuyJ.c.burkil(25) showing 67 % cases of GIST showed internal cystic areas.

Histologically based on Laurence , intestinal type is the commonest (56 %) ,33.4% were diffuse types and the rest 10.6 % were indeterminate which are in close agreement with research done in central Florida by Bing Hu, Nassim El Hajj (30)showing relative frequencies of approximately 54% for intestinal type, 32% for the diffuse type, and 15% for the indeterminate type .

The study showed that sensitivity of and specificity of MDCT was100 % and 92.4% respectively for GIST. But it was difficult to evaluate accuracy of MDCT for gastric cancer since most of the cases were already known case of gastric cancer imaged for staging.

It was found that the accuracy of MDCT was excellent for T4 tumor (90.1) better than the report by Yan etal(21) (90.9 % versus 85.8 %). But relatively low for T3 and lower than Yan etal(44.5 % versus 86.6 %) .The lower accuracy of T3 tumor in this research could be due to the CT protocol is portal phase only in this study which is not sufficient to describe the layered appearance for differentiating T2 and T3 tumor.

The accuracy of MDCT for nodal staging was relatively low as compared other research. 55.6 % for N0,54.7 % for N1,33.3 % for N2 and 16.7 % for N3 versus 82.3 % for N0 ,64.7 % for N1 and 60 % for N2 in Yan etal(21)

7. Conclusion and Recommendations

7.1. Conclusion

Gastric cancer commonly affects elderly men (mean age 52 year).Non cardia gastric cancer was common in this study. Patients were image at advanced stage of the disease; majority at stage T3 and T4. Metastasis from gastric cancer was common at time of diagnosis (36.4%).

MDCT has better value in differentiating GIST from other gastric tumor. But the pattern of gastric wall thickening, secondary sign like splenomegaly and extensive lymphadenopathy were absent to sufficiently differentiate between lymphoma and gastric cancer .MDCT has relatively higher value for advanced gastric cancer staging .The accuracy is 90.9 % for T4 but has relatively low accuracy for early gastric cancer; 44 % accuracy for T3 tumor and MDCT has relatively low accuracy of differentiation between T3 and T2 tumor. MDCT had relatively high accuracy for early nodal staging (54.7% for PN0 and 54.6 % for PN1) but overall accuracy is low as compared with other study. In our study MDCT tend to under stage nodal staging particularly PN3 .The low over all accuracy of N staging could be due to high cut of lymph node size and in adequate nodal sampling during surgical resection. The low accuracy of early gastric cancer like T2 and T3 staging could be due to routine gastric distension and biphasic gastric protocol including arterial phase is not practiced in our setup.

The other explanation could be due to the time gap between imaging and post-surgical pathologic analysis is relatively long

7.2 Recommendations

To increase accuracy of MDCT for diagnostic and staging of gastric cancer, proper gastric protocol should be practiced with full gastric distension and biphasic scan including arterial phases especially for EGC.To increase the value of MDCT for staging of lymph node metastasis, the size criteria should be modified and adequate nodal sampling during surgical resection is recommended .Large scale study should be done with involvement of surgery and pathology department. Different types gastric neoplasm should be studied separately with adequate sample sizes particularly gastric lymphoma .The coding of patient at pathology department should be easy so that researcher could find card number and patient address easily.

Limitations of the study

Lacks of properly handled patients' chart with full information.

Small number of included gastric lymphoma to reach conclusion on imaging

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Annex

DATA COLLECTION FORMAT

Patient card No _____

1.1. Age _____Sex: ___

1.3. Findings on endoscopy.

_____
_____

1.2. Clinical presentation/other associated factors

_____
_____

1.4–finding on barium meal if done

_____
_____

2.1-CT finding

2.1.1. Gastric wall thickening:

-thickness along the thickest part (measure in cm)

-Extension along the circumference of stomach

Circumferential or focal thickening …….

-Extension along the longitudinal axis of stomach (measure in cm)

2,1,2-Mucosal irregularity

2.1.3- gross appearance of a lesion:

Polypoid……..

Intramural……

Exophytic……..

2.1.4. Pre contrast density of the lesion

Hypo dense hyper dense heterogeneous

2.1.5- Is there internal cystic change seen within the lesions?

Yes…..

No……

2.1.6- Post contrast enhancement of the lesion

Homogeneous

Heterogeneous

2.2.1- Site of origin of the lesion

A. cardia B.fundus.C. Body D. antrum/pylorus E.diffuse involvement.

2.3.1- tumor extent

A. mucosa B. muscularis mucosa B.submucosa D.Muscularisproperia and serousa E.extension beyond the serosa

2.3.2-tumor extension to nearby structure?

Yes ….

No…..

-If yes which structure involved? Specify

2.3.3- is there distant metastasis

A.liver B.lung C.other specify

2.4.1-Is there enlarged lymph node region seen?

Yes …..

No……

2.4.2- <3 regional lymph nodes (mention which region involved)

2.4.3 –3-5 regional lymph nodes (mention which region involved)

2.4.4 .6-15 regional lymph nodes (mention which region involved)

Mention the diameter of the largest lymph node in long diameter for all cases

2.4.5. Enhancement of lymph node

A. Homogeneous enhancement. B. Heterogeneous enhancement.

C. Heterogeneous with central necrosis.

3. 1-Histopathology result

Histological diagnosis----------
