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Role of MDCT in Evaluation of GI Malignancy with Histopathological Correlation

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Abstract:

Background: Understanding the CT scan features of gastrointestinal lesion will help us differentiate it as benign or malignant lesion further with help of CT scan we can find out the extent of lesion and that help us in staging of malignancy and further that can help us understand the pathology of the disease in better way and conditions associated with it thereby plan management.**Objectives:** In this study we aim to to evaluate CT scan features of GI malignancy and differentiate benign and malignant lesion, find out the extent of lesion and its precise location and check for distant metastasis, stage GI malignancy (Gastric cancer, Small bowel cancer, Large bowel cancer) on CT scan, Compare Air MDCT with hydro MDCT for stomach and large bowel in T staging of neoplastic lesions.

Methodology: A prospective study will be done at Acharya Vinoba Bhave Rural Hospital, Sawangi, involving35 patients who present with abdominal complaints and clinical suspicion of GI malignancy(gastric, small bowel and large bowel)after taking properly informed consent and ethical clearance, patient will undergo in depth history recording and CT scan evaluation under respective standard protocol for scanning.

Results: After appropriate statistical analysis, we expect to evaluate role of MDCT in GI malignant lesion and correlate it with histopathology report, proper staging of malignant lesion and the extent of lesion will be studied and distant metastasis will be checked in all malignant lesions.**Conclusion:** In this prospective study, we expect to find out the role MDCT in staging of malignant lesion, to find the extent of lesion, region involved and distant metastasis sites if there are any and correlate it with histopathological report we also seek to evaluate role of air vs hydro MDCT in T staging of malignant lesion.

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Keyword: MDCT, GI malignancy, Air MDCT, Hydro MDCT

INTRODUCTION:

With recent technological advances in CT the MDCT provides new opportunities in gastrointestinal imaging. With the use of attenuated collimation and superior quality multi-planar reformation and 3-D reconstructions the visualization and the extent of GI malignant tumour can be studied accurately. The MDCT offers information about the gastric wall and extra-gastric nature of the disease, unlike endoscopic visualization and contrast studies of the stomach. The key indication for the use of MDCT is preoperative staging for gastric carcinoma. Prerequisite for accessing the stomach wall is adequate distention of stomach which can be achieved by using water as negative oral contrast agent. Proper contrast content injection procedures offer improved separation between tumour tissue and natural mucosa, so the combination of near isotropic CT imaging with water-enhanced CT allows enhanced detection of a wide range of gastric diseases, including gastric malignancies.[1]

Gastric cancer has gross five years survival rate of less than about twenty percent, the peak prevalence of gastric cancer is between 50 and 70 years of age group. Conditions such as atrophic gastritis, gastric polyp, partial gastrectomy, pernicious anaemia and menetrier disease predispose patients to development of gastric cancer. Gastric cancer can be divided into early and late gastric cancer, the early gastric cancer is confined to mucosa or submucosa irrespective of lymph node status and is of 3 types, the “type I” gastric cancer are raised lesion and they extend more than 5 millimetres into the lumen . “type II ”early gastric cancer can be further divided into type two a lesions which are raised but extend less than 5 millimetres into the lumen, the type two b which are flat lesions, the slightly depressed type two lesion do not invade muscular mucosa, The muscularis mucosa is penetrated by type three lesions but they do not extend up to muscularis propria. .The advance gastric cancer may present as large, segmental, or diffuse wall thickening, ulceration and they invade the muscularis propria. The MDCT enables non-invasive evaluation of gastric wall and the extraintestinal extent of disease.[2]

Small bowel malignancies comprise of adenocarcinoma, neuroendocrine tumor (NET), lymphoma, and sarcoma. The most common histology is of NETs which consist of forty four percent of all small bowel tumors. “Adenocarcinomas, lymphomas, and sarcoma represent thirty three percent, fifteen percent, and eight percent of new cases on small bowel tumours, respectively”. Small bowel adenocarcinomas are typically diagnosed at an early stage because of the lack of clear symptoms. In order to understand tumour characteristics and for metastasis evaluation, enhanced computed tomography (or magnetic resonance imaging) is useful.

Colorectal cancer is second most common cause of cancer death in developed countries. The main factor influencing the prognosis is the depth of invasion into the wall and the presence or absence of lymph node and distant metastasis. About thirty percent of colorectal cancers are seen in sigmoid, twenty five percent are seen in the rectum, twenty five percent in ascending colon and caecum and the rest of twenty percent of cancer occur in descending colon and transverse colon. Adenoma-carcinoma sequence leads to development of colorectal

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cancer with stimulation of protooncogenes and the appease of tumour regressing genes. Thebulk of colon cancer develops as a distinct soft tissue mass that lowers the colonic lumen, and can also be found in the focal colonic wall as an area of thickening and luminal narrowing. Obstruction, rupture and fistula formation are symptoms of colonic malignancy, which can be correctly visualized on CT. on the MDCT territorial extension of the tumour is seen as an extra-colic mass or simply as the thickening and penetration of pericolic fat. In the case of colorectal carcinoma, the liver is the most prominent site of distant metastasis and the liver metastasis occurs on CT as hypo attenuating masses that are better visualized during the portal venous process of liver enhancement. Other sites for colorectal cancer metastasis include adrenal glands, lungs and bones. Optical colonoscopy is gold standard test for screening of colorectal cancer but has technical limitations such as looping of scope, poor bowel preparation, redundant colon, colonic spasm, patient discomfort. CT being a noninvasive approach to screen entire colon might overcome these limitations and help in better tumor staging and grading.[3]

RATIONALE:

In the literature, imaging characteristics of gastrointestinal tumours appearing at multiple locations of the GI tract have been conventionally identified as a single cohort without site-specific examination. Therefore this research is an effort to identify wall thickening as either benign or malignant based on attenuation pattern in patients with gastrointestinal lesions; The research also aims to evaluate the role of CT in malignant tumour staging. Finally, the CT findings would be compared to histopathological observations.

OBJECTIVES:

1. To evaluate CT scan features of GI malignancy and differentiate benign and malignant lesion.

2. To find out the extent of lesion and its precise location and check for distant metastasis.

3. To stage GI malignancy (Gastric cancer, Small bowel cancer, Large bowel cancer) on CT scan.

4. Compare Air MDCT with hydro MDCT for stomach and large bowel in T staging of neoplastic lesions.

METHODS:

Study Area: Acharya Vinoba Bhave Rural Hospital (AVBRH), Sawangi and Jawaharlal Nehru Medical College(JNMC)

- **Source of Data:** Patients from AVBRH attached to DMIMS. The patients are taken from both IPD and OPD basis.

Research design: Prospective study

Subjects: Patients presenting with abdominal complaints and clinical suspicion of GI malignancy(gastric, small bowel and large bowel)

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Sampling Procedure: All patients referred to the department of Radiology, AVBRH, Sawangi with abdominal complaints and clinical suspicion of GI malignancy (gastric, small bowel and large bowel) will be subjected for the study. After taking properly informed consent and ethical clearance, patient will undergo in depth history recording and CT scan evaluation.

Sample Size: patient with abdominal complaints and clinical suspicion of GI malignancy (gastric, small bowel and large bowel**)** referred to Acharya Vinoba Bhave Rural Hospital, Sawangi (Meghe) will be included. Calculated by formula:

Considering the study by Elais Netal[4] sample size was calculated using online sample size calculator Open Epi software

At 95% confidence interval

80% of power of the study

Population size (for finite population correction factor or fpc)(*N*): 1000000

Sample size required is 28 to 34, Hence the sample size is calculated to be 35.

Duration of study: 2 years

PROCEDURE FOR THE FOR GASTRIC SCANNING [1]

Patient preparation – patient will be instructed to be in fasting state for at least 6 hours of no solid food consumption.

Positioning - Patient position: for gastric antrum lesion prone position and for rest supine position.

Scanning -Section collimation 0.75–1.25 millimetres.

Image processing- Axial, coronal, and sagittal planes with MPR section thickness 4 millimetres.

Contrast material injection

Volume of contrast material – 120 millilitres

Volume of saline solution, -60 millilitres.

Flow rate 4 millilitres/sec

Arterial phase: 30 seconds.

Portal venous phase: 60 seconds.

SMALL BOWEL:

Small bowel scanning Protocol:

For a thorough CT exam of the small intestine water will be prescribed as negative oral contrast, usually 750 cubic centimeters 20 minutes before the examination followed by a

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further 250 cubic centimeters directly before the study. It guarantees opacification of both the small intestine and the stomach. IV contrast will be administered three to five cubic centimeter per second through a peripheral angio catheter. Depending on the indication, arterial and/or portal venous imaging will be performed using a twenty five-second and fifty-to sixty-second scan delay, respectively.[5]

LARGE BOWEL: The patient will be put in a supine position on the CT table after informed consent and the rectal tube will be implanted and room air softly puffed into the colon to achieve sufficient colonic distension. IV injection of 100 millilitres of omnipaque 350 will be administered at 3ml/sec. CT acquisition will be performed in the arterial phase and in the portal venous phase at a rotation speed of 0.8 sec. The lesion will be characterised based on the thickening of the bowel wall, depth of involvement of lesion and peri colonic spread. The results obtained from the CT scan studies will be correlated with the surgical and histopathological findings.

Care shall be taken not to cause any discomfort or harm to the patient, utmost care will be taken to make the patient comfortable during the entire procedure. If the patient is uncomfortable or experiences any discomfort the procedure shall be deferred and done whenever the patient is ready.[6]

INCLUSION CRITERIA

- All patients having clinical suspicion of gastro intestinal malignancy (gastric, small bowel and large bowel).
- All endoscopically proven cases of gastric, small bowel and colon neoplasm.
- Hemodynamically stable patient.

EXCLUSION CRITERIA

- Patient already diagnosed with ca esophagus and oral malignancy or suspicious of having ca esophagus and oral malignancy.
- Patient already diagnosed with hepatobiliary system neoplasm or suspicious of having hepatobiliary malignancy.
- Patient already diagnosed with pancreatic malignancy or suspicious of having pancreatic neoplasm.
- Post-operative patients.

DISCUSSION:

In recent years the Multi detector computed tomography (MDCT) has taken a very important place in investigation for detection, staging of tumor preoperatively and also to know the limit of lesion. To know the regional involvement and metastases if any, it is becoming very important to know the accuracy of the diagnostic test which will help the treating physician to

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decide about the best mode of treatment for the patient. Therefore, in the present study we will be evaluating the sensitivity and specificity of MDCT in staging of cancers of stomach, small and large intestine. Study also aims at differentiating benign vs malignant lesion and check for distant metastasis in case of malignant lesion.

Riccardo Iannaccone[7], et al. did a study in 2003 on 158 patients that underwent colonoscopy taking in consideration MDCT as reference . CT colon pictures were interpreted by two radiologist in view to assess the presence of malignancy or polyp. per-patient and per-polyp basis lead to sensitivity calculation . In the former specificity and PPV and NPV were also calculated. The weighted CT dose and the effective CT dose were determined on the basis of the reference body phantom measurements collected.By commercially using seven software, ED was calculated. The findings obtained showed that all twenty-two carcinomas in CT colonography were correctly seen. In all thirteen polyps examined, the susceptibility for identification was about ninety-nine percent, ten millimetres or more in diameter, about eighty percent in twenty of twenty-four polyps, six to nine millimetres, and about fifty percent in nineteen out of thirty-seven lesions, five millimetres or smaller. CT colonovisualisation with a sensitivity of around ninety six percent and a precision of around ninety seven percent with a PPV of ninety four percent and an NPV of ninety eight percent was indicated in the each patient report.

In a study by Eun Young Ko[8] et al. in 2010 Compared with nonmucinous carcinoma results, mucinous carcinoma displayed more extreme and more eccentric bowelwall thickening. In mucinous carcinoma, the heterogeneous contrast rise was more common than in nonmucinous carcinoma. In comparison to nonmucinous carcinoma, mucinous carcinoma had more regions with fewer attenuation, and the heavy portion of mucinous carcinoma displayed less improvement than that of nonmucinous carcinoma. Further intratumourol calcification was demonstrated by mucinous carcinoma . Heterogeneous augmentation reported the highest sensitivity of about 80 percent but low accuracy of about 55 percent in diagnosing mucinous carcinoma.

In a meta analysis by Elias N et al in 2016 the result based on a thirteen studies, where clubbed as odds ratio, specificity and sensitivity for identifying tumour extension away from the bowel wall T3–T4 were about 91 %, 68% and about 20 % respectively. For accessing of tumour invasion extent of 5 millimetre or greater, estimates from four studies were about 76% , about 71% , and about 7 % respectively. For nodal participation , around sixteen studies were included with values of about 70% , about 66%, and about 4% respectively of them two studies using CT colonography were included with sensitivity and specificity of about 96% and about 80% respectively, for evaluating T3 and T4 tumours. They found that CT has better sensitivity for the detection of T3 and T4 tumours, and results suggested that CT colonography markedly surge its accuracy.

In a study done by Abid Ali Sahito in 2019 colorectal carcinoma was labeled in 224 patients on CECT abdomen, out of these among 206 patients; carcinoma was proven on histological findings. Contrasted enhanced computed tomography showed diagnostic accuracy of 89.8% followed by sensitivity 92.0% and specificity 65.0%. The authors concluded that CT is a non-invasive imaging modality in the assessment of colorectal malignancy with sensitivity 92.0% and specificity 65.0%. Few other related studies were reviewed[9-11]. Jagtap et. al

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reported on metastatic malignancy by frozen section and imprint cytology[12]. Patwa et. Al. studied the ultrasound and color doppler features of transitional cell carcinoma of the endometrium with pathological correlation[13]. Rinait et. Al. reported on location and staging of tumours in patients of gastric carcinoma [14]. Similar Study by Shweta et al was reviewed [15].

CONCLUSION:

This research is an effort to identify wall thickening as either benign or malignant based on attenuation pattern in patients with gastrointestinal lesions; The research also aims to evaluate the role of CT in malignant tumour staging. Finally, the CT findings would be compared to histopathological observations.

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