# DISCUSSION

The peritoneum is the largest and most complex serous membrane in the body.[6]It is a common site of neoplasm. Peritoneal tumors are classified to primary and secondary tumors, secondary tumors are much more common than primary. [29]

Detection of peritoneal dissemination is essential in staging and subsequent management of the primary tumors.[1] CT enables accurate evaluation of the complex peritoneal cavity anatomy, which is the key to understand the pathologic processes that occur there.[14]

The aim of this study was to assess the role of multidetector computed tomography in evaluation of peritoneal and mesenteric tumors with pathological correlation.

This study was conducted on 30 patients with peritoneal and mesenteric tumors, 56.7% were females and 43.3% were males. The age of patients ranged between 5 to 73 years old with a mean age of 44.87 ± 17.30 years.

Secondary peritoneal and mesenteric tumors ( 76.7 %) were found to be much more common than primary tumors (23.3 %). The most common source of peritoneal metastasis were ovarian tumors (34.7%) followed by gastrointestinal tumors (30.4%).

Ayantunde AA et al[126] who studied 209 patients with malignant ascites, 67% were females and 33% were males, median age being 67 (30-98) years found that the commonest cancer was ovarian followed by gastrointestinal cancers.

Chu DZ et al [37] who studied one hundred patients with peritoneal carcinomatosis from non-gynecological malignancies , observed that the most common non-gynecological primary tumors was gastrointestinal tumors (45%) which was matching with our study.

Peritoneal metastasis in this study manifested in CT as omental cake, fine nodular thickening, heterogeneously enhancing mass(es), serosal implants on the bowel or hepatic subcapsular deposits and the most common affected site of the peritoneum was the greater omentum (40%). Le O [127] documented that intraperitoneal metastases can manifest as soft tissue nodules or mass-like plaques in CT images. Parietal peritoneal involvement can be seen as smooth or nodular thickening with enhancement on CT imaging with intravenous contrast and that the pouch of Douglus /rectovesicular space, right lower quadrant at the inferior junction of the small bowel mesentery, right paracolic gutter, and superior aspect of the sigmoid mesocolon are common sites for intraperitoneal deposition of tumor .

This study showed that primary peritoneal and mesenteric tumors were uncommon (23.3%) .Levy AD et al [29] also documented that primary tumors of the peritoneum are rare, When peritoneal masses are discovered, the principal diagnostic concern is metastatic disease, which is the most frequently encountered neoplastic process that involves the peritoneal cavity. However, primary peritoneal tumors should be included in the differential diagnosis, particularly when there is no evidence of a visceral primary malignancy.

A study was designed in 1995 and named EVOCAPE (Evolution of Peritoneal Carcinomatosis) studied staging of peritoneal carcinomatosis in 370 patients according to

the size of peritoneal deposits and either it is diffuse or localized. It was found that large peritoneal deposits (more than 2 cm in greatest dimension) associated with poor survival rate and bad prognosis. [38]

Calcifications was detected in 6 cases (20%) in this study ; it was observed in cases of peritoneal metastasis from mucin producing tumors as in ruptured mucinous adenocarcinoma of the appendix and signet cell gastric adenocarcinoma. It was also found as a characteristic of some primary tumors ; as in cases of mesenteric carcinoid tumors and neuroblastoma case. This was matched with Agarwal A et al [128] who documented that tumors such as serous cystadenocarcinoma, carcinoid and less commonly gastric and colon cancer can produce calcified peritoneal metastatic deposits.

According to Ayantunde AA et al[126] , ascites is the first detected sign of intra-abdominal malignancy in 52%-54% of cases of peritoneal carcinomatosis, while in our study ,ascites was not such common finding, it was detected in 8 cases (26.7%).

Sugarbaker PH et al [129] documented that the appendiceal region should be closely inspected in all newly diagnosed cases of pseudomyxoma peritonei. In many cases, it may be impossible to identify the originating appendiceal mucinous low-grade neoplasm or cystadenocarcinoma at CT or surgery because, after rupture, the residual appendix may be small or fibrosed .This was similar to a case in our study of pseudomyxoma peritonei from ruptured mucinous cystadenocarcinoma of the appendix as the appendiceal origin wasn't identified on CT basis.

Regarding lymphoma, Healy JC [130] observed that almost 50% of patients with non-Hodgkin's lymphoma and 5% of patients with Hodgkin's disease will have mesenteric nodes at presentation. The most common causes of solid mesenteric masses are non-Hodgkin lymphoma and metastatic disease so mesenteric lymphadenopathy is a relatively common CT manifestation of non-Hodgkin lymphoma. This study included two cases of mesenteric lymphoma presented as multiple pathologically enlarged lymph nodes encasing the mesenteric vessels .

This study also included two cases of Burkitt's lymphomas , presented in CT as ill-defined extensive soft tissue masses infiltrating the root of mesentery ,encasing mesenteric vessels with involvement of the pelvic peritoneum , associated with pleural nodular thickening , pleural effusion and ascites.

According to Cinar HG et al[131] who studied peritoneal lymphomatosis in children with Burkitt's lymphoma , peritoneum is amongst the sites that can be infiltrated in Burkitt lymphomas and can mimic peritoneal carcinomatosis. Peritoneal thickening, periportal infiltration in the liver, extensive mesenteric infiltration, intestinal wall thickening, omental cake, pleural effusion and ascites were common findings.

In contrast to peritoneal carcinomatosis, peritoneal lymphomatosis is curable without surgery. Although uncommon, Burkitt's lymphoma should be considered in the differential diagnosis of diffuse peritoneal malignancy in children as it is a highly agressive form of B-cell Non-Hodgkin lymphoma with a doubling time of 24 hours and early diagnosis is important for patient management. CT is the method of choice in imaging for being noninvasive, accurate and successful to reveal anatomic details and the extent of involvement for staging. [131]

In our study there was a misdiagnosed case by CT as TB peritonitis while pathological biopsy revealed Burkitt's lymphoma. According to Ha HK et al [132] who studied 135 cases In attempt to distinguish between TB peritonitis and Peritoneal carcinomatosis by CT, it was found that most of the findings of both diseases overlap together however mesenteric macronodules, omental irrigurality and calcifications are more with TB peritonitis.

In some cases CT can't differentiate between secondary peritoneal tumors as peritoneal carcinomatosis or lymphomatosis and other diffuse peritoneal diseases as TB peritonitis, sclerosing mesenteritis and inflammatory pseudotumor, unless the presence of other primary tumor which suggest more the diagnosis of secondary peritoneal tumor, however pathological correlation is essential in some cases.

This study included a case of pathologically proved leiomyomatosis peritonealis disseminata in postmonopausal female (51 years old) with no uterine fibroid that was misdiagnosed by CT as peritoneal metastasis of unknown primary. Deering S et al [100] reported that Leiomyomatosis peritonealis disseminata is usually discovered incidentally during surgery or imaging examinations of women of childbearing age who have uterine leiomyomas. It may be associated with high estrogen states, caused by pregnancy and oral contraceptive use, but rare cases in postmenopausal women and men have also been reported.

A case of inclusion cyst (benign multicystic mesothelioma ) was one of primary peritoneal tumors in this study. There was a history of previous pelvic surgery .It shows typical CT appearance of inclusion cyst as multilocular pelvic cyst with thin wall, thin septae, no soft tissue component and normal radiological appearance of both ovaries.

Two cases of mesenteric desmoid were diagnosed in this study . one case presented in CT as well defined hypoattenuating mesenteric mass but it was of poor prognosis as it was case of multiple desmoids ; at the anterior abdominal wall ,at left subdiaphragmatic space ,and mesenteric one indenting the 2$^{nd}$ part of the duodenum and there was no associated colonic polyposis. it was managed by chemotherapy .

The other case was misdiagnosed by CT as mesenteric carcinoid ,it had speculated margins and surrounded by mild stranding ,but pathologically proved to be mesenteric desmoid.

Most mesenteric desmoids are iso attenuating relative to muscle , although large lesions may display areas of low attenuation caused by necrosis .[108,109]

CT is useful in planning surgical resection and predicting prognosis. Large size (10 cm or more); multiplicity; and extensive infiltration, tethering, and encasement of small bowel loops and entrapment of the ureters are poor prognostic signs. [109]

Desmoid tumor is associated with colonic polyposis in patients with familial adenomatous polyposis (Gardner syndrome), occurring in 9%–18% of cases.[107]

Burke AP et al [133] documented that the small bowel mesentery is the most common site of origin of desmoid tumor.

This study included two mesenteric carcinoid cases with no detected ileal primary lesion ,associated with surrounding desmoplastic reaction . According to Woodard PK et al[121] the mesenteric carcinoid detected easily in CT while the primary ileal is often small, sometimes occult, and only occasionally diagnosed at CT. It was also found that mesenteric carcinoid can present as primary mesenteric tumor in rare cases.

At CT, the most common manifestation of mesenteric carcinoid tumors is an enhancing soft-tissue mass with linear bands radiating in the mesenteric fat. Calcifications are visible in up to 70% of lesions at CT .[106]

Radiologic-pathologic correlation has shown that these radiating strands of soft tissue do not generally represent tumor infiltration along neurovascular bundles but rather result from the intense fibrotic proliferation and desmoplastic reaction in the mesenteric fat and the adjacent mesenteric vessels caused by the release of serotonin and other hormones from the primary tumor.[117] Thickening of adjacent small bowel loops caused by tumor infiltration or by ischemia owing to sclerosis of mesenteric vessels as well as angulation can be present .[120]

Regarding the sensitivity of CT in diagnosis of peritoneal tumors, Coakley FV at al[16] demonstrated sensitivity (85%–93%) but poor sensitivity (25%–50%) for detection of tumor implants less than 1 cm. Healy JC[130] documented that specificity of CT for the diagnosis of peritoneal metastases is high ranging from 85–87%, however its sensitivity is low, ranging from 42–47%.

In contrast, Low RN et al [25] showed that MR imaging has been shown to have better sensitivity (85%–90%) than CT for the detection of tumor nodules less than 1 cm and an overall sensitivity for all peritoneal tumor nodules of 84%.

Sadeghi B et al [38] who studied the prognosis of peritoneal metastasis from non-gynecological primary tumors in Three hundred seventy patients observed that presence of ascites associated with poor progonosis and differentiation of the primary tumor doesn't affect the prognosis of peritoneal carcinomatosis. He also documented that sensitivity of CT scan in the diagnosis of peritoneal deposits was 70% for lesions 2 cm in greatest dimension and only 28% for lesions less than 5 mm in greatest dimension.

The reason for this variability is likely multifactorial, including differences in patient or tumor characteristics, CT techniques, radiologist experience, and the diagnostic criteria used in CT interpretation.

Laparoscopy has also demonstrated a significant incidence of peritoneal metastases in patients with a negative CT scan. Notably if ascites is present but no peritoneal deposits are seen on CT, laparoscopy demonstrated deposits in 75% of cases. [130]

Kim SJ et al [134] who studied detection of peritoneal metastasis by multidetector CT in 498 patients did surgery for gastric cancer observed that when CT results are not definitely positive for peritoneal deposits , staging laparoscopy is still recommended if a patient is considered to have greater tumor size and T stage.

Rubini G et al [135] compared between 18F-FDG PET/CT and CECT in diagnosis of 51 cases of peritoneal carcinomatosis. It was found that sensitivity and specificity of 18F-FDG PET/CT were 78.6 % and 91.3 % respectively while sensitivity and specificity of

CECT were 53.6 % and 60.9 % respectively. This study also proved that 18F-FDG PET/CT is a useful diagnostic tool when peritoneal biopsy can't be performed.

In our study, by correlation between the CT diagnosis and the pathological analysis of the cases, the CECT was able to correctly diagnose 26 cases (86.6%) .

Spencer JA et al who studied 35 female patients with peritoneal carcinomatosis to assess image-guided peritoneal core biopsy for the diagnosis of tumor type and treatment of patients proved that image-guided peritoneal core biopsy with hematoxylin-eosin analysis supplemented with immunohistochemical analysis is a simple, safe, and accurate technique for providing site-specific diagnosis of peritoneal carcinomatosis.[136]

Taking a biopsy from peritoneal tumors was a big challenge in this study as there were cases with bad clinical condition, bad coagulation profile or no safe site for biopsy. Also the rarity of the primary peritoneal tumors was an obstacle to study them well in this 30 cases study.

In this study CT was useful for detection, characterization, and staging of the primary non peritoneal tumors besides the detection of peritoneal deposits. It was also helpful in guided biopsy for tissue diagnosis.

It was found that correlation of imaging findings with clinical history and recognition of important pathological findings are essential to reach an appropriate diagnosis and initiate proper management.

# SUMMARY

The peritoneum is a large complex serous membrane, and common site for neoplastic process. Primary neoplasms of peritoneum occur much less frequently than metastatic and direct peritoneal involvement from a known or occult primary tumor.

Direct visualization of the peritoneum and mesentery with the use of computed tomography (CT) has enabled a great expansion of knowledge about the normal anatomy of the peritoneal lining, the mesenteries, spaces, and ligaments that arise from the peritoneum.

The aim of our study was to study the role of multidetector computed tomography in evaluation of peritoneal and mesenteric tumors with pathological correlation. The study was conducted on thirty patients of peritoneal and mesenteric tumors. their age ranged between 5 and 73 years old with median age 48 years. 17 cases were females (56.7 %) and 13 cases were males (43.3 %).

Secondary peritoneal and mesenteric tumors were much more common than primary tumors, as 23 cases were secondary tumors (76.7%), while primary peritoneal and mesenteric tumors were 7 cases (23.3%). It was found that ovarian tumors (34.7%) followed by gastrointestinal tumors (30.4%) were the most common sources of secondary peritoneal and\or mesenteric tumors.

In this study the greater omentum was the most common peritoneal space for secondaries (43.5 %) and the most common patterns of secondaries were omental cake (34.8%), followed by fine nodular thickening of the peritoneum (26.1%).

In correlation with the pathological analysis of the biopsies, the CECT was able to correctly diagnose 26 cases out of 30 cases (86.6%).

In our study CT was useful not only for the detection, characterization, and staging of peritoneal tumors, but also for guided biopsy for tissue diagnosis. Correlation of imaging findings with clinical history and recognition of important pathological findings are essential to reach an appropriate diagnosis and initiate proper management.