

Multidetector CT Patterns of Peritoneal Involvement in Patients with Abdominopelvic Malignancies

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ABSTRACT

Objective: To determine the patterns of peritoneal involvement in patients with abdominopelvic malignancies.

Study Design: Retrospective observational study.

Place and Duration of Study: Shifa International Hospital, Islamabad, Pakistan, from May 2004 to May 2012.

Methodology: Two hundred and three patients with histopathologically proven abdominopelvic malignancies with peritoneal involvement who underwent contrast-enhanced CT abdomen and pelvis were identified through electronic data base system and were included in this study after ethical committee approval. Peritoneal disease pattern, predominant sites of involvement and associated findings of ascites, lymph nodes and metastasis were assessed. Patients with tuberculosis and lymphoproliferative disorders were excluded.

Results: The malignancies showing peritoneal involvement, in decreasing order of frequency, were ovarian cancer (n=118), colorectal cancer (n=45), pancreatic cancer (n=11), gastric cancer (n=7), endometrial cancer (n=6), gallbladder/cholangio-carcinoma and hepatocellular cancer (n=5 each), cervical cancer (n=3), renal cell carcinoma (n=2) and transitional cell urinary bladder cancer (n=1). The most common pattern of peritoneal involvement was mixed in 79 patients (39%), omental caking in 74 patients (37%) and nodular deposits in 50 patients (24%). The most common sites of peritoneal involvement were pelvic peritoneum followed by greater omentum.

Conclusion: Peritoneal involvement is the commonest with ovarian and colorectal carcinoma. Mixed pattern of peritoneal disease was most frequently seen in these patients followed by omental caking and nodular peritoneal deposits.

Key Words: Peritoneal involvement. Ovarian cancer. Colorectal cancer. Omental caking. Nodular deposits. Multi-detector CT.

INTRODUCTION

The peritoneum is the largest serous membrane in the body and the one with the most complex structure. Peritoneal reflections form the greater and lesser omenta and the natural gravitational flow determine the route of spread of intraperitoneal fluid and consequently of disease processes within the abdominal cavity.¹⁻³

Multi-detector CT with multi-planar reformation allows accurate examination of the complex anatomy of the peritoneal cavity and helps in understanding the pathologic processes affecting the greater and lesser omenta.³

Metastatic peritoneal tumors most often originate from the carcinomas of ovary, stomach, pancreas, colon, uterus, and bladder.⁴ Ovarian cancer is the most commonest abdominopelvic malignancy with peritoneal disease with approximately 70% of patients having peritoneal involvement at the time of diagnosis. It spreads predominantly by direct invasion and intraperitoneal dissemination.⁵⁻⁷

Common sites of intraperitoneal seeding include the omentum, paracolic gutters, liver capsule and diaphragm. Thickening, nodularity, and enhancement are all signs of peritoneal carcinomatosis, however, microscopic spread of disease cannot be ruled out by any imaging modality alone and a full staging laparotomy is always required.^{7,8} It is important to determine exact extent of peritoneal disease as it changes the staging of disease, treatment plan and prognosis of patient, i.e. early ovarian cancer is treated with comprehensive staging laparotomy, whereas advanced but operable disease is treated with primary cyto-reductive surgery (debulking) followed by adjuvant chemotherapy.⁹ Patients with unresectable disease may benefit from neoadjuvant (pre-operative) chemotherapy before debulking.¹⁰

Characterization of different CT patterns of peritoneal carcinomatosis is also important as there is predilection of different malignancies for having different patterns of peritoneal disease.¹¹⁻¹³ Peritoneal deposits can be seen as omental caking, cystic, nodular, smudged or may be of mixed variety.¹³⁻¹⁵ There may be pre-dominance of one of these patterns for different diseases.^{16,17} Understanding, knowledge and identification of patterns of peritoneal carcinomatosis can help in diagnosis and staging of different malignancies, thereby improving the diagnostic accuracy and effectively guiding patient management.

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The objective of this study was to determine the patterns of peritoneal involvement in patients with abdominopelvic malignancies.

METHODOLOGY

This is a retrospective study performed from May 2004 to May 2012 at Radiology Department of Shifa International Hospital, Islamabad. Institutional Review Board and Ethics Committee approval was taken (IRB # 2019-068-2012). Cases were identified from electronic data base. Six hundred patients with peritoneal involvement were identified on CT scan of abdomen and pelvis. Of these, 203 patients with histopathological diagnosis of primary malignancy and documented peritoneal disease on CT scan were included in this study. Patients with tuberculosis and lymphoproliferative disorders were excluded from this study.

Two radiologists with more than 3 years experience in body CT reviewed the cases.

CT scans were performed on 64-slice CT scanner (Toshiba) after intravenous (I/V) contrast injection. Three-mm reconstructed images were reviewed and when necessary multiplanar reformations at different window level and settings were performed.

The patterns of peritoneal involvement were identified as smudged pattern (increased density or soft tissue permeation of the omental fat), nodular pattern (enhancing soft tissue nodules), omental caking (diffusely thickened masses replacing normal omental fat), cystic pattern (soft tissue masses with cystic component) and mixed pattern (having two or more of above described patterns). Peritoneal sites were broadly divided into pelvic, greater omentum and small bowel mesentery. Associated findings of ascites, enlarged lymph nodes and bone metastases were also evaluated.

Statistical analysis was done using SPSS version 16. Frequencies and percentages were calculated for categorical while mean ± standard deviation (SD) were calculated for continuous variables and graphs made for comprehensive review of study outcomes.



Figure 1: (A) Axial CT images of patient of ovarian cancer showing omental caking (arrow). (B) Coronal CT images of patient of endometrial cancer showing mixed pattern (arrow).

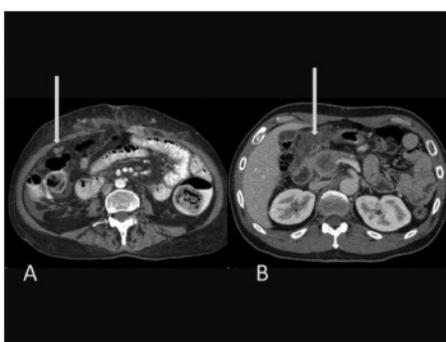


Figure 2: (A) Axial CT images of patient of recto-sigmoid cancer showing nodular pattern (arrow). (B) Axial CT images of patient of pancreatic cancer showing omental caking (arrow).

RESULTS

Age of patients ranged from 24 to 74 years with mean age of 55 ± 14 years. Male to female ratio was 2:3. All patients with histopathologically diagnosed malignancies were assessed for extent, site and pattern of peritoneal involvement. The malignancies showing peritoneal involvement in decreasing order of frequency, were ovarian cancer (118 patients, Figure 1A), colorectal cancer (45 patients, Figure 2A), pancreatic cancer (11 patients, Figure 2B), gastric cancer (7 patients), endometrial cancer (6 patients, Figure 1B), gallbladder/cholangio-carcinoma and hepatocellular cancer (5 patients each), cervical cancer (3 patients), renal cell carcinoma (2 patients) and transitional cell urinary bladder cancer (1 patient).

The most common pattern of peritoneal involvement was mixed in 79 patients (39%), omental caking in 74 patients (36%) and nodular deposits in 50 patients (24%).

The most common malignancy showing peritoneal involvement was ovarian cancer seen in 58% patients (n=118 patients) having omental caking as the commonest pattern in 55% (n=65 patients) of these patients followed by mixed peritoneal disease in 38% (n=45 patients) and nodular pattern in 7% (n=8 patients). The predominant sites of peritoneal involvement in ovarian cancer were pelvis followed by greater omentum and small bowel mesentery. The second most common malignancy with peritoneal carcinomatosis was colorectal cancer showing mixed pattern in 57.7% (n=26 patients) and nodular pattern in 42.3% (n=19 patients). Perirectal and pericolonic mesentery were the commonest site of involvement in these cases. Predominant pattern in pancreatic cancer was omental caking whereas in gastric, renal cancer and endometrial cancer was nodular. In gallbladder cancer, cholangio-carcinoma, hepatocellular cancer, transitional cell cancer mixed pattern was predominant. Cervical cancer cases showed nodular and mixed patterns (Figure 3).

The most common sites of involvement were pelvic peritoneum in 45% (n=91), followed by greater omentum

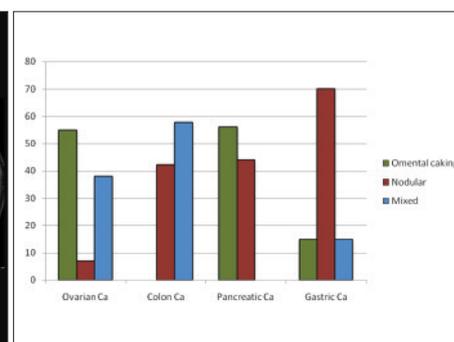


Figure 3: Graph showing patterns of peritoneal involvement in abdominopelvic malignancies.

in 25% (n=51), anterior abdomen in 15% (n=31) and small bowel mesentery in 15% (n=30) patients.

Around 70% (n=142) patients had ascites, 55% (n=112) had enlarged lymph nodes and 20% (n= 41) had bony metastasis.

DISCUSSION

Recognition of pattern of peritoneal involvement is of fundamental importance in abdominopelvic malignancies as presence and extent of peritoneal involvement changes the overall staging and management plan of patient. There are no published studies regarding this important area in our local literature. So, it was important to determine and compare patterns of peritoneal involvement in our country with the available foreign literature.

Regarding patterns of involvement the present results were comparable to studies by Motta *et al.*⁴ and Rodriguez *et al.*¹⁸ Mixed pattern of peritoneal disease was seen in 40% cases in the study by Motta *et al.*⁴ as compared to 38% in this study. Another study by Rodriguez *et al.*¹⁰ showed omental caking in 36% which is also quite similar to the present results showing 36% omental caking. Some difference was seen in nodular pattern which was seen in 24% cases in this study compared to 36% seen in study by Rodriguez *et al.*¹⁸ This study showed mixed pattern being commonest pattern of involvement of peritoneum in overall malignancies followed by omental caking and nodular pattern.

The site of peritoneal involvement in study by Anthony *et al.* was rectovesical pouch (50%), small-bowel mesentery (40%) and sigmoid mesocolon (20%).¹⁹ This study showed common sites as pelvic involvement (45%), greater omentum (25%), and small bowel mesentery (15%).

Ovarian cancer constituted the majority of the cases of this study. This is consistent with various studies reported in literature.³⁻⁵ It is followed by colorectal carcinoma, pancreas cancer, stomach cancer and other malignancies including hepatocellular cancer, transitional cell cancer, gallbladder cancer and endometrial cancer.^{6,7,12} The colonic and pancreatic carcinoma with peritoneal involvement were seen in 22% and 5% of these cases respectively. These results are quite similar to those by Abdullah *et al.* who showed peritoneal carcinomatosis in 31% cases of colonic and 15% cases of pancreatic cancer.³

This study showed omental caking as commonest pattern for metastatic ovarian cancer. Mamlouk *et al.* also showed ovarian carcinoma as commonest cause of omental caking in his study.¹³ Mamlouk *et al.* also showed colonic and pancreatic cancers to be next in order of frequency as a causative factor of peritoneal carcinomatosis. The present study showed that these

malignancies cause enhancing nodular omental deposits. This is also favored by other studies.^{11,13,17}

Use of MDCT has unmatched value in diagnosis of tiny sub-centimeter omental deposits. MDCT has established role in evaluation of primary site of disease causing thickening, mass formation and distortion of normal anatomical appearance of stomach, pancreas and colon.¹² Adnexal and ovarian pathologies can also be seen and difference between simple and complex malignant masses can be made on MDCT. This radiological interpretation with co-existing peritoneal disease is a road map towards accurate and final diagnosis of the patient.

Patterns of omental and peritoneal involvement may not be truly diagnostic in many patients but it is very helpful to narrow down the long list of differential diagnosis. In many of the cases CT findings can actually guide the clinicians towards final diagnosis.^{12,13} So it is very important for the radiologist to carefully evaluate peritoneal involvement, to characterize different patterns of peritoneal carcinomatosis and to establish single or fewer possible diagnosis to obviate unnecessary investigations for the patients.^{12,13}

Regarding recent advances in this field, CT combined with 18F-FDG-PET has improved the sensitivity and specificity of detection of peritoneal disease. In a study by Dirisamer *et al.*, CT detected peritoneal seeding in 26/31 (84%) patients, 18F-FDG-PET in 25/31 (81%) patients, and 18F-FDG-PET/MDCT in 30/31 patients, indicating a higher degree of sensitivity and specificity of combined PET-CT approach.²⁰

Characterization of omental disease is a subjective finding and no quantitative measurements are described in literature, however, we feel that in the hands of experienced radiologists many of the diagnostic dilemmas can be solved through better characterization of patterns of peritoneal involvement.

Being a single-centre study is a limitation of this study so the results cannot be generalized. More studies with larger sample sizes will be required for definitive results in the local population.

CONCLUSION

Peritoneal involvement is common in majority of abdominopelvic malignancies with ovarian and colorectal carcinoma being commonest in this study. Mixed pattern of peritoneal pattern was most frequently seen in these patients followed by omental caking and nodular peritoneal deposits. The most common sites of peritoneal involvement were pelvic peritoneum followed by greater omentum.

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